2021

Lake Pontchartrain & Vicinity, Louisiana General Re-Evaluation Report with Integrated Environmental Impact Statement

US Army Corps of Engineers
New Orleans District

U.S. Army Corps of Engineers, New Orleans District
Non-Federal Sponsor: Coastal Protection and Restoration Authority Board of Louisiana

July 2021

Cover Sheet

Project Title: Lake Pontchartrain and Vicinity, Louisiana General Re-Evaluation Report with Integrated Environmental Impact Statement

Proposed Action: The New Orleans District of the U.S. Army Corps of Engineers is re-evaluating the performance of the Lake Pontchartrain and Vicinity system given the combined effects of consolidation, settlement, subsidence, and sea level rise over time and new datum to determine if additional actions are recommended to address the economic and life safety risks associated with flooding due to hurricanes and coastal storms.

Location: St. Charles, Jefferson, Orleans, and St. Bernard Parishes, Louisiana

Type of Statement: Final Environmental Impact Statement

Lead Agency: U.S. Army Corps of Engineers

Cooperating Agencies: U.S. Fish and Wildlife Service
National Oceanic and Atmospheric Administration

For further Information:
Mr. Bradley Drouant, P.E.
U.S. Army Corps of Engineers, New Orleans District
CEMVN-PMO-L, Room 361
7400 Leake Avenue
New Orleans, LA 70118
(504)862-1516
CEMVN-LPVGRR@usace.army.mil
https://www.mvn.usace.army.mil/About/Projects/BBA-2018/studies/LPV-GRR/

Abstract: This General Re-Evaluation Report with integrated Environmental Impact Statement presents the results of a U.S. Army Corps of Engineers (USACE) coastal storm risk management study for the Lake Pontchartrain and Vicinity project located in the greater New Orleans area, Louisiana. USACE is undertaking the study in partnership with the Coastal Protection and Restoration Authority Board of Louisiana, the study's non-federal sponsor. Southeast Louisiana is generally characterized by weak soils, general subsidence, and the global incidence of sea level rise that will cause levees to require future lifts to sustain or improve performance. The Recommended Plan consists of 50 miles of levee lifts and 3 miles of floodwall modifications and replacements to be constructed as needed before the combined effects of consolidation, settlement, subsidence, and sea level rise reduce elevations below the required design elevations.

LAKE PONTCHARTRAIN & VICINITY, LOUISIANA GENERAL RE-EVALUATION REPORT WITH INTEGRATED ENVIRONMENTAL IMPACT STATEMENT

EXECUTIVE SUMMARY

This General Re-Evaluation Report (GRR) with integrated Environmental Impact Statement presents the results of a U.S. Army Corps of Engineers (USACE) coastal storm risk management study for the Lake Pontchartrain and Vicinity (LPV) project located in New Orleans, Louisiana. This study is authorized by Section 3017 of the Water Resources Reform and Development Act of 2014. USACE is undertaking the study in partnership with the Coastal Protection and Restoration Authority Board of Louisiana, the study's non-federal sponsor. This report provides documentation of the plan formulation process to identify a recommended coastal storm risk management plan, along with environmental, engineering, and cost details of the Recommended Plan.

The existing LPV project includes features in four parishes (St. Charles, Jefferson, Orleans, and St. Bernard) located in the greater New Orleans area on the east bank of the Mississippi River. This is a high-density residential and commercial area. Currently, the LPV project includes a total of approximately 126.5 miles of levees and 56 miles of floodwalls, floodgates, water control structures, and other risk reduction features. This includes primary perimeter storm surge risk reduction features, and detention basin features along the IHNC and GIWW, and the three outfall canals. The existing project reduces the risk of flooding associated with a coastal storm surge and wave event with a 1% chance of being exceeded in any given year.

Southeast Louisiana, including the greater New Orleans area, is generally characterized by weak soils, general subsidence, and the global incidence of sea level rise that will cause levees to require future lifts (raises) to sustain the current performance of the project. This GRR re-evaluates the performance of the LPV system given the combined effects of consolidation, settlement, subsidence, and sea level rise over time and the availability of new elevation data (vertical datums), and determines if additional actions are recommended to address the economic and life safety risks associated with overtopping of the levee system due to hurricanes and tropical storms.

A Semi-Quantitative Risk Assessment (SQRA) was performed to identify the magnitude of the risk associated with levee system overtopping. Due to the limited time and funding available to conduct the study, a full SQRA that examines all potential failure modes was not able to be conducted. Given the authorizing language to "address consolidation, settlement, subsidence, sea level rise, and new datum to restore Federally authorized hurricane and storm damage reduction projects", the risk assessment performed for this study focused on risks related to overtopping of the levee system. This decision is supported by examination of the available Screening Level Risk Assessments, which identified overtopping of levees as the major risk driver and was fully coordinated with the USACE Levee Safety Program team. The system may have other potential modes of failure prior to overtopping but the risk assessment did not seek to quantify any risks not related to overtopping. An additional semi-quantitative risk assessment is planned in the future to support the FEMA levee certification purposes and that effort will take a comprehensive look at system risks.

The study utilized a 50-year period of analysis and estimated future conditions at the end of that period if no action is taken to address the identified problems. These projections include over $246 million in expected annual economic damages. The future estimated average annual incremental life loss related to overtopping of the system is 3E-02 (0.032) lives per year. Additionally, for the climate change analysis, the study considered potential relative sea level change impacts on system performance and adaptability during a 100-year performance horizon.

USACE identified several structural and non-structural measures to reduce coastal storm risk in the study area. An initial array of five action alternatives was formulated, evaluated, and compared primarily (but not exclusively) based on cost, economic damage reduction, life safety risk reduction related to overtopping of the system, and environmental and cultural resources impacts.

The National Economic Development (NED) Plan is the alternative that reasonably maximizes net economic benefits while remaining consistent with the federal objective of protecting the environment. Alternative 2 was identified as the NED Plan and the Recommended Plan.

The Recommended Plan includes system-wide levee lifts and raising floodwalls to address the projected 1% annual exceedance probability (AEP) flooding event through the year 2078. The general features included in the Recommended Plan can be seen in Figure ES-1. The plan consists of 50 miles of levee lifts to be constructed before the combined effects of consolidation, settlement, subsidence, and sea level rise reduce the levee elevations in each levee reach below the required design elevation. Additionally, the Recommended Plan includes 1 mile of floodwall replacements and 2.2 miles of new floodwall to be constructed prior to the combined effects causing the design requirements to be exceeded for each structure. Existing foreshore protection along Lake Pontchartrain will be restored following levee or floodwall modifications, which will require limited dredging to provide access to deliver and place the stone protection. Mitigation is anticipated to be required to address potential impacts to habitat along the Mississippi River. The Recommended Plan has a total project first cost of approximately $1.1 billion and a Benefit-to-Cost Ratio (BCR) of 7.3. It reduces the estimated annual economic damages to approximately $53 million and reduces life loss related to overtopping risk.

The Recommended Plan has many other impacts (both positive and negative) in addition to NED benefits. Regional Economic Development (RED) benefits support a total of 292 average annual, full-time equivalent jobs, $1.1 billion in labor income, $1.3 billion in gross regional product, and $2.1 billion in economic output in the local impact area. Other Social Effects (OSE) benefits include a reduction of life safety risk associated with overtopping of the levee system to tolerable levels, a reduction in the risk of overtopping that could result in contamination of farmland and drinking water and could negatively impact community cohesion, and reduced overtopping flood risk to three National Register Historic Districts and an archaeological site. The plan has negative Environmental Quality (EQ) effects including impacts to bottomland hardwoods along the Mississippi River and lake bottom habitat in Lake Pontchartrain, as well as soil and wildlife impacts in borrow sites.

Implementation of the Recommended Plan would result in potential impacts to Bottomland Hardwood-Wet (BLH-Wet) habitat. These impacts would be avoided to the maximum extent practicable but would be unavoidable in some locations due to existing infrastructure on the protected side of the levees. The proposed mitigation plan assumes these 12.1 Average Annual

Habitat Units (AAHUs) of BLH-Wet impacted (approximately 20 acres) by the Recommended Plan would be offset through the purchases of equivalent mitigation bank credits.

The public had the opportunity to review and comment on the draft report during the 55-day public review period which began in December 2019. Public meetings were held in January 2020 to present the tentatively selected plan and allow the public to respond and ask questions prior to finalizing the recommendation. Comments received and responses can be found in Appendix L. Numerous environmental commitments are listed within the EIS to ensure environmental compliance, including development of a Programmatic Agreement with State Historic Preservation Officers, Tribes, and the Advisory Council on Historic Preservation. Additional NEPA documentation and associated public review would be conducted, as necessary, to address any changes not evaluated within the scope of the impact assessment.

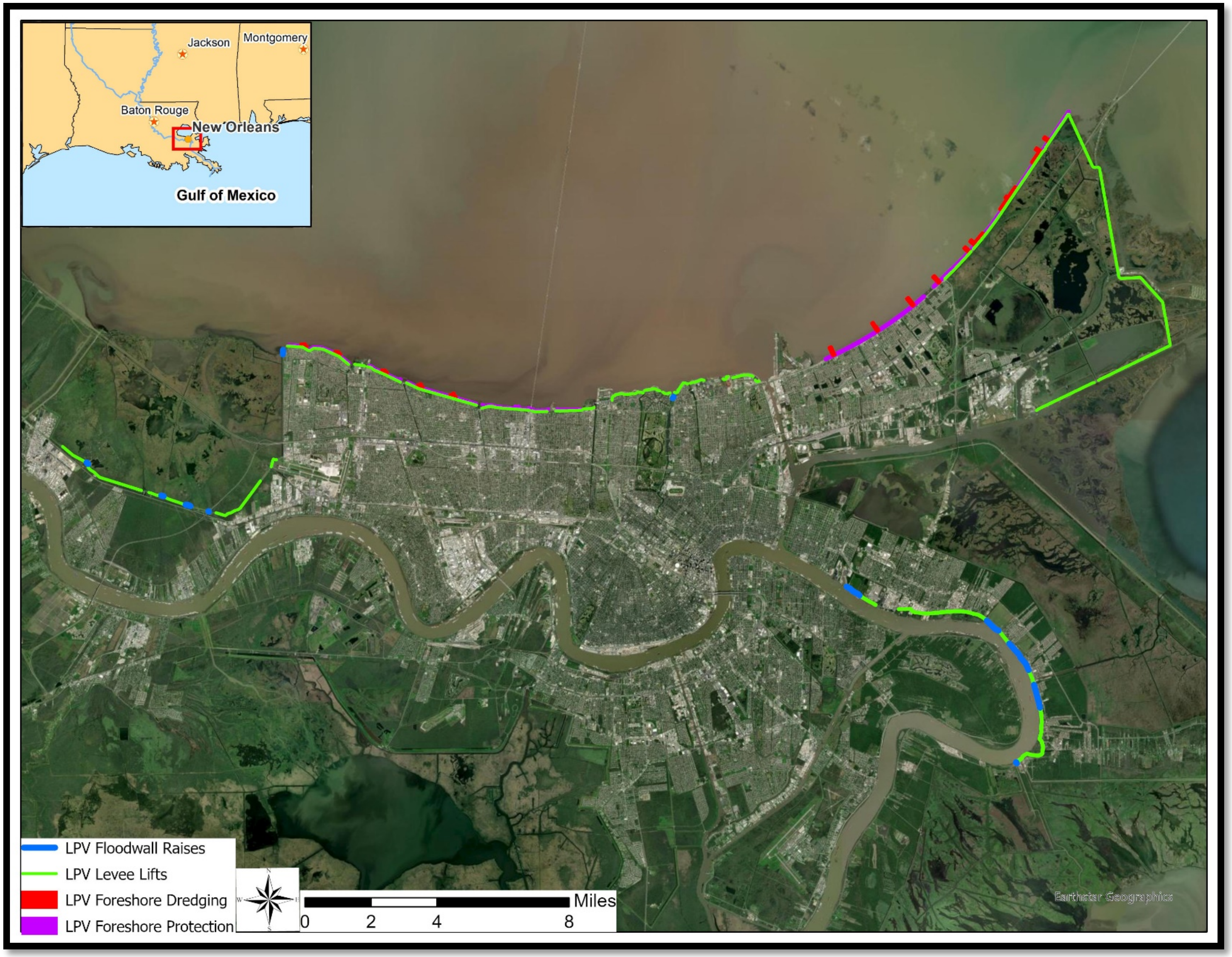

Figure ES-1. LPV Recommended Plan – General Features

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**Sections marked with an asterisk are required content for compliance with the National Environmental Policy Act following 1978 Council on Environmental Quality NEPA Regulations*

APPENDICES

LIST OF FIGURES

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ACROYNYMS AND ABBREVIATIONS

AAHU: Average Annual Habitat Units
AALL: Average Annualized Life Loss
ACHP: Advisory Council on Historic Preservation
ACS: American Community Survey
ADCIRC: Advanced Circulation
AEP: Annual Exceedance Probability
APE: Area of Potential Effects
APF: Annual Probability of Failure
ASTM: American Society for Testing and Materials
ATR: Agency Technical Review
BCR: Benefit-to-Cost Ratio
BGEPA: Bald and Golden Eagle Protection Act
BLH-Wet: Bottomland Hardwood-Wet habitat
BMP: Best Management Practice
CDP: Census Designated Place
CED: Comprehensive Environmental Document
CEQ: Council of Environmental Quality
CERCLA: Comprehensive Environmental Response, Compensation and Liability Act
cfs: cubic feet per second
CFR: Code of Federal Regulations
CO: Carbon Monoxide
COTP: Captain of the Port
CPRAB: Coastal Protection and Restoration Authority Board
CSVR: Content-to-Structure Value Ratio
CWA: Clean Water Act
dB: decibel
dBA: A-Weighted Decibel
DNL: Day-Night Average Sound Level
DO: Dissolved Oxygen
DoD: Department of Defense
DQC: District Quality Control
DWS: Drinking Water Supply
EAD: equivalent annual damage
ECB: Engineering and Construction Bulletin
EFH: Essential Fish Habitat
EIS: Environmental Impact Statement
EJ: Environmental Justice
EO: Executive Order
EOP: Environmental Operating Principles
EPA: Environmental Protection Agency
EQ: Environmental Quality
ER: Engineer Regulation
ERDC: Engineer Research and Development Center
ESA: Environmental Site Assessment
FEMA: Federal Emergency Management Agency
FMP: Fishery Management Plan
FPPA: Farmland Protection Policy Act
FWAC: Future Without Action Condition
FWOP: Future Without Project
FWP: Fish and Wildlife Propagation
FY: Fiscal Year
GIWW: Gulf Intracoastal Waterway
GMFMC: Gulf of Mexico Fisheries Management Council
GRR: General Re-evaluation Report
HEC: Hydrologic Engineering Center
HEC-FDA: Hydrologic Engineering Center Flood Damage Analysis
H&H: Hydrology and Hydraulics
HSDRRS: Hurricane Storm Damage and Risk Reduction System
HTRW: Hazardous, Toxic, and Radioactive Waste
HUD: Housing and Urban Development
IER: Individual Environmental Report
IHNC: Inner Harbor Navigation Canal
IPET: Interagency Performance Evaluation Task Force
JPM-OS: Joint Probability Method-Optimal Sampling
LDEQ: Louisiana Department of Environmental Quality
LDNR: Louisiana Department of Natural Resources
LDWF: Louisiana Department of Wildlife and Fisheries
LERRD: Lands, Easements, Rights-of-way, Relocations, and Disposal
LORR: Level of Risk Reduction
LPV: Lake Pontchartrain and Vicinity, Louisiana
MM: Mile Marker
MR&T: Mississippi River and Tributaries
MRGO: Mississippi River Gulf Outlet
MRL: Mississippi River Levee
NAAQS: National Ambient Air Quality Standards
NAVD88: North American Vertical Datum of 1988

NED: National Economic Development
NEPA: National Environmental Policy Act
NMFS: National Marines Fisheries Service
NOAA: National Oceanic and Atmospheric Administration
NO_x: Nitrogen Oxides
NRCS: National Resources Conservation Service
NRHP: National Register of Historic Places
NSI: National Structure Inventory
O_3: Ozone
O&M: Operations and Maintenance
OMRR&R: Operations, Maintenance, Repair, Replacement, and Rehabilitation
OSE: Other Social Effects
OYS: Oyster Propagation
PCR: Primary Contact Recreation
PED: Preconstruction Engineering and Design
PFM: Probable Failure Mode
PM: Particulate Matter
PPA: Project Partnership Agreement
RAS: River Analysis System
REC: Recognized Environmental Conditions
RED: Regional Economic Development
RM: River Mile
RNA: Regulated Navigation Areas
ROW: Right-of-Way
RSLC: Relative Sea-Level Change
RSLR: Relative Sea-Level Rise
SAV: Submerged Aquatic Vegetation
SCR: Secondary Contact Recreation
SELA: Southeast Louisiana Urban Flood Control Project
SHPO: State Historic Preservation Office
SO_x: Sulfur Oxides
SQRA: Semi-Quantitative Risk Assessment
SWPPP: Stormwater Pollution Prevention Plan
TDS: Total Dissolved Solids
THPO: Tribal Historic Preservation Officer
TRG: Tolerable Risk Guidelines
TSP: Tentatively Selected Plan
USACE: U.S. Army Corps of Engineers
USCG: United States Coast Guard
USDA: U.S. Department of Agriculture
USEPA: United States Environmental Protection Agency
USFWS: U.S. Fish and Wildlife Service
USGS: United States Geological Survey
VOC: Volatile Organic Compound
VRAP: Visual Resources Assessment Procedure
WBV: West Bank and Vicinity, Louisiana
WRDA: Water Resources Development Act
WRRDA: Water Resources Reform and Development Act

LAKE PONTCHARTRAIN & VICINITY, LOUISIANA GENERAL RE-EVALUATION REPORT WITH INTEGRATED ENVIRONMENTAL IMPACT STATEMENT

1 INTRODUCTION

1.1 STUDY SCOPE

This General Re-Evaluation Report (GRR) with integrated Environmental Impact Statement (EIS) presents the results of a U.S. Army Corps of Engineers (USACE) coastal storm risk management study for the Lake Pontchartrain and Vicinity project located within the greater New Orleans area, Louisiana. This study is authorized by Section 3017 of the Water Resources Reform and Development Act of 2014 (Public Law 113-121).

Following the storm damage that occurred as a result of Hurricane Katrina in 2005, the Congress and Administration provided authorization and appropriations through supplemental acts, "…to raise levee heights where necessary and otherwise enhance the existing Lake Pontchartrain and Vicinity (LPV) project to provide the levels of protection necessary to achieve the certification required for participation in the National Flood Insurance Program (NFIP) under the base flood elevations current at the time of this construction;…" This level has sometimes been referred to in the past as the "100-year", "1% Level of Risk Reduction (LORR)", or "1% annual exceedance probability" (AEP) event. Throughout this report, flooding within the LPV system caused by coastal storm events will be referred to by its AEP, which is the probability that a given amount of flooding may be realized or exceeded in any given year. For example, a flood event with a 1% AEP would have a 1% probability of occurring every year. For more information on terminology, see Section 2.0 (Problems and Opportunities).

There are multiple projects adjacent to the existing LPV project. Although not a hurricane and storm damage risk reduction project, the Mississippi River and Tributaries Project (MR&T) is a riverine flood risk reduction project which, between River Miles (RM) 81 and 127 on the East Bank, includes the Mississippi River Levees (MRL) that tie into the LPV hurricane alignment to form the comprehensive system perimeter. This includes a small portion of the East Bonnet Carré Lower Guide Levee making a connection between the MRL and LPV alignments on the west side of the system. There are also several Gulf Intracoastal Water Way (GIWW) locks which provide navigation connections to the Mississippi River and as such provide MR&T riverine flood risk reduction at those points. The nearby West Bank and Vicinity (WBV) project provides an equivalent level of hurricane and storm damage risk reduction for a portion of the New Orleans metropolitan area located on the west bank of the Mississippi River.

There are numerous complex structures, levees lining interior navigable and drainage retention areas, and interior drainage infrastructure situated within the LPV and MRL perimeter alignments. The interior drainage infrastructure includes local pump stations and drainage canals, the federal flood risk reduction Southeast Louisiana Urban Flood Control Project ("SELA"), and the post-Hurricane Katrina authorized storm-proofing of interior pump stations to ensure the operability of the stations during hurricanes, storms, and high water events. LPV was designed and constructed so as not to adversely impact internal drainage.

The authorization found in Section 3017 of WRRDA 2014 is only applicable to the LPV and WBV projects. Thus, while these GRRs, being conducted under Section 3017 of WRRDA 2014, are for LPV and WBV, when used in this report the term Hurricane and Storm Damage Risk Reduction System (HSDRRS) will refer the LPV and WBV projects, as well as other projects which contribute, as an incidental benefit, to providing risk reduction for the 1% AEP event. The other projects that contribute to the provision of 1% hurricane and storm damage risk reduction associated with the HSDRRS system are the Mississippi River Levees (MRL), the Southeast Louisiana (SELA) project, and the Storm Proofing Pump Stations project. The scope of this study will focus on the LPV project and components of adjacent projects if applicable and necessary for LPV to provide coastal storm risk management.

This GRR will re-evaluate the performance of the LPV project given the combined effects of consolidation, settlement, subsidence, and sea level rise over time and the availability of new elevation data (vertical datums), to determine if additional actions are recommended to sustain the current level of risk reduction for hurricanes and tropical storms. To be recommended, these actions must be determined to be technically feasible, environmentally acceptable, and economically justified. The evaluation will utilize a specified future timeframe, termed the "period of analysis", in order to consider future conditions and evaluate the effects of alternatives over time (see Section 5 for more information about how the period of analysis is identified).

Alternatives will consider increasing, maintaining, or decreasing this level of risk reduction in order to ensure all reasonable alternatives have been evaluated. However, as described in Section 1.3, Section 3017 of WRRDA 2014 only authorizes measures to restore LPV to the 100-year LORR (the authorized level of risk reduction). This limitation to the study authorization guided the team as alternatives were formulated and evaluated in order to identify the National Economic Development (NED) plan.

1.2 PURPOSE OF REPORT

The general purpose of this study with integrated Environmental Impact Statement (EIS) is to analyze alternatives to reduce hurricane and storm risk within the LPV study area. The study will evaluate and compare the benefits, costs, and impacts (positive or negative) of alternatives including the No Action Alternative. The study will identify whether an economically justified plan exists to reduce economic damages and life risk due to the combined effects of subsidence, consolidation, settlement, sea level rise, and datum changes on the LPV system. This report also satisfies the requirement of the National Environmental Policy Act (NEPA) to evaluate the proposed federal action.

Risks to human life are a fundamental component of all facets of flood and coastal storm risk management and must receive explicit consideration throughout the study process. As described in Section 3.4, a risk assessment was performed to identify the magnitude of the risk associated with levee system overtopping. This assessment, including an evaluation of tolerable risk guidelines, informed the formulation and evaluation of alternatives for the study.

1.3 PROJECT AUTHORITY

The Secretary of the Army is authorized to construct the Lake Pontchartrain and Vicinity, Louisiana Project for hurricane storm damage risk reduction in Southeastern Louisiana by:

- The Flood Control Act of 1965 (P.L. 89-298, Title II, Sec. 204);
- Water Resource Development Acts of 1974 (P.L. 93-251, Title I, Sec. 92), 1986 (P.L. 99-662, Title VIII, Sec. 805), 1990 (P.L. 101-640, Sec. 116), 1992 (P.L. 102-580, Sec. 102),

1996 (P.L. 104-303, Sec. 325), 1999 (P.L. 106-53, Sec. 324), and 2000 (P.L. 106-541, Sec. 432);

- Energy and Water Development Appropriations Acts of 1992 (P.L. 102-104, Title I, Construction, General), 1993 (P.L. 102-377, Title I, Construction, General), and 1994 (P.L. 103-126, Title I, Construction, General).

Following Hurricanes Katrina and Rita in August and September 2005, several supplemental acts provided authority and appropriated funds to repair, accelerate to complete, and improve the hurricane and storm damage risk reduction features in the LPV study area.

The DoD (Department of Defense) Emergency Supplemental Appropriations to Address Hurricanes in the Gulf of Mexico, and the Pandemic Influenza Act of 2006 (Public Law 109-148, Chapter 3, Construction, and Flood Control and Coastal Emergencies) or "3rd Supplemental," appropriated funds to accelerate the completion of the previously authorized project, and to restore and repair the project at full federal expense.

In June 2006, the Emergency Supplemental Appropriations Act for Defense, the Global War on Terror, and the Hurricane Recovery of 2006 (Public Law 109-234, Title II, Chapter 3, Construction, and Flood Control and Coastal Emergencies) or "4th Supplemental," appropriated funds and added the authority to raise levee heights where necessary, reinforce and replace floodwalls, armor critical elements, and otherwise enhance the project to provide the levels of protection necessary to achieve the certification required for participation in the NFIP under the base flood elevations current at the time of construction.

In May 2007, the U.S. Troop Readiness, Veterans' Care, Hurricane Katrina Recovery, and Iraq Accountability Appropriations Act, 2007 (Public Law110-28, Title IV, Chapter 3, Flood Control and Coastal Emergencies and Sec. 4302) or "5th Supplemental" provided $1,300,000,000 to carry out projects and measures for the WBV and LPV projects as described in Public Law 109-148 and provided flexibility to the Secretary to reallocate un-obligated funds from the Public Law 109-234 projects funded under the Flood Control and Coastal Emergencies heading, subject to coordination with the House and Senate Committees on Appropriation.

The Water Resources Development Act (WRDA) of 2007 (Public Law 110-114 at Section 7012) authorized the raising of levee heights where necessary and otherwise enhance the WBV and LPV projects to provide the level of protection necessary to achieve the certification required for participation in the NFIP under the base flood elevation current at the time of construction.

The 6th Supplemental, "Supplemental Appropriations Act, 2008," (Public Law 110-252, Title III, Chapter. 3, Construction) provided LPV $1.1 billion dollars (funds that became available October 1, 2008) subject to a federal 65% and 35% non-federal cost share "to modify authorized projects in southeast Louisiana to provide hurricane, storm and flood damage reduction in the greater New Orleans and surrounding areas to the level of protection necessary to achieve the certification required for participation in the NFIP under the base flood elevations current at the time of enactment of this Act". This Act was became law on 30 June 2008.

The 7th Supplemental, "Consolidated Security, Disaster Assistance, and Continuing Appropriations Act, 2009," (Construction heading, Division B, Title I, Chapter 3 of Public Law 110-329) provides that the Secretary of the Army is directed to use $350,000,000 of the $1,500,000,000 appropriated under that heading to fund the estimated amount of non-federal cash contributions to be financed in accordance with Section 103(k) of the WRDA of 1986, over a period of 30 years from the date of completion of the work undertaken pursuant to the LPV Project Partnership Agreement (PPA), or separable element thereof.

1.4 STUDY AUTHORITY

Section 3017 of the Water Resources Reform and Development Act (WRRDA) 2014 (Public Law 113-121) authorizes the Secretary of the Army to carry out measures that address consolidation, settlement, subsidence, sea level rise, and new datum to restore certain federally authorized hurricane and storm damage reduction projects to their authorized levels of protection, if the Secretary determines the necessary work is technically feasible, environmentally acceptable, and economically justified. In addition, the authority of Section 3017 to study and construct measures terminates 10 years after the date of enactment of WRRDA 2014 on 10 June 2024.

WRRDA 2014 stipulates:

SEC. 3017. REHABILITATION OF EXISTING LEVEES.

(a) IN GENERAL – The Secretary shall carry out measures that address consolidation, settlement, subsidence, sea level rise, and new datum to restore Federally authorized hurricane and storm damage reduction projects that were constructed as of the date of enactment of this Act to the authorized levels of protection of the projects if the Secretary determines the necessary work is technically feasible, environmentally acceptable, and economically justified.

(b) LIMITATION. – This section shall only apply to those projects for which the executed project partnership agreement provides that the non-Federal interest is not required to perform future measures to restore the project to the authorized level of protection of the project to account for subsidence and sea-level rise as part of the operation, maintenance, repair, replacement, and rehabilitation responsibilities.

(e) TERMINATION OF AUTHORITY – The authority of the Secretary under this subsection terminates on the date that is 10 years after the date of enactment of this Act.

1.5 NON-FEDERAL SPONSOR

The non-federal sponsor for this study is the Coastal Protection and Restoration Authority Board of Louisiana (CPRAB) and the feasibility cost-share agreement was executed on October 09, 2018.

The CPRAB is established as the single state entity with authority to articulate a clear statement of priorities and to focus development and implementation efforts to achieve comprehensive coastal protection for Louisiana. The CPRAB's mandate is to develop, implement, and enforce a comprehensive coastal protection and restoration Master Plan. Working with federal, state, and local political subdivisions, including levee districts, the CPRAB is working to establish a safe and sustainable coast that will protect communities, the nation's critical energy infrastructure, and natural resources into the future.

The CPRAB has stated that it intended or intends to enter into cooperation endeavor agreements or other sub-agreements, in accordance with the Constitution and laws of the state of Louisiana, for performance of CPRAB's obligations under a PPA. Some of the state entities which CPRAB may enter into cooperation endeavor agreements or other sub-agreements with include, but are not limited to:

- The Southeast Louisiana Flood Protection Authority – East
- The Pontchartrain Levee District
- St. Charles Parish
- Jefferson Parish
- Orleans Parish
- New Orleans Sewerage and Water Board

1.6 STUDY AREA AND MAPS

1.6.1 GENERAL STUDY AREA

The general study area (Figures 1-1 and Figure 1-2) includes the areas within the hurricane and storm damage risk reduction systems of the LPV and WBV projects. It includes the parishes of Jefferson, St. Bernard, Orleans, Plaquemines, and St. Charles. It is in southeast Louisiana 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. The study area is also bisected by the Mississippi River, with LPV to the north and WBV to the south. To the south there are numerous lakes, bayous, fragmented marsh, and wetlands that ultimately lead to the Gulf of Mexico.

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. The study area occupies a portion of one of the oldest delta complexes in the Mississippi River Deltaic Plain. It is in the lower Mississippi River alluvial plain in the Pontchartrain Basin.

The study area is dissected by numerous canals and waterways. Numerous sensitive environmental resources are located near the study area. In general, these environmental resources are largely comprised of bottomland hardwood forests, cypress-tupelo swamps, and various freshwater, brackish and saline marsh, and scrub-shrub habitats.

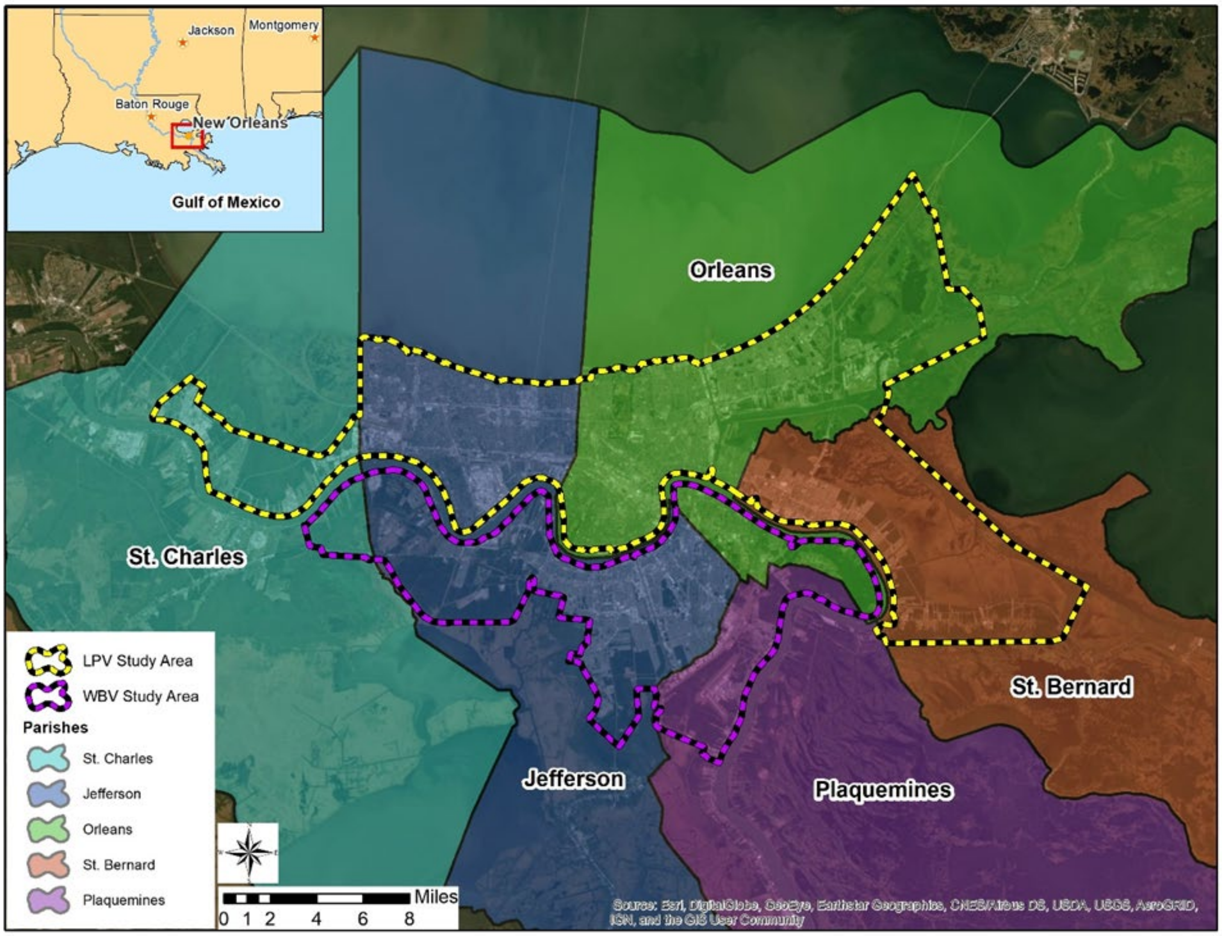

Figure 1-1. General Study Area Including Parishes

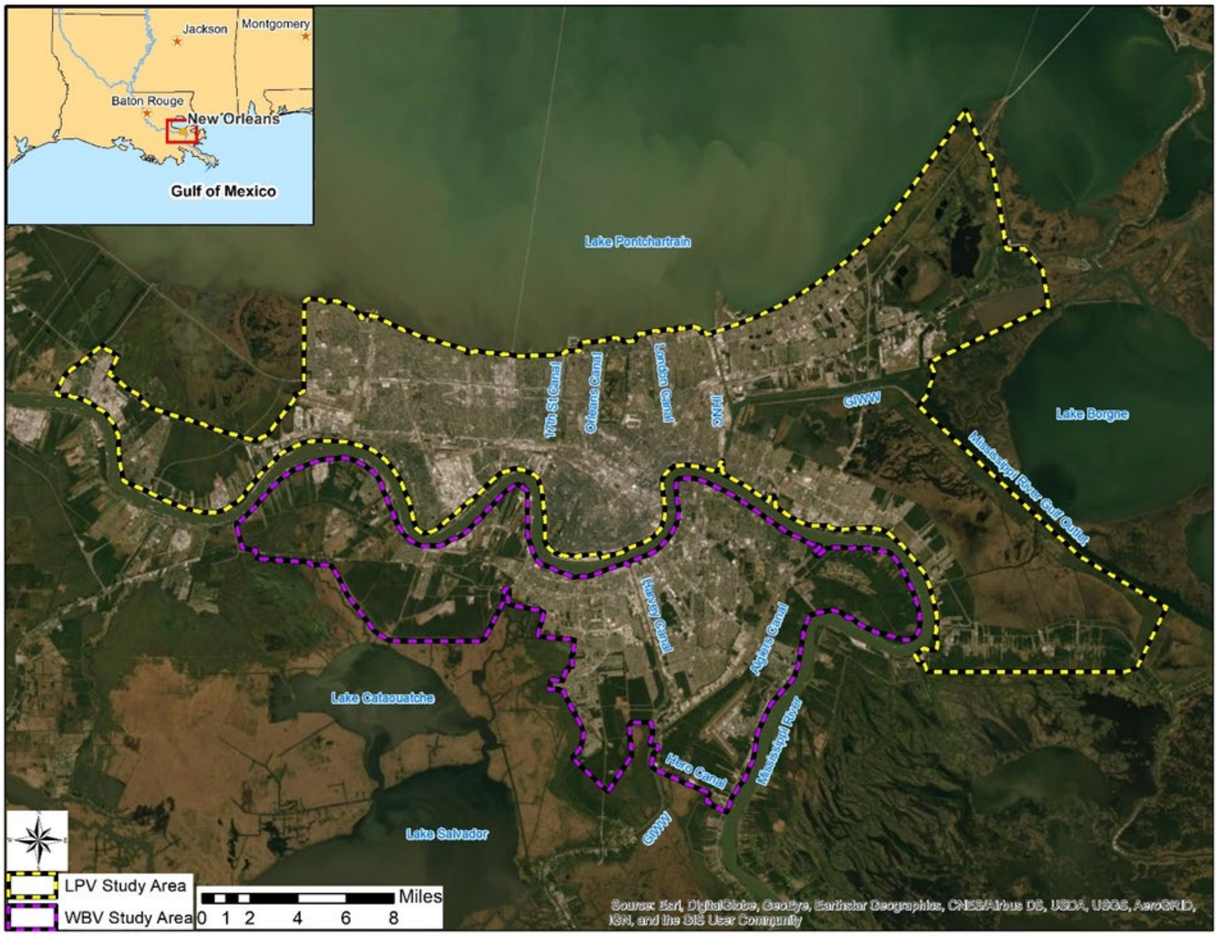

Figure 1-2. General Study Area Including Water Bodies

1.6.2 LPV PROJECT AND STUDY AREA

The LPV project includes features in four parishes (St. Charles, Jefferson, Orleans, and St. Bernard) located in the greater New Orleans area on the east bank of the Mississippi River. Currently, LPV contains approximately 126.5 miles of levees and 56 miles of floodwalls, floodgates, water control structures, and other risk reduction features. This includes primary perimeter storm surge risk reduction features along the IHNC and GIWW and the three outfall canals. The project is in a high-density residential and commercial area.

The Mississippi River and Tributaries' levee (MR&T levees or MRL) along with the Lower Bonnet Carré Guide Levee provides risk reduction from riverine flow flood risks. The LPV project connects to the MRL at both the west and east of the system.

The levees and floodwalls along the Inner Harbor Navigation Canal (IHNC) and Orleans Parish outfall canals were removed from frontline or perimeter risk reduction features and became interior risk reduction features by construction of the Seabrook Gate Closure and the IHNC - Lake Borgne Surge Barrier and Permanent Canal Closures and Pumps. Although these interior levees and floodwalls are not part of the hurricane perimeter defenses, they are an integral part of the LPV hurricane and storm damage reduction system required for reducing the risk of flooding caused by precipitation during a hurricane or tropical storm and over topping of the Lake Borgne Closure Surge Barrier.

Typical operations, maintenance, repair, replacement, and rehabilitation (OMRR&R) activities include mowing levees and ensuring sufficient turf growth, maintaining High Performance Turf Reinforcement Mats (armoring), maintaining and repairing spalls in floodwalls and concrete levee transition armoring, maintaining and operating floodgates, and operating and maintaining the complex structures such as IHNC surge barrier, Seabrook Complex, and Permanent Canal Closures and Pumps.

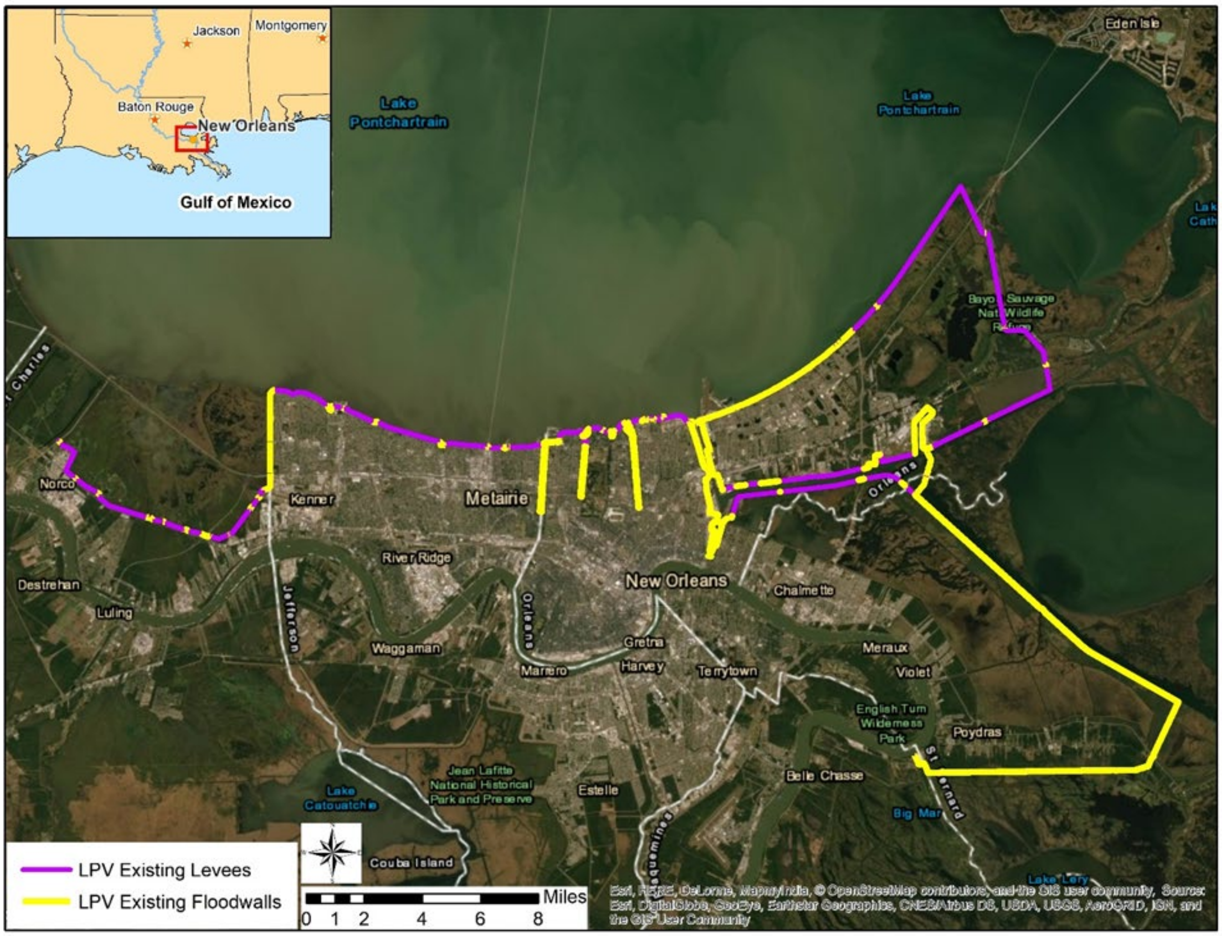

Figure 1-3. Existing LPV Levees and Floodwalls

1.7 INTERAGENCY STUDY TEAM & COOPERATING AGENCIES

The CPRAB was part of the interagency study team. The interagency study team provided data and subject matter expertise to identify problems, characterize existing and future conditions, develop measures, and formulate and evaluate alternatives.

Cooperating agencies include the U.S. Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration (NOAA).

1.8 PRIOR REPORTS, EXISTING WATER PROJECTS, & ONGOING PROGRAMS

1.8.1 PRIOR REPORTS

The following is a list of recent studies in the study area relevant to the Lake Pontchartrain and Vicinity Project:

- USACE. 1965. Chief of Engineers Report on Lake Pontchartrain and Vicinity, LA Hurricane Protection Project. This is the report for the original authorized project.
- USACE. 1984. Chief of Engineers Report on Lake Pontchartrain and Vicinity, LA Hurricane Protection Project. This report re-evaluated the original project and recommended elimination of the authorized surge barrier at the eastern end of Lake Pontchartrain in favor of higher levees.
- USACE. 1994. Southeast Louisiana Hurricane Preparedness Study. This study established evacuation zones for each parish and provided estimated “clearance times” to evacuate each zone based on hurricanes of different sizes, strengths, and forward speeds.
- USACE. 2006. Hurricane and Storm Damage Risk Reduction System Design Report. This report was prepared post-Katrina and updated the H&H modeling and 100-year design elevations for LPV and WBV. The analysis utilized for this report utilized the latest models available, including ADCIRC, and was the first update to design heights since the 1984 study.
- USACE. 2007. Elevations for Design of Hurricane Protection Levees and Structures Lake Pontchartrain, Louisiana and Vicinity Hurricane Protection Project and West Bank and Vicinity, Hurricane Protection Project. This report provides a detailed documentation of the coastal and hydraulic engineering analysis performed to determine the 1% AEP project design elevations for these two hurricane protection projects. The report has been prepared to provide levee and structure elevations so that USACE can initiate detailed design and construction as described in the 4th Supplemental Appropriation, Public Law 109-234 of the One Hundred Ninth Congress. Available at: https://www.mvn.usace.army.mil/Portals/56/docs/engineering/HurrGuide/ElevationsforDesignofHurricaneProtectionLeveesandStructures.pdf
- USACE 2007. Hurricane Protection Office (HPO). Senior Review Panel Best Technical Solution Evaluation Report. Conceptual Design Services for Permanent Pump Stations and Canal Closures at the Outfalls of the 17th Street, Orleans Avenue and London Avenue Canals, Orleans Parish, Louisiana. This report evaluates potential solutions for the three outfall canals that would protect the City of New Orleans from encroachment of a storm surge and not impede the ability of the city’s internal drainage system to function.
- Interagency Performance Evaluation Task Force (IPET). 2009. Interagency Performance Evaluation of the New Orleans and Southeast Louisiana Hurricane Protection System. Final Report of the Interagency Performance Evaluation Task Force. This report is the result of an intense performance evaluation of the New Orleans and Southeast Louisiana Hurricane Protection System during Hurricane Katrina.
- USACE. 2009. Inner Harbor Navigation Channel (IHNC) Lock Replacement Project. Supplemental Environmental Impact Statement. Available at: https://www.mvn.usace.army.mil/Portals/56/docs/PD/Projects/IHNCLockRepl/2009/2009

%20Final_SEIS_03_23_09.pdf. This report evaluates possible actions for relieving navigation traffic congestion associated with the existing IHNC.

- USACE. 2009. Louisiana Coastal Protection and Restoration Final Technical Report, Hydraulics and Hydrology Appendix – Volume 1. New Orleans District, New Orleans, LA. The Technical Report informs decision makers, stakeholders, and the public of the tradeoffs that should be considered in future decisions in order to maintain existing risk levels and/or reduce risk along the Louisiana coast.
- USACE. 2012. Hurricane Isaac With and Without 2012 100-year HSDRRS Evaluation. Preliminary Report. February 2012. New Orleans District, New Orleans, LA. This report evaluated whether construction of HSDRRS had a measurable effect on areas outside the system inundated by Hurricane Isaac, which provides insight into possible project impacts.
- USACE. 2013. Comprehensive Environmental Documents - Phase I, Greater New Orleans Hurricane and Storm Damage Risk Reduction System, Volumes 1-3. This document describes and evaluates the cumulative impacts of the 217 miles of the HSDRRS described by the Individual Environmental Reports. Available at: https://www.mvn.usace.army.mil/Missions/Environmental/NEPA-Compliance-Documents/HSDRRS-Projects/
- USACE 2013. Greater New Orleans Hurricane and Storm Damage Risk Reduction System (HSDRRS) National Flood Insurance Program (NFIP) Levee System Evaluation Report . The report documents the technical levee system evaluation, associated assumptions, and analyses conducted to demonstrate NFIP requirements for a FEMA accredited levee system.
- USACE 2013. Greater New Orleans Hurricane and Storm Damage Risk Reduction System, Levee Armoring Research Document Report. This report provides the background and summary of Task Force Hope funded research and development for wave overtopping armoring of the landside levees and transitions within HSDRRS.
- USACE. 2014. Greater New Orleans Hurricane and Storm Damage Risk Reduction System, Levee Armoring, Engineering Alternatives Report. This report presents alternatives analyzed to provide resiliency to the landside of earthen levees and the final recommended armoring solution that meets the Congressional authorization for resiliency.
- USACE. 2014. Elevations for Design of Hurricane Protection Levees and Structures Report, Version 2.0. This report provides a detailed documentation of the coastal and hydraulic engineering analysis performed to determine the project design elevations for three projects within the greater New Orleans HSDRRS: Lake Pontchartrain and Vicinity, West Bank and Vicinity, and New Orleans to Venice Projects, including the portions of the Mississippi River levees coincident with these projects. Available at: https://www.mvn.usace.army.mil/Portals/56/docs/PAO/Matt/%281%29-FINAL-MAIN-REPORT-2014-DER.pdf
- Coastal Protection and Restoration Authority (CPRA). 2017. Louisiana's Comprehensive Master Plan for a Sustainable Coast. The 2017 Coastal Master Plan sets an ambitious path to respond to the loss of coastal land and the threats from storm surge events. Available at: http://coastal.la.gov/wp-content/uploads/2017/04/2017-Coastal-Master-Plan_Web-Single-Page_CFinal-with-Effective-Date-06092017.pdf

- Long Distance Sediment Pipeline (LDSP), Bayou Dupont Marsh and Ridge Creation (p36 CPRA MP). The LDSP has borrowed and transferred nearly 10 million cubic yards of Mississippi River sediment to support Bayou Dupont Marsh and Ridge creation projects.

Some of the above reports were referenced in support of this study. Table 1-1 summarizes which were referenced and identifies the type of data or information that was utilized from each.

Table 1-1. Relevant Data Sources

		Relevance to LPV			
		Data Source	Structural	Non Structural	Future Without Project
1994	Southeast Coastal Louisiana Hurricane Preparedness Study	X	X	X	X
2006	HSDRRS Design Report	X	X	X	X
2009	Louisiana Coastal Protection and Restoration Final Technical Report	X	X	X	X
2013	NFIP Levee System Evaluation Report	X	X	X	X
2017	CPRA 2017 Coastal Master Plan	X	X	X	X

1.8.2 EXISTING WATER PROJECTS & ONGOING PROGRAMS

Mississippi River Levee (MRL)

The Mississippi River and Tributaries Project (MR&T) was authorized by Congress and constructed to reduce the risk of flood damage from high river flows. At the time of this study the crossover point on the east bank, where LPV design height requirements exceed the MRL design elevations, is downstream of the study area. However, it will move upstream into the project area over the 50-year period of analysis. Operation and maintenance of the reaches of the MR&T where the MRL design grade is equal to or higher than the LPV design grade are funded and guided by the separate MR&T authorities and guidance.

The Southeast Louisiana Urban Flood Control Project (SELA)

SELA is a flood control project, authorized by Congress to improve the rainfall drainage systems in Orleans, Jefferson and St. Tammany Parishes. On the East Bank, SELA focuses on improving existing - and constructing new - drainage channels and stormwater pump stations. These features convey stormwater via pump stations across the LPV risk reduction perimeter, and impact the interior drainage flow that LPV gates and pump stations need to handle. CPRAB has been the non-federal sponsor of SELA projects since 2009.

GIWW (Gulf Intercoastal Water Way)

The GIWW exits the perimeter protection at the Inner Harbor Navigation Channel (IHNC) Lake Borgne Surge Barrier which provides risk reduction for the 1% AEP event to a large portion of

Orleans and St. Bernard parishes by reducing the risk of surge entering the GIWW/IHNC corridor from Lake Borgne and the Gulf of Mexico. the Seabrook Floodgate Complex, which is located at the north end of the IHNC,works in tandem with the IHNC Surge Barrier. The Seabrook Floodgate Complex consists of a 95-foot wide navigable sector gate and two 50-foot wide, non-navigable vertical lift gates with floodwall tie-ins on the east and west sides.

Gulf Spill Restoration: Programmatic Restoration Plan

The Louisiana Trustee Implementation Group supports implementation of a programmatic restoration plan for the Gulf of Mexico, which is part of a legal settlement associated with the Deepwater Horizon oil spill. While restoration projects occur across the entire Gulf region, there are several large-scale projects near the study area. Recent funding approvals include nearly $26 million for three projects aimed at increasing oyster production in Louisiana state waters as well as over $200 million for marsh restoration for a section of Lake Borgne in St. Bernard Parish and near the mouth of the Mississippi River.

2 PROBLEMS & OPPORTUNITIES

This section focuses on the purpose and need for the study, including discussion of the problems to be addressed by the study, potential opportunities to be considered, study goals and objectives, as well as study constraints. Scoping and coordination with the public, state agencies, and federal agencies was also conducted during the process of identifying the problems and opportunities. These activities are also described.

Throughout this section and all subsequent sections, flood and coastal storm events and their resultant inundation will be referred to by AEP, which is the probability that this storm or level of flooding may be realized or exceeded in any given year. For example, a flood event with a 1% AEP would have a 1% probability of occurring every year. This is a change in terminology from the recent commonly used term "annual chance of exceedance" (ACE). Additionally, in the past, flood events have often been described by their "return period" – or the estimated average length of time between flood events of a similar magnitude. A 1% AEP event would have been referred to as having a 100-year return period or being a 100-year event. This terminology is no longer used because it falsely conveys a sense of time and lowers public risk perceptions. Table 2-1 provides a list of AEP flooding events that were considered during the study, with their equivalent "return period." It is important to note that all AEP references in this report are for expected water levels inside and outside the system, not the AEP of meteorological events (i.e. a 1% flood event is not the same as, nor does it necessarily occur as a result of, a 1% storm event).

Table 2-1. Comparison of AEP, ACE, and Return Period Terminology

AEP/ACE	Return Period*
20%	5-year
10%	10-year
4%	25-year
2%	50-year
1%	100-year
0.5%	200-year
0.2%	500-year
0.1%	1000-year
*Note: Return Period is a term that can be misleading, is often misunderstood, and is no longer used by USACE (see ER 1110-2-1450).	

2.1 PURPOSE & NEED*

The federal objective of water and related land resources planning is to contribute to national economic development consistent with protecting the nation's environment, pursuant to national environmental statutes, applicable executive orders, and other federal planning requirements. The purpose of the study with integrated EIS is to analyze alternatives to reduce overtopping flood risk due to coastal storms within the LPV study area. The study evaluated and compared the benefits, costs, and impacts (positive or negative) of alternatives including the No Action Alternative. The study identified whether a NED plan exists to reduce life risk and economic damages due to the combined effects of subsidence, settlement, consolidation, sea level rise and the availability of new vertical datums on the LPV system. The study identified and analyzed benefits across a full array of benefit categories and also considered if life risks warrant additional action above and beyond the NED plan. The integrated report includes assessment of the environmental effects of a reasonable range of potential alternatives or actions designed by USACE, including the No Action Alternative, prior to decision making.

2.2 PROBLEM IDENTIFICATION

2.2.1 PROJECT HISTORY

Since 1852, 39 hurricanes have made landfall within 65 nautical miles of metropolitan New Orleans. Storm surge flooding threatens lives, damages homes, businesses and infrastructure, and disrupts the nationally significant energy industry. According to the Department of Health and Hospitals (DHH), approximately 1,400 deaths were reported following Hurricane Katrina and approximately 1.3 million residents were displaced immediately following the storm. Estimated property and infrastructure damages were in excess of $28 billion in the New Orleans area and as much as $125 billion along the Gulf Coast (NOAA 2018, USACE 2006).

The LPV project construction began in 1966 but was incomplete at the time Hurricane Katrina made landfall in 2005. 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 $14.6 billion, with restoration, accelerated construction, improvements, and enhancements of various risk reduction projects and environmental mitigation within southeastern Louisiana, including the Lake Pontchartrain and Vicinity, Louisiana, Project (LPV) and the West Bank and Vicinity, Louisiana, Project (WBV). P.L 109-234 authorized the construction of a system to provide the levels of risk reduction necessary to achieve the certification required for participation in the NFIP under the base flood elevations current at the time of construction. The total budgeted cost for the LPV project, under the post-Hurricane Katrina supplemental acts, is approximately $7 billion. The completion of the levees, floodwalls, gates, and pumps that together form the HSDRRS provided risk reduction for a 1% AEP hurricane and storm damage event to the areas within LPV and WBV.

The Greater New Orleans HSDRRS is currently designed to reduce the flood risk associated with a 1% AEP storm surge and wave event. Levees in LPV were constructed on a limited footprint with the understanding that additional height would need to be added (termed “levee lifts”) in the future to counteract soil consolidation, settlement, subsidence, and sea level rise, and maintain the designed level of risk reduction. Floodwall heights were designed to account for an estimated one foot of future sea level rise by the year 2057.

Interior rainfall is conveyed by non-Federal pump stations and gravity flow outside of tropical events. When the river or storm surge events cause perimeter gates to be closed, pumping stations that are part of LPV are activated to work in series with non-Federal pump stations to remove rainfall from the project area.

The LPV project is currently accredited by the Federal Emergency Management Agency (FEMA) for the 1% AEP level of risk reduction, utilizing specific HSDRRS guidelines. However, as with any hurricane and storm damage risk reduction project, there are remaining life safety and economic damage risks associated with the potential for project non-performance (some form of physical failure) or design exceedance. In an extreme case, non-performance can result in sudden localized high-velocity flows and rapid increases in flood depth on the interior of the system. Design exceedance occurs when a lower-probability event brings higher surge levels and greater wave overtopping rates than the system was designed to address. Design exceedance impacts can range from increased interior flooding of the system to project non-performance.

2.2.2 PROBLEMS TO BE ADDRESSED BY THIS STUDY

Southeast Louisiana, including the greater New Orleans area, is generally characterized by weak soils, general subsidence, and the global incidence of sea level rise that will cause existing levees to require future lifts to sustain performance of the LPV system. The post-Hurricane Katrina supplemental acts authorities did not provide for future lifts and by the terms of the PPA for construction of the “New Work”, the sponsor is not required to perform future measures to restore the “New Work” to the authorized level of protection to account for subsidence or sea level rise as part of its federal OMRR&R responsibilities. Engineering analysis indicates that absent future levee lifts to offset consolidation, settlement, subsidence, and sea level rise, at some point in the future the project will not provide risk reduction for the 1% AEP event.

New Datums

The study authority included consideration of the effects of new vertical datums on future project performance. Following review of datum changes, changes to the existing or future performance of the LPV system based on new vertical datum values were identified as negligible and, therefore, not a problem that needs to be directly addressed in this study. Survey and spatial data used in this study were collected utilizing the North American Vertical Datum of 1988, Epoch 2004.65 (NAVD88 (2004.65)) and the standards set forth in EM 1110-2-6065 (DOA 2010). Datum changes occur periodically resulting in an updated value for the base reference plane at any specific horizontal location. Vertical Control Monuments (benchmarks) located throughout the LPV system area are updated with datum changes which can be used to update the LPV system vertical measurements relative to the current datum at the time of measurement.

Settlement and Consolidation

Consolidation is the change in soil volume over time due to applied load leading to dissipation of porewater pressure. Settlement is a result of consolidation and other factors. Levee settlement considers changes to the levee itself and that of the foundation soils under the levee. Settlement of the levee consists of shrinkage (reduction in soil volume) and lateral spread. Settlement of the foundation consists of immediate and primary consolidation settlement. Immediate settlement is caused by the elastic deformation of dry, moist and saturated soils without any change in the moisture content, as the pore water initially resists the applied load. Primary consolidation settlement is the result of a volume change in saturated cohesive soils because of expulsion of the water that occupies the void spaces. The volume change is caused by a stress increase which in turn is caused by the applied levee load.

The amount and rate of settlement will vary based on the levee soil properties and geometry, foundation stratigraphy, and pre-consolidation pressure.

Settlement below the 1% AEP design elevation increases the risk of overtopping by reducing the crown elevation of the levee over time. Settlement amounts and rates vary across the systems and decrease over time.

Subsidence

In general, subsidence is the sinking of the ground because of underground material movement. It is caused by naturally occurring geologic and human-caused processes, which may include faults in rock formations; human withdrawal of water, oil, and gas; and compacting of shallow sediments. In the study area, subsidence is primarily caused by groundwater pumping (known as dewatering). Other local factors include the natural consolidation of alluvial deposits, as well as groundwater and sea level fluctuations over time.

In the study area, subsidence contributes to the lowering of the levee top elevations by lowering the ground that the levee sits on.

Sea Level Change

Sea level change can be an increase or decrease in water levels and varies regionally around the globe. Sea level rise increases risk by increasing the initial water elevation (stillwater) that hurricanes influence, thereby increasing storm surge and wave elevations. Relative sea-level change (RSLC) is a combination of eustatic (global or widespread) sea-level rise and local subsidence. Figure 2-1 below graphically depicts the combined effects of subsidence and sea level rise.

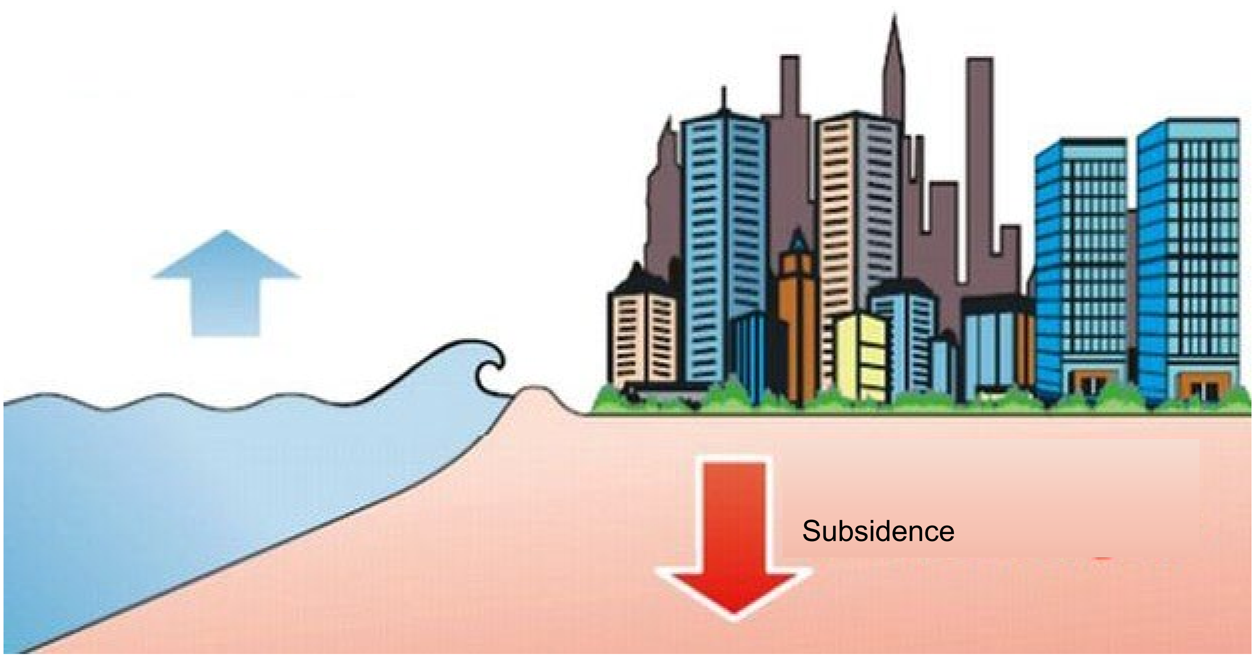

Figure 2-1. Graphical depiction of subsidence and sea level rise effects (Bucx, Dam, de Lange, Erkens, & Lambert, 2015)

Combined Effects

Figure 2-2 demonstrates how sea level rise (dashed blue line), changes in the levee top elevation due to settlement (dotted black line), and changes in ground elevation due to regional subsidence (dashed black line), combine to reduce the ability of the levee system to provide the designed 1% AEP risk reduction in the future, absent future levee lifts.

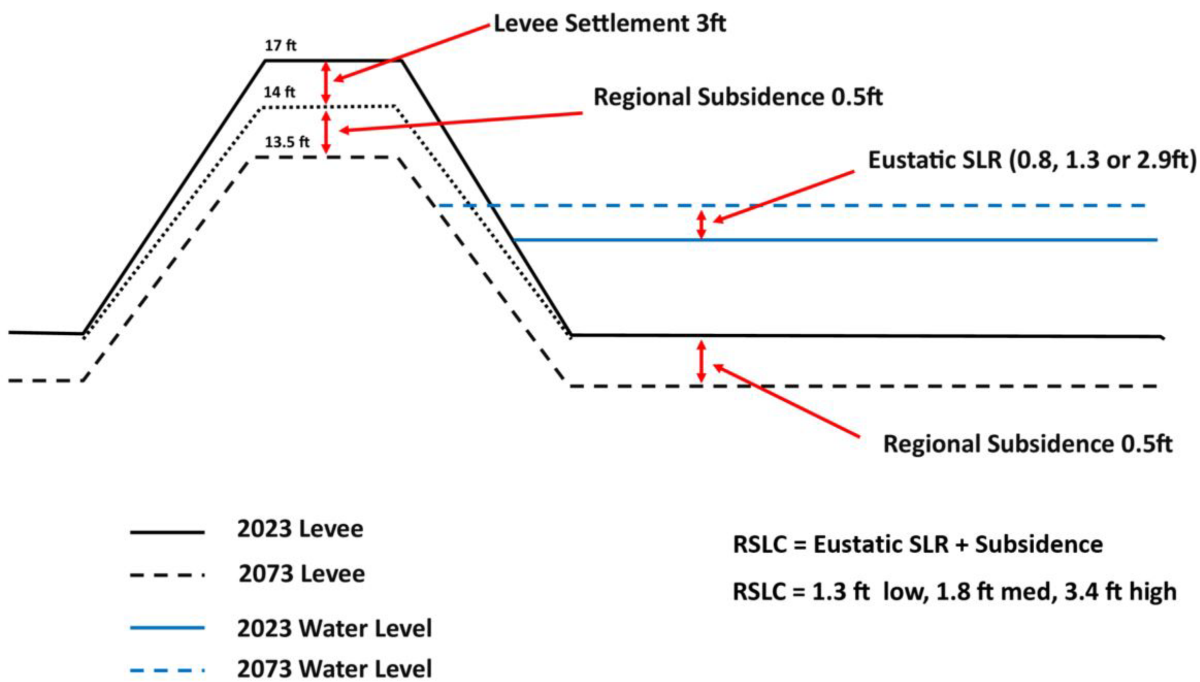

Figure 2-2. Example of the Combined Effects of Settlement, Subsidence and Sea Level Rise (SLR) on a Levee

2.2.3 SCOPING & COORDINATION*

Scoping is an early and open process for determining the scope of alternatives to be considered and the range of issues to be addressed in an EIS and for identifying the significant concerns related to a proposed federal action. A public scoping meeting was held on April 30, 2019 after the Notice of Intent to Prepare an EIS was published in the Federal Register on April 2, 2019.

Additionally, USACE coordinated with the following state and federal agencies, Federally-recognized Tribes, and other interested parties:

- Louisiana Coastal Protection and Restoration Authority Board (CPRAB)
- Louisiana Coastal Protection and Restoration Authority (CPRA)
- U.S. Fish and Wildlife Service (USFWS)
- National Park Service
- U.S. Environmental Protection Agency (USEPA)
- U.S. Geological Survey (USGS)
- National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service
- Louisiana Department of Natural Resources (LDNR)
- Louisiana Department of Environmental Quality (LDEQ)
- Louisiana Department of Wildlife and Fisheries (LDWF)
- Louisiana State Historic Preservation Office (SHPO)
- Alabama-Coushatta Tribe of Texas
- Chitimacha Tribe of Louisiana
- Choctaw Nation of Oklahoma

- Coushatta Tribe of Louisiana
- Jena Band of Choctaw Indians
- Mississippi Band of Choctaw Indians
- Muscogee (Creek) Nation
- Seminole Nation of Oklahoma
- Seminole Tribe of Florida
- Tunica-Biloxi Tribe of Louisiana
- The Southeast Louisiana Flood Protection Authority – East
- The Pontchartrain Levee District
- St. Charles Parish
- Orleans Parish
- St. Bernard Parish
- Jefferson Parish

Please see Appendix L, *Coordination*, for related documents.

2.2.4 COORDINATION MEETINGS

Study collaborators discussed problems, opportunities, and potential measures through numerous coordination meetings. While not comprehensive, the following meetings are examples of ongoing coordination:

- Plan Formulation coordination meeting (1st iteration): September 10, 2018
- Plan Formulation coordination meeting (2nd iteration): November 6, 2018
- Stakeholder and sponsor: November 5, 2018
- Federal coordination: November 6, 2018
- State coordination: November 7, 2018
- Levee District Strategic Partnership Meeting: March 29, 2019

The intent of the 1st and 2nd iteration Plan Formulation meetings was to complete early rounds of the USACE six-step planning process to inform the development of potential alternatives for the study. Subsequent coordination meetings were focused on agency and stakeholder collaboration during early stages of the study process.

2.2.5 PUBLIC REVIEW AND COMMENTS

Public input occurred at multiple points during the planning study. The general public could learn about the study through information posted to the New Orleans District's public website. As noted above, a public scoping meeting was held in April 2019. The Draft EIS was released for a 55-day public comment period, beginning when the Notice of Availability was published in the Federal Register on December 13, 2019. USACE conducted one public meeting on January 22, 2020 to encourage the public to provide comments on the Draft EIS and the proposed. For additional information see Appendix L, *Coordination*.

2.2.6 PROBLEM SUMMARY AND STATEMENT

The combined effect of subsidence, settlement, and sea level rise will continue and increase the risk of overtopping of levees during hurricane storm events as time progresses. This in turn increases:

- Risk of catastrophic failure from overtopping

- Risk to life safety
- Risk of damage to property & infrastructure
- Regional economic impacts
- Risk to cultural heritage and population, and other social effects
- Risk of environmental damages and human health safety impacts from industrial flooding

PROBLEM STATEMENT: Due to subsidence, settlement, and potential sea level rise there is an increased risk of overtopping of LPV levees during hurricane storm events over the period of analysis, resulting in increased risk to life safety and storm-related flood damages within the LPV area.

2.3 OPPORTUNITIES

Opportunities are positive conditions in the study area that may result from implementation of a federal project, such as:

- Maintain the coastal storm risk reduction benefits associated with the initial ($7.1B) federal investment in the LPV system
- Protect environmental resources
- Evaluate a level of risk reduction above the 1% AEP event
- Reduce the costs associated with hurricane and storm damages to the environment and human health.

2.4 FEDERAL INTEREST

As originally established by the Flood Control Act of 1965, and further exemplified in the $7.1 billion dollars invested in the LPV system after Hurricane Katrina, there is a federal interest in hurricane and storm risk reduction for the LPV area. As described in section 2.2.1, hurricanes and coastal storm events continue to threaten lives, damage property and infrastructure, and disrupt the nationally significant energy industry. A federal interest exists in further reducing the coastal storm and life safety risk of the LPV system to offset the long-term effects of consolidation, settlement, subsidence, and sea level rise.

2.5 GOALS & OBJECTIVES*

The federal objective of water and related land resources planning is to contribute to national economic development consistent with protecting the nation's environment, pursuant to national environmental statutes, applicable executive orders, and other federal planning requirements. The study will evaluate and compare the benefits, costs, and impacts (positive or negative) of alternatives including the No Action Alternative, including identification and analysis of benefits across a full array of benefit categories.

The goal of the study is to reduce the risk of life loss and economic damages due to hurricane storm surge in the greater New Orleans metropolitan area. Specific study objectives were developed to identify measures and alternatives which can address the study area's problems while taking advantage of the identified opportunities and avoiding the constraints. The following study objectives were developed based on the study area problems, opportunities, and goals, as well as the federal objective and regulations. Per the study's authorizing language, the following objectives will include, at a minimum, consideration of an alternative to restore the authorized level of risk reduction (the 1% AEP flood event).

Objectives:

1. Reduce the risk of life loss due to hurricane and storm damage in LPV over the 50-year period of analysis associated with consolidation, settlement, subsidence, sea level rise, and new datum. This includes identifying at least one alternative which reduces life safety risk associated with system overtopping below tolerable levels (see Section 3.4.1). This will be primarily measured by life safety risk reduction estimates.
2. Reduce economic damages due to hurricane and storm damage in LPV over the 50-year period of analysis associated with consolidation, settlement, subsidence, sea level rise, and new datum. This will be primarily measured by economic benefits estimates.

2.6 CONSTRAINTS

A planning constraint limits the extent of the plan formulation process. Plans should be formulated to meet study objectives and avoid violating the constraints. All USACE studies have a set of "universal" constraints and study-specific constraints. These are outlined below, along with a list of additional considerations that, while not constraints, may influence the study process.

The criteria below are considered constraints when formulating management measures.

Universal Study Constraints Applicable to this Study

- Avoid or minimize environmental and cultural resources impacts, including but not limited to Clean Water Act Section 404 wetlands, endangered species, and critical habitat
- Avoid or minimize locating project features on lands known to have Hazardous, Toxic and Radioactive Waste (HTRW) concerns
- Resource constraints – time, money, knowledge
- Adhere to applicable laws and policies

Study-Specific Constraints

- Avoid impacts to the functions of other federal projects in the vicinity. These projects include but are not limited to the GIWW, MR&T, IHNC, SELA, etc.
- Per the study authority, selection of a recommended plan is limited to the 1% AEP level of risk reduction. Therefore, plan formulation will be primarily focused on this LORR.
- Per the authority, Section 3017 only applies to projects for which an executed PPA provides that the non-federal interest is not required to perform future measures to restore the project to the authorized level of protection of the project to account for subsidence and sea-level rise as part of OMRR&R responsibilities .

Additional Study Considerations

- *Real Estate*. Due to urbanization, many areas have very little open land adjacent to the existing levee features. Increases to the project footprint may be difficult without buying out structures.
- *Wetland mitigation*. Mitigation areas may be hard to find. Mitigation bank credit availability varies with time, and potentially impacted habitat types may have limited suitable land nearby for identification of potential mitigation sites.
- *Environmental Justice*. An Environmental Justice (EJ) analysis focuses on the potential for disproportionately high and adverse impacts to minority and low-income populations during the construction and normal operation of a federal action. The study must strive to avoid or minimize this potential impact.
- *Transfer of risk.* The study must identify and address any potential transfer of risk to other entities. Increases to economic, life safety, or environmental risk should be avoided and/or minimized.

3 EXISTING CONDITIONS LEVEE PERFORMANCE

One of the first steps in the USACE planning process is to assess the existing conditions in the study area. This generally includes describing all of the factors that are relevant to the study, as they exist during the study period. This section discusses the current condition of the levee, the hydrology and hydraulic conditions that affect the levee's performance, the potential economic damages if the levee's current elevations were to be exceeded by storm surge and/or waves (known as overtopping), and the potential life safety consequences if levees were overtopped or failed (breached) due to overtopping (breach prior to overtopping was not evaluated – see Section 3.5 for more information). Section 4 discusses the potentially affected existing environment. Section 5 will consider potential changes in the future which may affect the levee's performance and estimates corresponding changes to economic damages, levee performance risk, and life safety consequences.

3.1 EXISTING LEVEE SYSTEM CONDITION

Currently, LPV project includes a total of approximately 126.5 miles of levees and 56 miles of floodwalls, floodgates, water control structures, and other risk reduction features. This includes primary perimeter storm surge risk reduction features, and detention basin features along the IHNC and GIWW, and the three outfall canals. The LPV project construction began in 1966 but was incomplete at the time Hurricane Katrina made landfall in 2005.

The floodwall design elevations resulting from the post-Hurricane Katrina Supplemental Acts were intended to reduce estimated tropical storm flood risk in the year 2057 (sometimes referred to as the "2057 design"), while the levees were designed with the understanding that lifts would be required in the future to maintain design heights. However, those authorities did not provide for future lifts to maintain the levee design elevations as levee soils consolidated over time. The construction resulting from the post-Katrina Supplemental Acts was essentially completed in 2018.

The Greater New Orleans HSDRRS is designed to reduce the flood risk associated with a 1% AEP storm surge and waves event. Design elevations of levees and floodwalls are set to limit the expected wave overtopping rate to 0.1cfs/ft at 90% confidence and 0.01 to 0.03 cfs/ft at 50% confidence for the 1% AEP storm surge and wave event at each design segment. Probabilistic overtopping estimates at each design segment assume simultaneous occurrence of 1% AEP surge level and 1% AEP wave characteristics. Additionally, the design elevations are checked for resiliency by comparing top of levee/structure elevations to the 0.2% AEP still-water elevations.

Levee top elevation, top width, and side slopes vary throughout the system. In some areas there are landside stability berms and there are some reaches with wave berms. All LPV perimeter levees are armored with either high performance turf reinforcement mat, concrete aprons, rip-rap, or articulated concrete blocks. The LPV/MRL co-located project area is defined as the area in which the LPV design elevations are higher than the MR&T design elevations. However, since the MR&T is established and maintained by previous authority that is not superseded by the LPV authority, the projects are said to co-exist or coincide, meaning the LPV levee or feature is built on top of, and over, the MR&T levee. Currently, there are no LPV/MRL co-located levees.

The levees have settled over time. Settlement begins to occur as soon as stresses are increased on the soil, which can begin when levee construction fill is placed, but can be due to other factors. Because the system was constructed over time, the amount of settlement varies throughout the system. Some reaches have been "lifted" (height added) by CPRAB and either Southeast Louisiana Flood Protection Authority - East or Pontchartrain Levee District, as a USACE Section 408 (Alteration to a Project) effort, prior to armoring being added, to compensate for settlement. However, the current PPA does not require the non-federal sponsor to maintain the authorized level of risk reduction of the "New Work" to account for subsidence or sea level rise as part of its Operations, Maintenance, Repair, Rehabilitation, and Replacement (OMRR&R) responsibilities. In order to assess the current levee elevations, a top-of-levee survey was completed in the fall of 2018. This survey was used to assess the accuracy of previous settlement projections and supported project future settlement (see Section 5).

Generally, armoring is intended to provide resiliency to the system when subject to events greater than the design event. The purposes of armoring are to reduce the risk of catastrophic failure during these less-frequent, more severe events, and to ensure that the system remains in place and functional for subsequent storm events. To this end, armoring is essential and is included as part of the system on all perimeter levees and in critical areas to include transition points where levees and floodwalls abut; pipeline crossings of levee alignments; and floodwalls where erosion could compromise wall stability. Although interior flooding due to wave overtopping could occur in larger events, the risk of catastrophic failure of the perimeter system is reduced with the installation of armoring.

Floodwalls including I-walls and T-walls are used throughout the LPV system. It is often not practical to add height to a completed hard structure. Therefore, the perimeter hard structures were constructed to the estimated 2057 required elevation based on projections for subsidence, sea level rise, and other variables at the time of design and construction. In some instances, structures were built with up to two feet of "structural superiority" for features that were deemed particularly difficult to modify in the future. Concrete T-walls are typically located at points along the levee where there is a high potential for erosion or insufficient space for an earthen levee. T-walls are located on either side of every river, railroad, interstate, and state highway crossings. Wall thickness varies by wall height and ranged between 1.5 and 4.5 feet. Base width and thickness varies by location and wall height. Base width ranged from 6 to 22.5 feet and base thickness ranged from 2 to 4.25 feet.

On the interior of the LPV system, drainage pump stations remove water that falls inside (rain) or overtops the system. These pumps remove water to the exterior of the system or to interior canals for storage and/or removal by other pumps.

The ability to withstand impacts from boats and barges that may become unmoored during a storm is an important consideration in parts of the interior of the system that are used for navigation but also function as temporary ponding areas during a storm event. Structural features located adjacent to major navigation routes are further protected by dolphins, berms, or Regulated Navigation Areas (RNA) to reduce the risk of contact from tows or loose vessels. Within the LPV system, these areas include the Inland Harbor Navigation Canal (IHNC) and a portion of the Gulf Intracoastal Waterway (GIWW).

The United Stated Coast Guard (USCG), with support from USACE, has implemented RNA where there are floodwalls with high probability of catastrophic failure should an unmoored, unimpeded barge strike them with any substantial force. Most of the existing floodwalls in subject areas were constructed pre-Hurricane Katrina and were not designed for barge impact loads. Risk reduction is maximized through evacuation of these areas prior to an event. If evacuation is not attainable, it is imperative that the USCG ensure that the requirements contained within 33 CFR 165.838 “Regulated Navigation Area; New Orleans Area of Responsibility, New Orleans, LA” are effective in keeping vessels under control and away from the floodwalls during tropical events. A supplemental notice for revisions to the RNA was filed in June 2013. Details of the RNA and revisions can be found in Chapter 33 of the Code of Federal Regulations: 33 CFR Part 165, [Docket No. USCG-2009-0139].

As of September 2013, this RNA is defined within the following areas of the LPV project: The GIWW from MM 22 East of Harvey Locks, west on the GIWW, including the Michoud Canal and the IHNC, extending North 1/2 mile from the Seabrook Floodgate Complex out into Lake Pontchartrain and South to the IHNC Lock.

3.2 EMERGENCY PREPAREDNESS AND ACTION PLANS

Each Parish, as well as the State of Louisiana, has an emergency action plan for a hurricane event. These plans include timing of evacuation orders, as well as procedures to be followed. The information presented in this section was gathered from existing emergency action plans and interviews with officials from the Parishes and the State of Louisiana.

Due to the extreme nature of the events which would result in a breach of the New Orleans levee systems, evacuation order timings are tied to the arrival of a storm rather than any imminent danger of system failure. Each Parish has its own mandatory evacuation timeline which is based on the arrival of a storm. These evacuation timelines are displayed in Table 3-1 below. Because the mandatory evacuation orders are issued well in advance of a storm’s arrival, individuals who choose to evacuate are likely to have enough time to do so.

Table 3-1. Issuance of Mandatory Evacuation Orders, by Parish

Parish	Hours Before Storm Arrival
Orleans	72
St. Bernard	48
St. Charles	40
Jefferson	54
Source: http://www.lsp.org/pdf/hurricaneguideSE.pdf	

The Parishes’ individual evacuation plans for major storms is supported by the State of Louisiana’s plan to enact contraflow on the major interstates in the area, I-10 east and west and I-55 and I 59. During contraflow, all travel lanes are redirected to exit the area. Many of the parishes also have staging areas or registries for those that do not have their own vehicles or need other special assistance evacuating.

While severe tropical storms and hurricanes are well-forecasted and most people have the means to follow news coverage, the study area has a large population of homeless and citizens living below the poverty line who may not have the technology necessary to receive warnings. These demographic groups may be hard to reach since there is not a loudspeaker or siren system in place for warning issuance. Additionally, some portion of the population will be unable to or choose not to evacuate. The percentage of each Parish that is anticipated to remain within the system despite a mandatory evacuation order (as estimated by Parish officials), is displayed in Table 3-2 below.

Table 3-2. Estimated Percentage of Population Not Likely to Evacuate, by Parish

Parish	Population Not Evacuating
Orleans	5%
St. Bernard	10%
St. Charles	20%
Jefferson	Not estimated
Source: https://www.sdmi.lsu.edu/sdmi/wp-content/uploads/2017/06/BehavioralAnalysisForSELAHurricaneEvents.pdf	

Additionally, the State of Louisiana and the Red Cross open shelters outside of the impacted areas for those with transportation, but no place to stay after evacuating.

The USACE New Orleans District emergency response includes sending embedded personnel to the Governor's Office of Homeland Security and Emergency Preparedness as well as liaisons to local parishes and levee districts in order to monitor system performance and provide engineering expertise and other assistance as required to minimize risks to the system.

3.3 HYDROLOGIC AND HYDRAULIC CONDITIONS

3.3.1 STORM MODELING

Storm effects for Future Without Project (FWOP) conditions were modeled in ADvanced CIRCulation (ADCIRC) using a suite of 152 synthetic storms. The storms cover a range of hypothetical tracks, forward speeds, intensities and sizes. The Joint Probability Method – Optimal Sampling (JPM-OS) synthetic storms are basically an extension of the limited observed record. The JPM-OS code combines the meteorological probability and the peak surge elevation of all 152 storm events to estimate the 5%, 2%, 1%, 0.5%, 0.2%, and 0.1% AEP surge elevations for the existing and FWOP conditions. No rainfall time-series are available for the 152 synthetic storms, therefore, rainfall was not included in the River Analysis System 2-demensional (RAS 2D) polder interior simulations described in subsequent sections.

Although rainfall was not included in the simulations, a two-part sensitivity analysis was conducted to explore the potential effects of rainfall on the inundation modeling. A simulation of Hurricane Katrina was performed with and without rainfall. The results of that test show that the model of interior flooding is not very sensitive to rainfall. The large overtopping volume expected during a modeled Katrina event dominated water levels and rainfall had only a small effect. With the second sensitivity, the HEC-RAS modeling of synthetic storms was completed with rainfall by assuming a 10YR rain accompanies each of the 152 synthetic storms. The resulting inundation showed extensive street flooding throughout the city. However, the HEC-RAS model does not include the extensive subsurface drainage network that is present in the city and this results in increased water levels when rainfall is applied. If the drainage network were modeled, it would have an effect of lowering water levels for the 10YR rain, and could possibly reduce the effect of the rainfall flooding component.

3.3.2 INUNDATION MODELING

Inundation of the system interior can result from wave action alone, or a combination of surge and wave action. The inundation estimates in this section assume that the levees and floodwalls do not fail prior to or as a result of overtopping by surge and waves (this is discussed further in Section 3.4).

To model interior flooding extent and depths, a RAS 2D model was developed. The LPV includes RAS 2D meshes for five sub-basins: St. Charles, Orleans and Jefferson Parish east bank, New Orleans East, and Chalmette Loop (Figure 3-1). All 2D meshes are connected using storage area connections with weir profiles assigned using the latest available surveys. The nominal mesh resolution is 700ft. This mesh resolution facilitates higher computational efficiency while producing realistic results. Manning's "n" (roughness) values were assigned using the 2011 National Land Cover Database.

Figure 3-1. LPV Sub-Basins

The perimeter levee and floodwall elevations are not incorporated into the Hydrologic Engineering Center (HEC) HEC-RAS 2D geometry but are used in overtopping calculations that are input as boundary conditions to the model. Rainfall was not included in the RAS 2D simulations described in this section. Pump information was extracted from the USACE pump database and the pumps in the model are modeled as 2D connections with outlet rating curves. The rating curve approach ensures the peak capacity of each pump is utilized in the simulations.

Overtopping rates were calculated at all design segments. Each segment has unique levee or floodwall geometry and hydraulic boundary conditions including surge elevation, significant wave height and mean wave periods.

ADCIRC hydrographs were extracted for all 152 synthetic storms at each segment. The ADCIRC dataset used was the “2017 CPRA Master Plan”. This surge hazard analysis is the only dataset available from the extensive post-Hurricane Katrina modeling of Southeast Louisiana that includes hydrographs, wave heights and wave periods for all the locations needed for this study. Additional inputs into the overtopping calculations include levee geometry parameters including wave berm elevation, levee slope and crest elevations. Levee and floodwall surveyed elevations were mapped to each of the 415 segment profiles.

Eutotop overtopping formulae were used to determine the wave and free-flow overtopping time-series for each synthetic storm. If the surge level is less than the crest elevation, wave overtopping formulae are used. If the surge is greater than the crest elevation, the weir equation is combined with the wave overtopping formulae, accounting for wave and freeflow overtopping. Overtopping rates were calculated at each survey point along each of the 415 design segments. The resulting overtopping rates at each survey point were then summed to produce a total for each segment. The width between each survey point is factored into the calculations. The overtopping time-series at each segment was then summed to the corresponding RAS 2D flow boundary. In total, 81 flow boundary conditions were assigned to the RAS 2D geometry.

HEC-RAS simulations were computed for all 152 JPM-OS synthetic storms. Once all 152 synthetic storms were evaluated, surge statistics could be completed using the latest JPM-OS code. The code was supplied by Engineer Research and Development Center’s (ERDC’s) Coastal Hydraulics Lab. The code combines the meteorological probability and the peak surge elevation of all 152 storm events to estimate the 5%, 2%, 1%, 0.5%, 0.2% and 0.1% AEP surge elevation.

Modeled storm surge elevations were plotted against the levee and floodwall elevation data to determine potential locations for surge overtopping. Additionally, in areas where surge or waves were estimated to overtop the levees or floodwalls, overtopping rates were calculated. Figures 3-2, 3-3 and 3-4 display the 1%, 0.5% and 0.2% AEP water depth for existing conditions. In these figures, the canals and navigation channels are apparent as relatively linear features with deep water.

Depth maps such as the figures below depict a coarse representation of high-resolution hydraulic model results. In HEC-RAS, a single peak water surface elevation is estimated for each 700ft cell. Depths within each cell will then vary by the underlying 3ft high resolution terrain dataset. The report figures show depth, measured from the minimum terrain elevation within each cell, mapped across the entire cell, so depths may appear coarser and more extensive than they are in the actual hydraulic modeling and subsequent economic analysis.

The high-resolution water surface profile and depths for all return periods were provided to the economics team for evaluation of damages (refer to Section 3.4 for economic analysis).

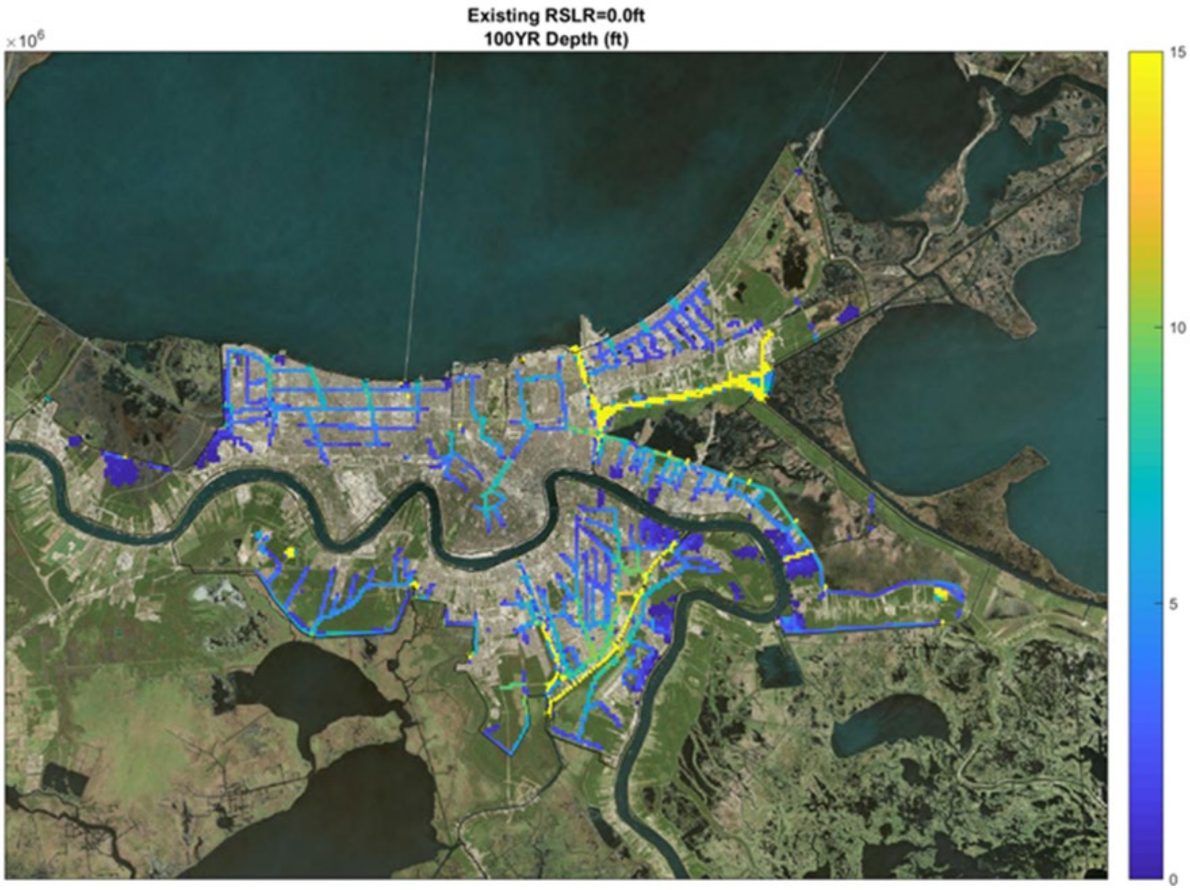

Figure 3-2. 1% AEP Peak Depths (ft.) for Existing Conditions

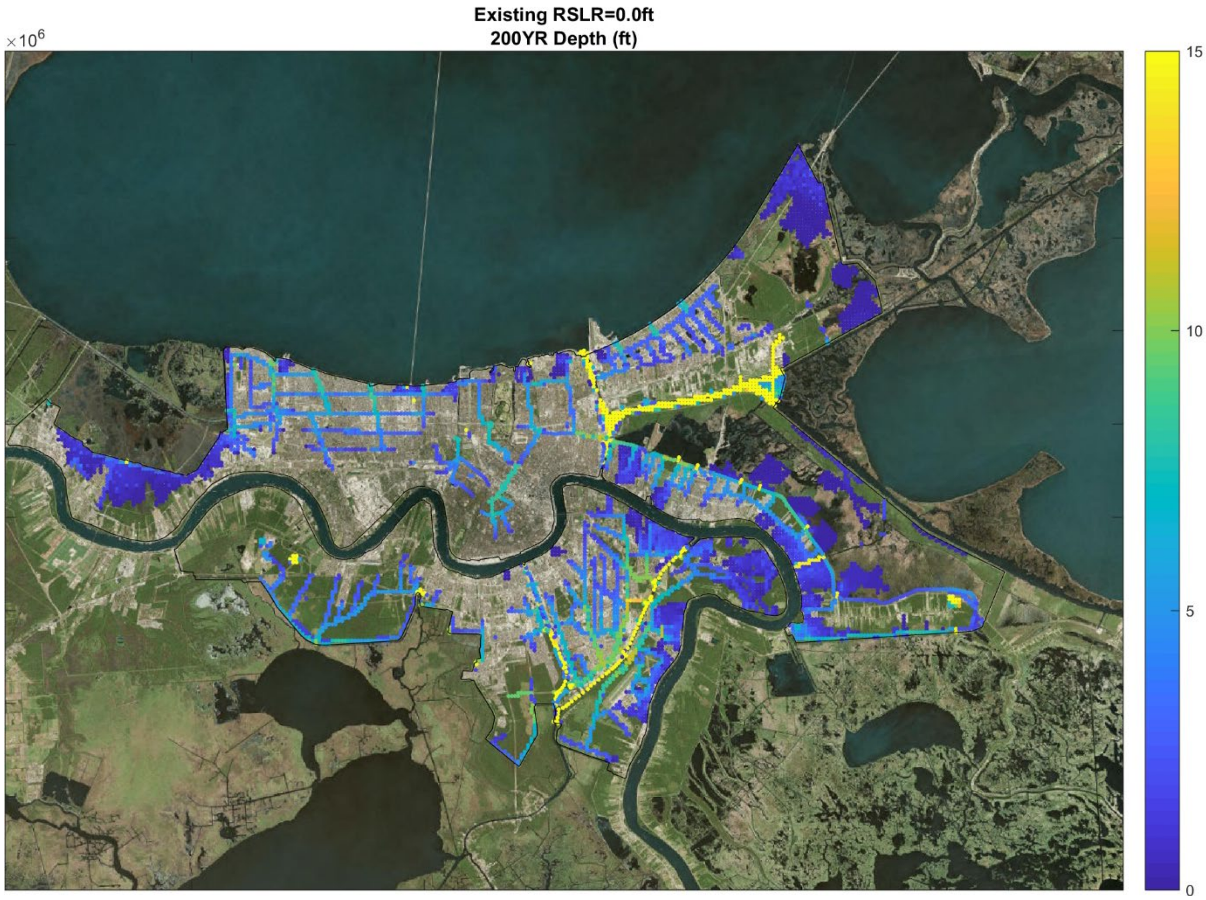

Figure 3-3. 0.5% AEP Peak Depths (ft.) for Existing Conditions

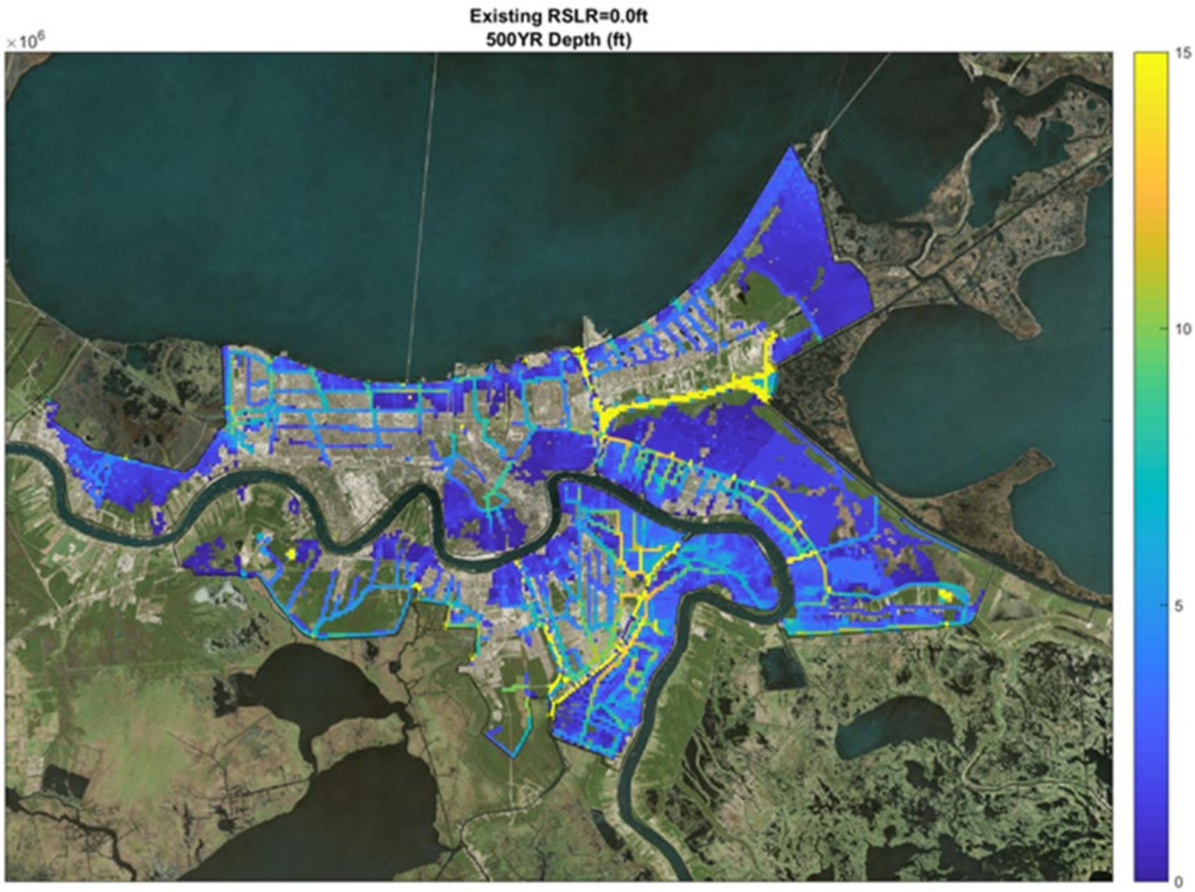

Figure 3-4. 0.2% AEP Peak Depths (ft.) for Existing Conditions

Estimations of inundation extent and depths varies by polder based primarily on interior topography and the interior drainage system. For example, overtopping along the Chalmette Loop or in parts of New Orleans East can be accommodated to an extent by storage capacity in wetlands within those basins. However, overtopping along the lakefront levees in Jefferson and Orleans would result in immediate impacts to populated areas because there is no storage capacity in those areas other than canals and streets. While the modeling assumes that all levee system pumps are functioning at 100% capacity, it does not take into account any local (sewer) drainage features.

3.4 EXISTING ECONOMIC DAMAGES

The Hydrologic Engineering Center Flood Damage Analysis (HEC-FDA) program version 1.4.2 was utilized to evaluate flood damages using risk-based methods. The key economic inputs for the analysis are the structure inventory, depth-damage functions, content-to-structure value ratios, and the associated quantified risk and uncertainty parameters associated with these inputs.

Structure Inventory

The structure inventory used for this study is the National Structure Inventory (NSI) version 2. This updated version of the inventory uses Zillow data, ESRI map layer data, and CoreLogic data to improve structure placement over the previous version of the NSI. RS Means was used to calculate the depreciated replacement value of structures. An extensive survey was conducted to estimate foundation heights for different sectors within the greater New Orleans area. Structure counts by occupancy types are shown in Table 3-3.

Table 3-3. Structure Counts by Occupancy Type

Lake Pontchartrain and Vicinity Structure Counts by Occupancy Type NSI 2019			
Residential		**Non-Residential**	
One-Story Slab	73,761	Eating and Recreation	3,718
One-Story Pier	67,339	Professional	12,065
Two-Story Slab	26,600	Public and Semi-Public	3,293
Two-Story Pier	23,478	Repair and Home Use	4,211
Mobile Home	3,420	Retail and Personal Services	7,666
		Warehouse	5,016
		Multi-Family Occupancy	2,795
Total Residential	194,598	Total Non-Residential	38,764

Depth-Damage Relationships and Content-to-Structure Value Ratio (CSVR)

Depth-damage relationships define the relationship between the depth of flooding and the percent of damage at varying depths that occurs to structures and contents. These mathematical functions are used to quantify the flood damages to a given structure. The content-to-structure value ratio (CSVR) is expressed as a ratio of two values: the depreciated replacement cost of contents and the depreciated replacement cost of the structure.

One method to derive these relationships is the “Expert Opinion” method described in the Handbook of Forecasting Techniques, IWR Contract Report 75-7, December 1975 and Handbook of Forecasting Techniques, Part II, Description of 31 Techniques, Supplement to IWR Contract Report 75-7, August 1977. A panel of experts was convened to develop site-specific depth-damage relationships and CSVRs for feasibility studies associated with Jefferson and Orleans Parishes. The results of this panel were published in the report Depth-Damage Relationships for Structures, Contents, and Vehicles and Content-To-Structure Value Ratios (CSVRS) In Support Of the Jefferson and Orleans Flood Control Feasibility Studies, June 1996 Final Report. Table 3-4 displays the CSVRs and their respective standard deviations used for LPV.

Table 3-4. Content to Structure Rations (CSVRs) and Standard Deviations

Content-to-Structure Value Ratios (CSVRs) and Standard Deviations (SDs)		
Structure Category		**(CSVR,SD)**
Residential	One-story	(0.69, 0.37)
	Two-story	(0.67, 0.35)
	Mobile home	(1.14, 0.79)
Non-Residential	Eating and Recreation	(1.70, 2.93)
	Groceries and Gas Stations	(1.34, 0.78)
	Professional Buildings	(0.54, 0.54)
	Public and Semi-Public Buildings	(0.55, 0.80)
	Multi-Family Buildings	(0.28, 0.17)
	Repair and Home Use	(2.36, 2.95)
	Retail and Personal Services	(1.19, 1.05)
	Warehouses and Contractor Services	(2.07. 3.25)

Vehicle Inventory

Based on 2010 Census information for the New Orleans Metropolitan area, there are an average of 2.0 vehicles associated with each household (owner occupied housing or rental unit). According to the Southeast Louisiana Evacuation Behavioral Report published in 2006 following Hurricanes Katrina and Rita, approximately 70 percent of privately owned vehicles are used for evacuation during storm events. The remaining 30 percent of the privately owned vehicles remain parked at the residences and are subject to flood damages. Only vehicles associated with residential structures were included in the analysis. Vehicles associated with non-residential properties were not included in the evaluation.

First Floor Elevations

Topographical data based on NAVD88 was used to assign ground elevations to structures and vehicles in the study area. The assignment of ground elevations and the placement of structures were based on a digital elevation model with a fifteen foot by fifteen foot grid resolution developed by the USGS. The ground elevation was added to the height of the foundation of the structure above the ground in order to obtain the first floor elevation of each structure in the study area. Vehicles were assigned to the ground elevation of the adjacent residential structures.

Levee Fragility

One possible input to the economic model is the inclusion of fragility curves. Fragility curves relate the levee loading (height of water on the levee) to the probability of failure and account for the possibility of damages occurring prior to levee overtopping. In addition, due to the complex nature of the storm modeling and the simplifying assumptions of the economic model (which, along with other factors specific to this study, limit its ability to reflect the complexity of hurricane-related flooding), there were no levee fragility curves utilized for this economic analysis. Therefore, the economic model assumes that the levees never fail and all damages are caused by water flowing into the system over the top of the levee. This assumption effectively reduces the damage estimates because there is always some probability that the levee could fail prior to overtopping, which would introduce more water into the system and increase flood damages. While economic damages may be underestimated due to the lack of fragility curves, this underestimation applies to all study conditions (existing, future without project, and future with project). If future risk assessments find that prior-to-overtopping failure modes drive the risk for the system, then it is possible that the project benefits identified by this study will not be fully realized.

The rationale for omitting fragility curves and the related uncertainty is discussed further in Section 9.7.1 It should be noted that the life safety model (see Section 3.5) uses a semi-quantitative risk assessment methodology and is able to estimate life safety risk related to the potential for levee failure due to overtopping.

Existing Conditions Damages Due to Overtopping

The existing conditions damages due to overtopping by probability event are displayed in Table 3-5 and the expected annual damages by sub-basin are displayed in Table 3-6. Table 3-5 presents the damages estimated to occur at each AEP event of that AEP (i.e., these damages are not cumulative and are not annualized).

Table 3-5. Existing Conditions Expected Annual Damages Due to Overtopping, by Probability Event

Lake Pontchartrain and Vicinity Expected Annual Damages by Probability Event 2023	
100%	$0
10%	$0
5%	$0
2%	$0
1%	$110,000
0.5%	$1,337,000
0.2%	$18,080,000
0.1%	$36,550,000

Table 3-6 presents the expected annual damages due to overtopping occurring for the 1% AEP event. Estimations of expected annual damages take into account the likelihood of damages for all AEP events. In Table 3-6, the significantly higher damages in the Jefferson East Bank polder are related to the area’s high level of development, high value structures, and lack of flood storage areas.

Table 3-6. Existing Conditions Annualized Economic Damages Due to Overtopping, by Sub-Basin (1% AEP Event)

Lake Pontchartrain and Vicinity Expected Annual Damages 2023 $1,000s	
Sub-basin	**Expected Annual Damages, 2023**
Chalmette Loop	$6,199
Jefferson East Bank	$67,037
Orleans East Bank	$8,564
New Orleans East	$9,520
St. Charles	$6,842
Total	$98,162

3.5 EXISTING CONDITIONS LIFE RISK

There is a significant risk to human health, safety, and property associated with hurricane storms in the greater New Orleans area, demonstrated by documented impacts as early as the 1920s. During many of these hurricane storm events, residents are evacuated from their homes, occasionally for extended periods of time. Structures experience major damage and evacuation routes are shut down by floodwaters. In addition, access to critical infrastructure such as hospitals, fire departments, police departments, and schools are cut off. This section describes the current probability of levee overtopping (with and without breach) during hurricane storm events and the associated life safety consequences.

3.5.1 RISK IDENTIFICATION

A Semi-Quantitative Risk Assessment (SQRA) was performed to identify the magnitude of the life risk associated with the levee system. Due to the limited time and funding available to conduct the study, a full SQRA that examines all potential failure modes was not able to be conducted. Given the authorizing language to “address consolidation, settlement, subsidence, sea level rise, and new datum to restore Federally authorized hurricane and storm damage reduction projects”, the risk assessment performed for this study focused only on risks related to those conditions. The relevant risks are all primarily related to overtopping of the levee system and a decision was made to focus the SQRA only on these overtopping risks. A prior-to-overtopping failure mode related to overstressing of the concrete and steel T-wall piles was considered for inclusion but it was determined that there was insufficient understanding of the potential problem in the future condition to support the analysis. This decision is supported by examination of the available Screening Level Risk Assessments, which identified overtopping of levees as the major risk driver and was fully coordinated with the USACE Levee Safety Program team. The system may have other potential modes of failure prior to overtopping but the risk assessment did not seek to quantify any risks not related to overtopping. An additional semi-quantitative risk assessment is planned in the future to support the FEMA levee certification purposes and that effort will take a comprehensive look at system risks.

In this context, risk is defined as a measure of the probability (or likelihood) and consequences of uncertain future events. The SQRA considered the probability of overtopping (with and without breach) along with the economic and life safety consequences associated with overtopping. This section discusses the existing risk, while Section 5 (Future Without Project Condition) discusses the estimated risk in the future as a result of the combined effects of settlement, subsidence, and sea level rise over the period of analysis.

Tolerable risk guidelines (TRGs) are used in risk management to help inform the process of characterizing and judging the significance of estimated risks developed during the risk assessment process. TRGs are described in more detail in Section 6.4.1. Tolerable risks are those that society is willing to live with to achieve or obtain certain benefits. Within the USACE framework, risks that are above these tolerable limits are determined to warrant some form of management action to reduce the risk. USACE guidelines for tolerable risk limits are related to average incremental life loss. Incremental risk is the increased life risk associated with the presence of flood risk reduction features (such as a levee or dam).

Annualized life loss estimates are often very small numbers and are, therefore, commonly reported in scientific notation. Table 3-7 provides conversions from scientific notation to decimal and text equivalents.

Table 3-7. Example Number Equivalents

Scientific Notation	Decimal Equivalent	Text Equivalent
1E-01	0.1	1 person in 10 years
1E-02	0.01	1 person in 100 years
1E-03	0.001	1 person in 1,000 years
1E-04	0.0001	1 person in 10,000 years
1E-05	0.00001	1 person in 100,000 years

3.5.2 PROBABLE FAILURE MODES

A probable failure mode (PFM) is a mechanism that, once initiated, could potentially progress to breach of a levee system. A PFM analysis results in an estimate of the likelihood of failure (breach) in a given loading situation. This information is used in conjunction with consequences information to estimate life safety risk. This differs from the economic analysis described in Section 3.3 which, due to different modeling requirements, assumes that the levees do not breach under any loading scenario.

The risk assessment team identified three overtopping potential failure modes as critical to the study’s purpose to address the effects of settlement, subsidence, and sea level rise.

- PFM 1 Overtopping with waves of Armored Levee leads to breach
- PFM 2 Overtopping with waves of Unarmored Levee leads to breach
- PFM 3 Overtopping with waves of Wall Levee Tie-in leads to breach

PFM 1 and 2 are overtopping of the levees in armored and unarmored reaches. Armoring reduces the probability of failure due to overtopping. LPV levees are armored and MRL levees above the existing crossover point are unarmored.

PFM 3 is for overtopping near/at a floodwall/levee tie-in, which was an area that experienced problems during Hurricane Katrina. Modifications were made post-Hurricane Katrina, and this PFM evaluates those modifications.

3.5.3 LEVEE RISKS

The term “levee risk”, sometimes referred to as “incremental risk”, is used to refer to the risk posed by the levee system itself. The “levee risk” associated with this project is the risk (probability of failure and associated consequences) to the landside area and floodplain occupants that can be attributed to the presence of the levee should the levee breach subsequent to overtopping, where the consequences considered are over and above those that would occur without levee breach.

In many levee systems, each risk-driving PFM would be evaluated for two scenarios: with and without intervention. Intervention is considered to be any human activity that takes place prior to or during a flood with the intent of increasing the probability that a levee system will successfully function during a given flood. The risk team determined that there were no intervention activities that could be taken during a hurricane event. Therefore, the only scenario considered is “without intervention.”

To model levee breach scenarios, the risk assessment team performed breach modeling at five locations on the LPV levees plus one more on the east bank of the Mississippi River upstream of the current crossover point to establish a PFM in an unarmored reach. These breach modeling locations were chosen as representative design and loading locations and were not reflective of any known or perceived deficiency in the system. Each breach location was loaded with the surge and wave outputs from the ADCIRC model for the 2%, 1%, 0.5%, and 0.2% AEP events in the existing condition. The model then estimated the hydraulic characteristics of depth, velocity, and associated arrival times of those flood water. Those were the inputs to the LifeSim model, which is a tool used to estimate life loss and direct damage during a flood or storm event.

3.5.4 NON-BREACH RISKS

Non-breach risks are risks associated with overtopping of the levee system that does not result in a failure (breach). These were also estimated by the LifeSim model using the surge overtopping estimates. The non-breach consequences are subtracted from the breach consequences to determine the incremental risk. It must be noted that the risk team did not run the non-breach scenario for the existing 1% or 0.2% AEP event, since the hydrology and hydraulics (H&H) modeling showed no stillwater overtopping of the levee in those cases. Appendix C, *Hydrology and Hydraulics*, contains information on special modeling performed to estimate non-breach wave overtopping inundation for all conditions of the study.

3.5.5 CONSEQUENCES

The LifeSim model estimated life safety risk for the existing conditions for the 1% AEP and 0.2% AEP events. The model used the hydraulic characteristics of depth, velocity, and associated arrival times of flood waters from breach modeling as inputs to the LifeSim model. The LifeSim model used a structure database to distribute population within the model. A number of variables were entered into the LifeSim model based on information from the Parishes' emergency action plans and discussions with Parish officials, such as relative warning issuance, hazard communication delay, warning issuance delay, warning diffusion time, and protective action initiation. The LifeSim model then utilized Monte Carlo analysis and computed multiple iterations in order to obtain a range of possible life loss outcomes. Due to the long warning times for the area (any individuals choosing to evacuate should have ample time to do so), traffic simulations were not used for evacuations. However, it must be noted that the risk team did not run the non-breach scenario for the 1% AEP event consequences because H&H modeling indicated there was no free-flow overtopping and very little wave overtopping. Based on the modeling for LPV, the incremental life loss estimates range from low to extremely high.

3.5.6 RISK CHARACTERIZATION

Given the limited scope of the SQRA, the risk characterization is limited to the incremental risk related to overtopping and, therefore, is not a full risk characterization for the project. The total incremental risk associated with overtopping, which combines the risks and consequences of all of the PFMs considered for the study, helps portray an overall levee overtopping risk picture.

In the existing condition, all overtopping PFMs are below tolerable risk and the total is below the societal tolerable risk line. The estimated total annual probability of failure due to overtopping for LPV existing conditions is between 1E-06 and 1E-05 (0.000001 and 0.00001) failures per year and the best estimate of the average annual incremental life loss is 1E-04 (0.0001) lives per year, which is considered tolerable from a societal perspective.

4 AFFECTED ENVIRONMENT*

This section assesses the historic and existing conditions of relevant resources within the study area and is organized by resource topic. This section is not a comprehensive discussion of every resource within the study area but rather focuses on those resources described as significant by laws, executive orders, regulations, and other standards of national, state, or regional agencies and organizations, technical or scientific agencies, groups, or individuals, and the general public. The relevant resources include the following: geology and soils, water resources, forest and wetland resources, upland resources, fisheries resources, wildlife resources, invasive species, federally-listed species, cultural and historical resources, ecological, scenic, and aesthetic resources, recreational resources, air quality, noise, transportation, socioeconomic resources and environmental justice, and HTRW.

4.1 ENVIRONMENTAL SETTING

4.1.1 STUDY AREA

The study area is located within the coastal zone on the east bank of the Mississippi River south of Lake Pontchartrain within St. Charles, Jefferson, Orleans, and St. Bernard Parishes in southeast Louisiana. The western end of the study area abuts the Bonnet Carré spillway. The eastern end of the study area is located in the Bayou Sauvage National Wildlife Refuge and along the now deauthorized Mississippi River Gulf Outlet (MRGO). The study area includes the communities of New Orleans, Norco, Kenner, Elmwood, Metairie, Chalmette, Poydras, and St. Bernard. Numerous canals and waterways dissect the study area. Numerous sensitive environmental resources are located near the study area including Bayou Sauvage National Wildlife Refuge, Lake Pontchartrain, Lake Borgne, the central wetlands area, the Gulf of Mexico, and the Mississippi River. In general, these environmental resources are largely comprised of bottomland hardwood forests, cypress-tupelo swamps, and various scrub-shrub, forested wetland, and marsh habitats.

The study team considered the affected environment to be the five sub-basins or polders in the study area. Refer to Table 4-1 and the corresponding location map (Figure 4-1).

Table 4-1. Study Area Overview

Sub-basin (Polder)	Parish	Sub-basin Area (acres)	Cities and Areas of Interest	Previous Improvement Efforts
St. Charles	St. Charles	13,064	Norco, Destrehan, St. Rose	Mississippi River Levees
Jefferson East Bank	Jefferson	28,529	Kenner, River Ridge, Elmwood, Harahan, Metairie	17th St. Canal, Lakefront Levees/Floodwalls
Orleans East Bank	Jefferson, Orleans	27,935	New Orleans, Metairie, Port of New Orleans	17th St. Canal, Orleans Ave. Canal, London Ave. Canal, IHNC, Lakefront Levees/Floodwalls
New Orleans East	Orleans	35,322	Bayou Sauvage NWR	IHNC Surge Barrier, GIWW, Lakefront Levees/Floodwalls
Chalmette Loop	Orleans, St. Bernard	49,295	Lower Ninth Ward, Arabi, Chalmette, Meraux, Violet, Poydras, St. Bernard, central wetlands area	IHNC Surge Barrier, GIWW, Caernarvon to Verret and Verret to Bienvenue Levee/Floodwall

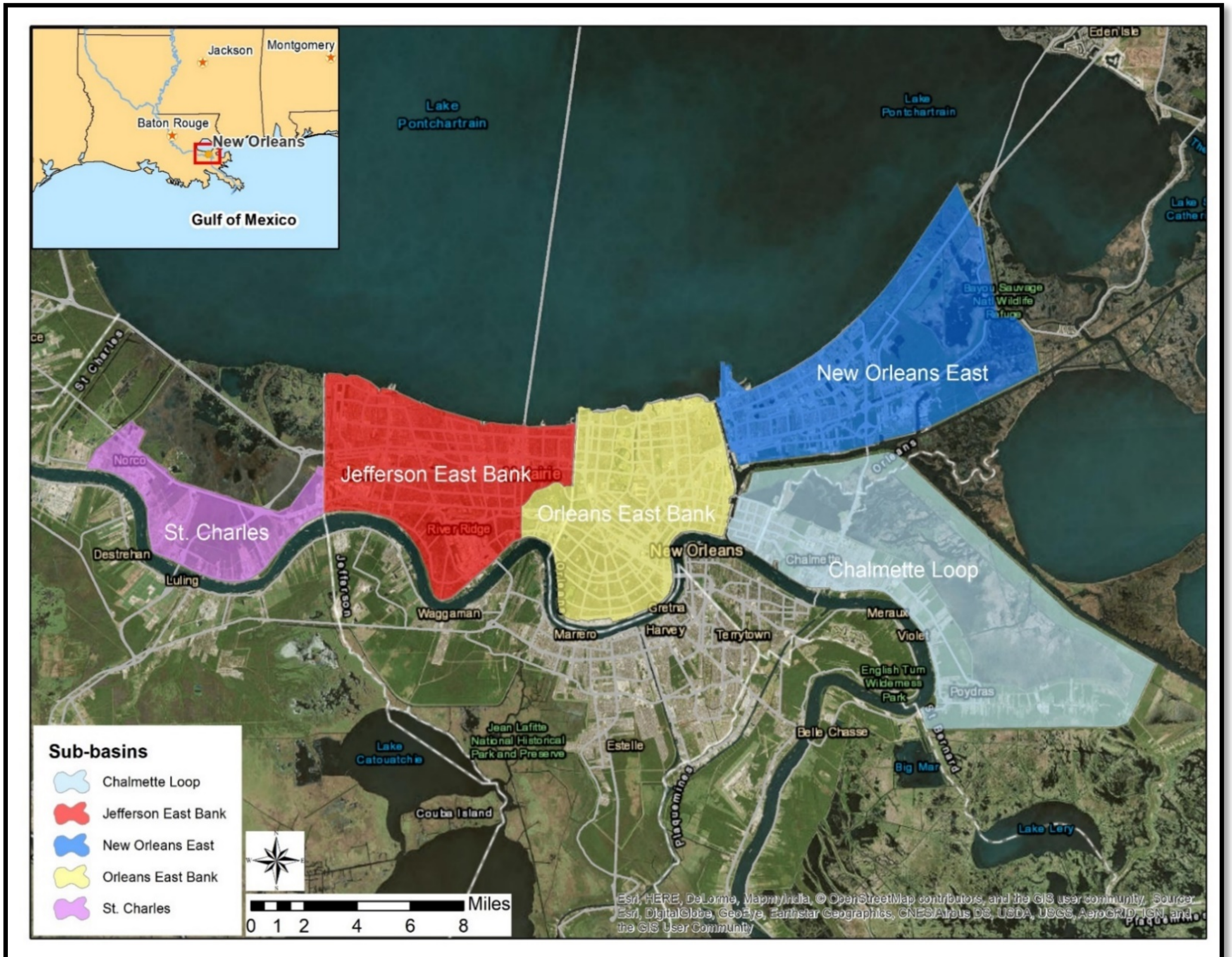

Figure 4-1. Sub-basins of the Lake Pontchartrain and Vicinity Study Area

4.1.2 PHYSICAL GEOGRAPHY & LAND USE

4.1.2.1 PHYSICAL GEOGRAPHY

The study area is located on the northeastern flank of the Deltaic portion of the Mississippi River Alluvial Plain. The area is located on the southern edge of the Pontchartrain Basin on the eastern side of the Mississippi River between RM 82 to 127 above Head of Passes. The Pontchartrain Basin is a shallow depression that lies between the alluvial ridge of the Mississippi River and the gulfward-sloping uplands on the north and west. The area is of extremely low relief with land elevations highest adjacent to the Mississippi River. Elevations within the study area vary from 31 feet NAVD88 on levees and floodwalls to near sea level in the back swamp and lake areas to below sea level in many of the urbanized areas that are under forced drainage.

4.1.2.2 LAND USE

The 2011 National Land Cover Database includes the most up-to-date data concerning the study area. Table 4-2 and Figure 4-2 identify various land uses within the study area.

Table 4-2. Land Use Acreage in Study Area by Sub-Basin

Land Use	St. Charles	Jefferson	Orleans East Bank	New Orleans East	Chalmette Loop	Study Area Total
Open Water	64	72	241	4,375	5,319	10,071 (6.6%)
Developed, Open Space	699	711	1,256	1,318	1,295	5,279 (3.5%)
Developed, Low Intensity	4,397	16,210	13,584	7,459	6,344	47,994 (31.3%)
Developed, Medium Intensity	1,184	6,574	8,110	3,023	2,760	21,651 (14.1%)
Developed, High Intensity	1,258	4,829	4,528	1,926	1,251	13,792 (9.0%)
Barren Land	107	37	0	744	554	1,442 (0.9%)
Deciduous Forest	50	30	23	24	120	247 (0.2%)
Evergreen Forest	22	0	1	0	69	92 (0.1%)
Mixed Forest	20	1	2	0	438	461 (0.3%)
Shrub/Scrub	48	8	6	29	195	286 (0.2%)
Herbaceous	35	9	0	144	99	287 (0.2%)
Hay/Pasture	79	10	3	43	360	495 (0.3%)
Cultivated Crops	123	0	0	116	544	783 (0.5%)
Woody Wetlands	4,358	13	3	6,342	9,594	20,310 (13.3%)
Emergent Herbaceous Wetlands	601	20	0	9,105	20,255	29,981 (19.6%)

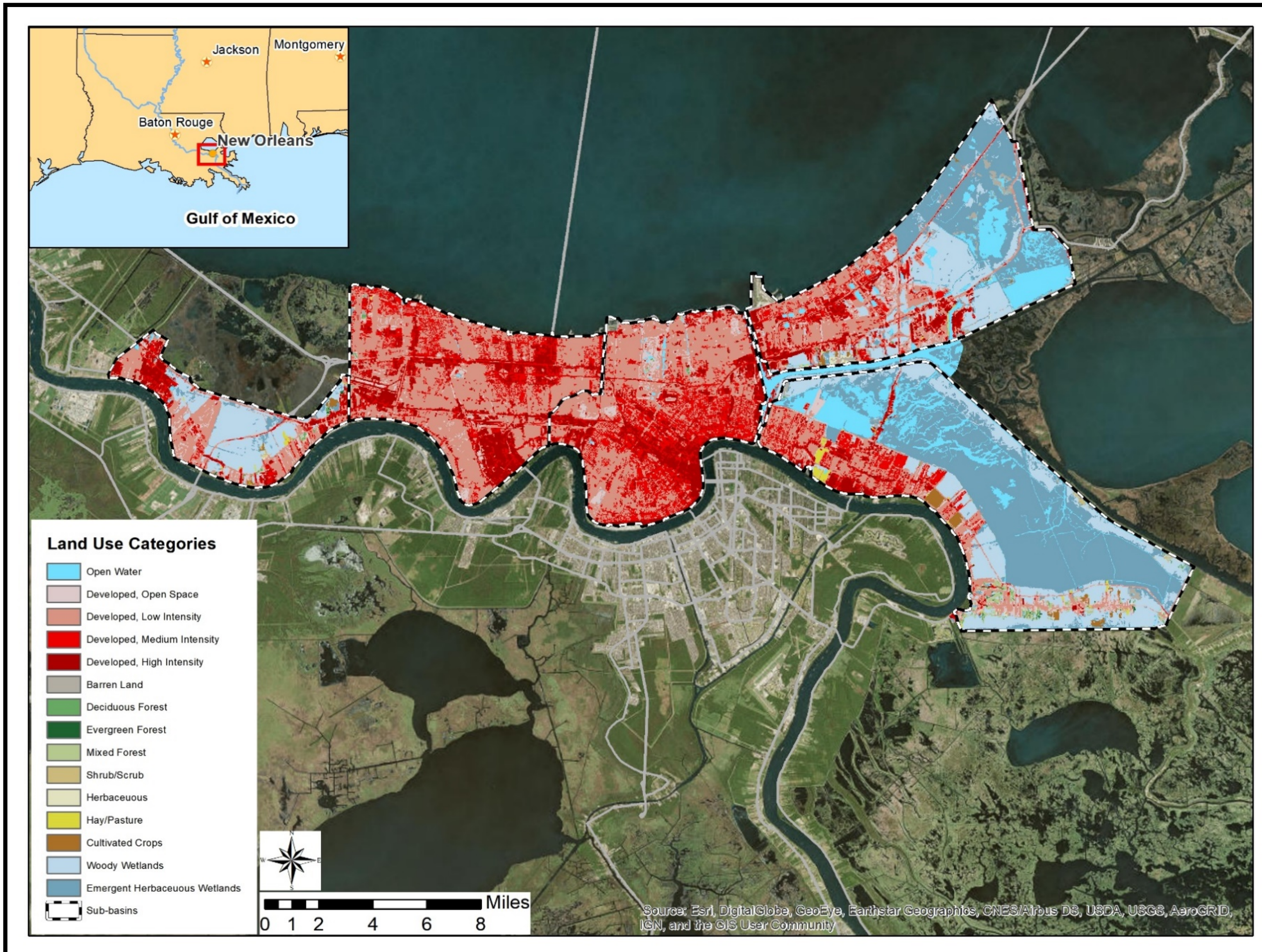

Figure 4-2. Land use categories within the Lake Pontchartrain and Vicinity Study Area

4.1.3 CLIMATE

Information on climate, climate change, relative sea level change and hydrology of the study area can be found in Section 5.2.

4.1.3.1 PRECIPITATION & TEMPERATURE

The study 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 climate is influenced by the many water surfaces of the lakes, streams, and the Gulf of Mexico. Precipitation generally is heavy in two fairly definite rainy periods. Summer showers last from mid-June to mid-September, and heavy winter rains generally occur from mid-December to mid-March. Table 4-3 provides a summary of weather averages (USclimatedata.com, 2019). For additional information on past climate see USACE (1994).

Table 4-3. Study Area Climate Averages at New Orleans

Weather Variable	Average
Annual High Temperature	77.1°F
Annual Low Temperature	62.3°F
Average Annual Temperature	69.7°F
Average Annual Precipitation – Rainfall	63.5 inches
Days Per Year with Precipitation - Rainfall	119 days

4.1.3.2 WINDS

Average wind speed and direction in New Orleans experience seasonal variation through the year. The windiest months occur between September and May with an average wind speed estimated at 8.9 miles per hour from an easterly direction. Southerly winds often occur from February through July while northerly winds are most common from November to February (weatherspark.com, 2019). For additional information on historic wind speeds see USACE (1994).

4.1.3.3 TROPICAL STORMS AND HURRICANES

Several tropical storms and hurricanes have passed through or near the study area. The frequency of hurricanes is greatest between August and October; however, hurricane season extends from June through November. Tropical storms and hurricanes typically produce the highest wind speeds and greatest rainfall events along the Gulf Coast. High winds are typically accompanied by massive storm surge, and in the case of the most powerful storms, these surges can be as high as 28 feet when they strike the Louisiana Coast (NOAA, Storm Surge Overview, 2019). Heavy rains, flooding, and wind are the primary problems associated with tropical storms and hurricanes. Table 4-4 provides a summary of recent hurricanes affecting the greater New Orleans area.

Table 4-4. Recent Hurricanes

Storm Name	Date	Landfall Location	Sustained Winds (mph)
Lili	3 Oct 2002	Vermilion Parish, LA	92
Katrina	29 Aug 2005	Buras-Triumph, LA, LA	125
Rita	24 Sept 2005	TX/LA border	115
Gustav	01 Sept 2008	Cocodrie, LA	105
Ike	13 Sept 2008	Galveston, TX	110
Isaac	29 Aug 2012	Plaquemines Parish, LA	80
Nate	07 Oct 2017	LA/MS coast	85
Harvey	August 2017	TX/LA coast	130
Barry	10-14 Jul 2019	Marsh Island and Intracoastal City, LA	75
Laura	27 Aug 2020	Cameron, LA	150
Sally	16 Sept 2020	Gulf Shores, AL	105
Delta	9 Oct 2020	Creole, LA	100
Zeta	28 October 2020	Cocodrie, LA	110

Online Sources (Accessed 9 Jan 2019): https://coast.noaa.gov/hes/docs/postStorm/Lili_%20final.pdf;
https://pubs.usgs.gov/circ/1306/pdf/c1306_ch7_j.pdf;
http://www.hurricanescience.org/history/storms/2000s/ike/;
http://www.hurricanescience.org/history/storms/2000s/rita/ ;
http://www.hurricanescience.org/history/storms/2000s/gustav/;
http://www.hurricanescience.org/history/studies/katrinacase/;
https://www.wunderground.com/hurricane/Katrinas_surge_contents.asp
https://www.nhc.noaa.gov/archive/2012/al09/al092012.posest.08282356.shtml
https://www.weather.gov/mob/sally
https://www.weather.gov/lch/2020Delta
https://www.weather.gov/lch/2020Laura
https://www.weather.gov/lch/2020Zeta

4.2 GEOLOGY AND SOILS

4.2.1 GEOLOGY

The geologic history since the end of the Pleistocene Epoch is pertinent to the study area. At the close of the Pleistocene, sea level was approximately 360 to 400 feet below the present sea level and the Mississippi River was entrenched into the older Pleistocene sediments. As sea level rose to its present stand, the entrenched valley was filled with sediment by the Mississippi River, resulting in an increase in meandering and channel migration. This meandering and channel migration resulted in a series of deltas extending into the Gulf of Mexico. Seven Holocene deltas are recognized in the lower Mississippi River Valley. For further details on the delta formation see USACE (1994). Overall, development of the deltas resulted in the gradual degradation of the study area through subsidence and shoreline retreat.

The deepest formations in the study area are Pleistocene deposits, consisting of somewhat hardened fluvial sands, silts, and mud at a depth of 40 to 60 feet below the ground surface to depths around 180 feet 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 results of gradual deposition of organic peat mixed with fluvial silt and mud deposited as overbank deposits and inter-distributary deposits of the Mississippi River in cypress swamps around Lake Pontchartrain (Kolb, Smith, & Silvia, 1975).

The existing near-surface geology of the area surrounding the HSDRRS study 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. Beneath the artificial deposits lie swamp deposits composed of organic clays, fat clays, and peats with occasional sand and silt layers. Swamp deposits are generally between 10 to 20 feet thick. Natural levee deposits composed of clays and silts are adjacent to abandoned distributaries.

4.2.2 SOILS

Much of the study area was formerly wetlands (cypress swamps and marshes). As the Greater New Orleans Metropolitan Area grew and the constructed levees were built even higher, water was drained from swamps and marshes by canals and pumps and dredged materials, 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 decreases with depth.

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

The study area can be divided into three main soil categories: (1) soils found on naturally occurring levees that are protected from flooding; (2) soils frequently ponded in marshes and swamps that experience frequent flooding; and (3) soils previously ponded, but which have been drained and are protected from flood (Trahan, 1989; Mathews, 1983).

4.2.3 PRIME AND UNIQUE FARMLANDS

The U.S. Department of Agriculture (USDA) defines prime farmland as land with the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and which is available for these uses. Since the supply of high-quality farmland is limited, the USDA encourages responsible governments and individuals to use the nation’s prime farmland wisely. The Farmland Protection Policy Act (FPPA) is intended to minimize the impact federal programs have on the unnecessary and irreversible conversion of farmland to nonagricultural uses. USACE prepared an AD-1006 application to evaluate the prime farmland in the study area during feasibility level design, which is included in Appendix G, *Environmental Compliance*. The assessment is completed on form AD-1006, Farmland Conversion Impact Rating, to establish a farmland conversion impact rating score which can be used as an indicator of the potential to convert farmland to non-farm use. Prior to final report approval and final public review, this evaluation will be included for the proposed construction footprint and updated during the Planning, Engineering, and Design phase upon identification of borrow sites. 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 FPPA.

Cancienne silt loam, Cancienne silty clay loam, Gramercy silty clay, Harahan clay, Shriever clay, Schriever silty clay loam, Thibaut clay, and Vacherie silt loam are designated prime and unique farmland soils in the study area (USDA, 2019). Areas of prime and unique farmland soils are shown in Figure 4-3. Many designated prime and unique farmland soils within the study area near the proposed action have been previously developed or contain existing levees and rights-of-way; however, some potentially impacted areas fall under the jurisdiction of the FPPA. Table 4-5 provides acres of prime and unique farmland soils by sub-basin and acres previously potentially impacted by HSDRRS.

Figure 4-3. Prime and Unique Farmland Soil Locations within the Study Area

Table 4-5. Acres of Prime and Unique Farmland Soils within the Study Area Sub-Basins

Sub-Basin	**Total Prime Farmland (acres)**	**Total Potentially Impacted Prime Farmland Soils from previous HSDRRS projects (acres)** (USACE, 2013)
St. Charles	322	0.0
Jefferson East Bank	2	0.0
Orleans East Bank	20	0.0
New Orleans East	224	29.7
Chalmette Loop	1,431	452.5
Total	1,999	482.2

4.3 WATER RESOURCES

4.3.1 GROUNDWATER & SURFACE WATER QUANTITY

Groundwater and surface water quantities have not been identified as resources of issue in southeast Louisiana. The primary groundwater resources within the study area include Norco and Gonzales-New Orleans aquifers (Prakken & Lovelace, 2014). The Mississippi River is the primary source of fresh surface water in the study area. 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 study area, water quality is a significant resource and is further described below.

4.3.2 WATER QUALITY

Section 303(d) of the Clean Water Act (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, the LDEQ 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, metals and toxics concentrations, turbidity, color, and total dissolved solids (TDS). Established by the state, the Designated Use articulates the vision for the activities that each water resource can support. The Designated Use establishes the water quality management goals for the water body and determines the associated water quality standards to use to determine if the water body supports the Designated Use (USEPA, 2019). Designated Uses of water bodies in and adjacent to the study area include Primary Contact Recreation (PCR), Secondary Contact Recreation (SCR), Fish and Wildlife Propagation (FWP), Drinking Water Supply (DWS), and Oyster Propagation (OYS).

PCR covers any recreational activity that involves prolonged body contact with water, such as swimming, water skiing, tubing, snorkeling, and skin diving. Parameters measured to determine a water body’s support of PCR include bacterial density, temperature, and metals and toxics concentrations. SCR covers any recreational activity that may involve incidental or accidental body contact with water and that involves a low probability of ingesting water, such as fishing, wading, and recreational boating. Parameters measured to determine a water body's support of SCR include bacterial density and metals and toxics concentrations. FWP covers the use of water for preservation and reproduction of aquatic biota and includes maintenance of water quality at a level that prevents contamination of aquatic biota consumed by humans. Parameters measured to determine a water body's support of FWP include DO, temperature, pH, chloride, sulfate, TDS, turbidity, and metals and toxics concentrations. DWS covers a surface or groundwater source that, after conventional treatment, will provide safe, clear, potable, and aesthetically pleasing water for uses such as human consumption and food processing and cooking. Parameters measured to determine a water body's support of DWS include color, bacterial density, and metals and toxics concentrations. OYS covers the use of water to maintain biological systems that support species such as oysters, clams, and mussels so that their productivity is preserved and human consumers are protected. Bacterial density is measured to determine a water body's support of OYS (LDEQ, 2018).

The study area includes or is adjacent to numerous LDEQ sub-watersheds (Figure 4-4), some of which are on the LDEQ Water Quality Inventory Integrated Report (Section 305(b) and 303(d)) list for 2018 for violating pollution criteria (LDEQ, 2018). Table 4-6 presents the water quality attainment status, designated uses that are in nonattainment, suspected causes of impairment, and suspected sources of impairment of the LDEQ sub-watersheds associated with the LPV study area.

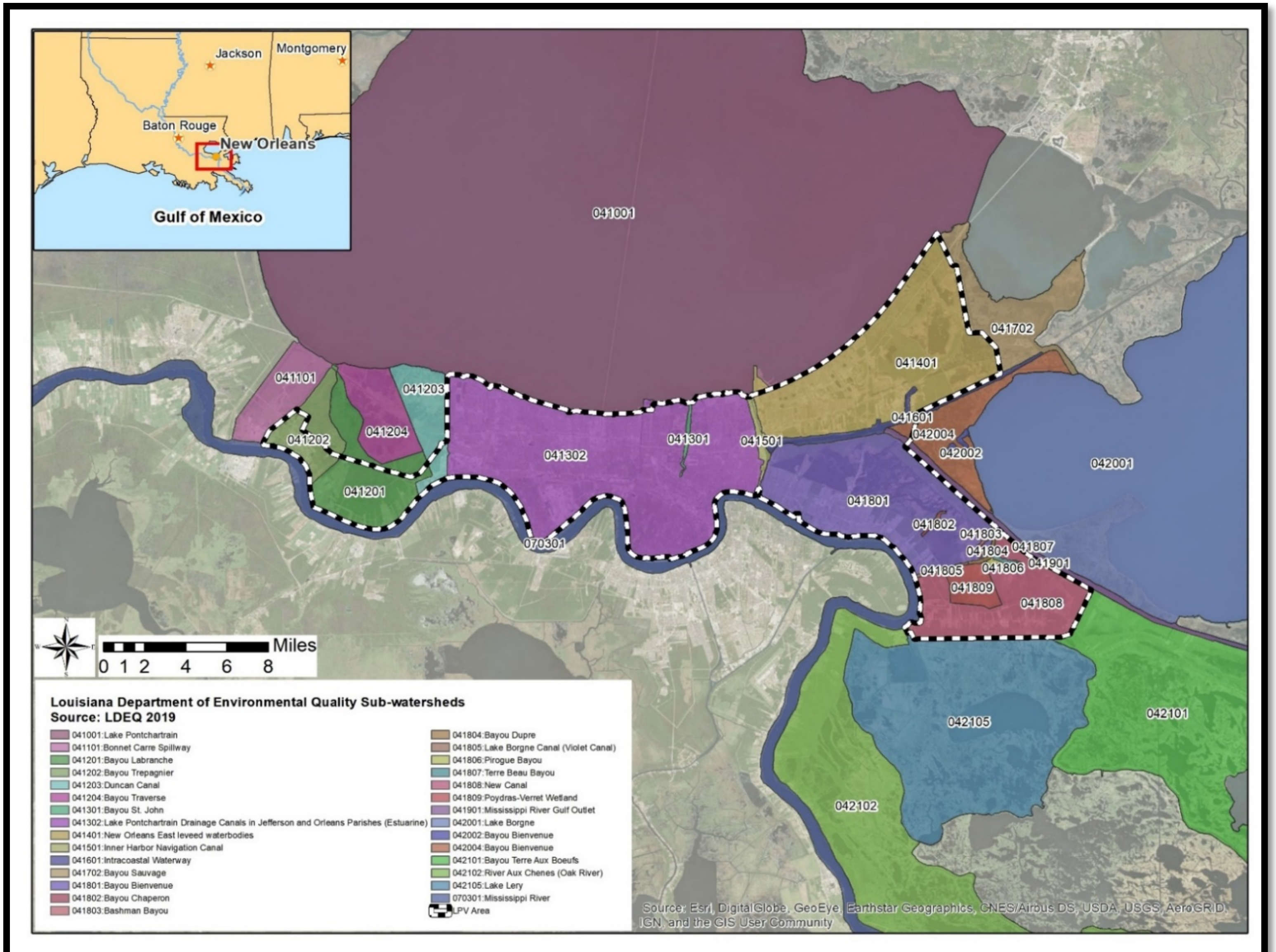

Figure 4-4. LDEQ Sub-watersheds within and adjacent to the Study Area

Table 4-6. Water Quality Attainment Status of LDEQ Sub-Watersheds in and near the Study Area

Sub-Watershed ID#	Sub-Watershed Name	Water Quality Attainment Status	Suspected Causes of Impairment	Suspected Sources of Impairment
041001	Lake Pontchartrain	Fully Supporting All Designated Uses	NA	NA
041101	Bonnet Carre Spillway	Not Supporting FWP	Chloride, Sulfate, TDS	Natural Sources
041201	Bayou Labranche	Fully Supporting All Designated Uses	NA	NA
041202	Bayou Trepagnier	Not Supporting FWP	DO	Natural Sources
041203	Duncan Canal	Not Supporting FWP	DO	Municipal Point Source Discharges; Natural Sources
041204	Bayou Traverse	No Data	No Data	No Data
041301	Bayou St. John	Not Supporting Primary Contact Recreation	Temperature	Natural Sources
041302	Lake Pontchartrain Drainage Canals in Jefferson and Orleans Parishes (Estuarine)	Not Supporting FWP	DO	Municipal (Urbanized High Density Area); Sanitary Sewer Overflows (Collection System Failures)
041401	New Orleans East Leveed Water Bodies	Fully Supporting All Designated Uses	NA	NA
041501	Inner Harbor Navigation Canal	Fully Supporting All Designated Uses	NA	NA
041601	Intracoastal Waterway	Not Supporting FWP	pH (low)	Transfer of Water from an Outside Watershed
041702	Bayou Sauvage	Fully Supporting All Designated Uses	NA	NA
041801	Bayou Bienvenue	Fully Supporting All Designated Uses	NA	NA
041802	Bayou Chaperon	Not Supporting FWP	DO	Natural Sources
041803	Bashman Bayou	Fully Supporting All Designated Uses	NA	NA
041804	Bayou Dupre	Fully Supporting All Designated Uses	NA	NA
041805	Lake Borgne Canal (Violet Canal)	Not Supporting FWP	DO	Natural Sources
041806	Pirogue Bayou	Not Supporting FWP	DO	Natural Sources
041807	Terre Beau Bayou	Not Supporting FWP	DO	Natural Sources
041808	New Canal	Not Supporting FWP	DO	Natural Sources
041809	Poydras-Verret Wetland	No Data	No Data	No Data
041901	Mississippi River Gulf Outlet	Not Supporting FWP	DO	Source Unknown

Sub-Watershed ID#	Sub-Watershed Name	Water Quality Attainment Status	Suspected Causes of Impairment	Suspected Sources of Impairment
042001	Lake Borgne	Fully Supporting All Designated Uses	NA	NA
042002	Bayou Bienvenue	Not Supporting FWP, OYS	pH (low), Fecal Coliform	Source Unknown
042004	Bayou Bienvenue	Not Supporting OYS	Fecal Coliform	Wildlife Other Than Waterfowl
042101	Bayou Terre Aux Boeufs	Fully Supporting All Designated Uses	NA	NA
042102	River Aux Chenes (Oak River)	Fully Supporting All Designated Uses	NA	NA
042105	Lake Lery	Fully Supporting All Designated Uses	NA	NA
070301	Mississippi River	Fully Supporting All Designated Uses	NA	NA

4.4 FOREST AND WETLAND RESOURCES

Vegetation found within the study area are typical of the Bottomland Hardwood Region of the Lower Mississippi River Alluvial Plain and are considered forested or non-forested wetlands providing a diverse suite of benefits to the study area (Table 4-7). Habitat types include oak-dominated bottomland hardwood forests, cypress-tupelo swamps, various fresh and saltwater emergent marsh, shrub-scrub and forested wetlands, tidal channels, creeks, and estuaries.

Table 4-7. Benefits of Wetlands

- Buffer storm impacts
- Store & convey floodwater
- Absorb nutrients, sediment, & contaminants
- Carbon sequestration
- Nitrogen & phosphorus sink
- Maintain high biological productivity & diversity
- Serve as a nursery for fish and wildlife, including marine species and shellfish
- Base of food webs

The maintenance of habitat types in the region was historically dependent upon sediment input from freshwater flooding events producing a slow and gradual elevation transition. The gradual elevation change provides a highly elongated freshwater to saltwater transition zone capable of supporting a high diversity of wetland and marsh vegetation communities.

Currently, these coastal areas are in a transgressive phase resulting in the rapid replacement of freshwater marsh and swamp habitat within increasingly marine-dominated habitats (Roberts H. H., 1997). Historically, the coastal region encompassing the study area would receive freshwater and sediment inputs during frequent flooding events from the Mississippi River. These flooding events would act to maintain the freshwater habitat characteristics and negate the effects of tidal outwash through silt deposition; however, the construction of levees and other flood reduction measures have significantly altered the freshwater, nutrient, and sediment inputs. Levees and water pumping have decreased the flooding necessary to maintain the natural forest and wetland by conversion of existing bottomland forest to more upland-like habitats. Figure 4-5 indicates the National Wetland Inventory data regarding wetland habitat in the study area.

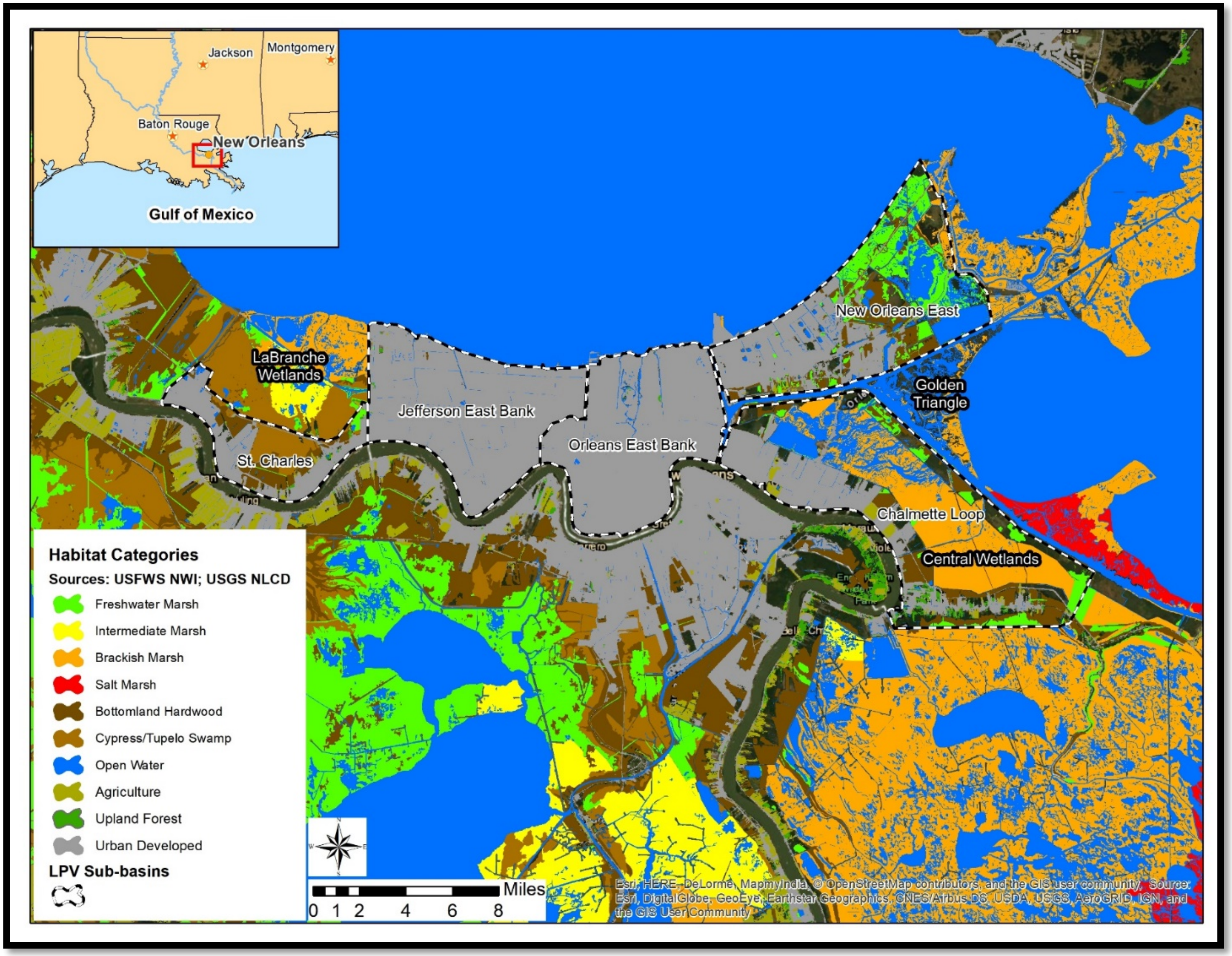

Figure 4-5. Location of major wetland categories in the vicinity of the study are

4.4.1 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 BLH habitats are wetland habitats.

The study area 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 wetland areas located within the study area 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, and the LaBranche Wetlands in St. Charles Parish. 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 suspended sediment. In addition, coastal wetlands buffer storm surges and reduce damaging effects on man-made infrastructure within the coastal area (USFWS, 2008). Table 4-8 summarizes wetland habitat types found in the vicinity of the study area and the following sections provide additional information on identified important wetland habitat types found in the vicinity of study area and the following sections provide additional information on identified important wetland habitat types in the study area.

Table 4-8. Habitat Types Found in and Near the Study Area, by Sub-Basin

Habitat Type		Sub-basin St. Charles	Jefferson East Bank	Orleans East Bank	New Orleans East	Chalmette Loop
Cypress-Tupelo Swamp	Cypress swamp and cypress-tupelo swamp habitat provide nesting, foraging and cover habitat to support a diversity of animals. Common wildlife species include: North American beaver (*Castor canadensis*), North American river otter (*Lontra canadensis*), nutria (*Myocastor coypus*), mud turtles (*Kinosternon* spp.), American alligator (*Alligator mississippiensis*), dabbling ducks, wading birds, and many other bird species (Conner & Buford, 1998).	X			X	X
Bottomland Hardwood	BLH forests provide valuable habitat for a diversity of wildlife species. The BLH forested wetlands within the study 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 study area are disturbed and contain large concentrations of invasive Chinese tallow.	X			X	X
Freshwater Marsh / Intermediate Marsh	These marsh types provide important nesting and foraging habitat for wintering waterfowl, American alligator, wading birds, and fish.	X	X	X	X	X
Brackish Marsh	Shrimp, crab, redfish, seatrout, and menhaden all use brackish marshes for nursery areas, and like freshwater/intermediate marshes, brackish marshes are important habitat for waterfowl, shorebirds, and wading birds.	X			X	X
Saline Marsh	Saline marshes act as a nursery area for many species of fish and crustaceans similar to other marsh types. Wildlife common in saline marsh include wading birds, shorebirds, small mammals, and polychaetes.					

Habitat Type		Sub-basin				
		St. Charles	**Jefferson East Bank**	**Orleans East Bank**	**New Orleans East**	**Chalmette Loop**
Open Water	Open water habitat within the study 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 (*Pelecanus occidentalis*) are known to occur in the inshore bays and estuaries. Sea turtles with the potential to occur in this habitat are protected species (See Section 4.10 Threatened and Endangered Species). Brown pelicans feed in shallow estuarine waters and use sand spits and offshore sand bars as resting and roosting areas.	X	X	X	X	X
Upland Forest	Upland forest habitat is comprised of non-wetland hardwood and young, commercial pine forests. These young pine forests do not support the diversity of plant and animal species that were once supported by the historic longleaf pine (*Pinus palustris*) 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 (*Urocyon cinereoargenteus*) also utilize upland forest habitat (Allen, Bernal, & Moulton, 1996). Small mammals may include harvest mouse (*Reithrodontomys* spp.), hispid cotton rat (*Sigmodon hispidus*), oldfield mouse (*Peromyscus polionotus*), and striped skunk (*Mephitis mephitis*). Similar species of woody vegetation can be found in upland hardwood forest scrub/shrub habitat as is found in BLH (described above).	X			X	X

Habitat Type		Sub-basin				
		St. Charles	Jefferson East Bank	Orleans East Bank	New Orleans East	Chalmette Loop
Urban Developed	Urban areas generally provide 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 (*Thamnophis sirtalis sirtalis*), Fowler's toad (*Bufo woodhousii fowleri*) and Gulf coast toad (*Bufo valliceps*). Mammals common to developed or urban habitats include raccoon (*Procyon lotor*), Virginia opossum (*Didelphis virginiana*), nine-banded armadillo (*Dasypus novemcinctus*), rabbits, grey squirrels (*Sciurus carolinensis*), mice, rats, and feral dogs and cats. Birds in this habitat type include the American crow (*Corvus brachyrhynchos*), songbirds, pigeons, and raptors.	X	X	X	X	X

4.4.1.1 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, 2019). Marsh types within the study 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.). 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.

Brackish and saline marshes in the vicinity of the study area, such as the wetland 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 (USFWS, 2019). Saline 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, 2004). There are relatively few saline marshes near the study area, and these are limited to the southern coastal areas.

4.4.1.2 OPEN WATER

Lake Pontchartrain, borrow ditches on either side of the levees, the GIWW, the Mississippi River, and smaller bayous are all open water bodies classified as jurisdictional waters of the U.S. The largest aquatic resource in proximity to project area is that of Lake Pontchartrain. Lake Pontchartrain, a large, brackish shallow estuary located north of the study area does support submerged aquatic vegetation (SAV), including wild celery (*Vallisneria americana*), widgeongrass (*Ruppia maritima*), slender pondweed (*Potamogeton perfoliatus*), Eurasian milfoil (*Myriophyllum spicatum*), and southern naiad (*Najas guadalupensis*) (Duffy & Baltz, 1998). Salinity in the Lake Pontchartrain estuary ranges from 0.5 to 15 parts per thousand (ppt).Historically, SAV was abundant on all shores of Lake Pontchartrain; however, the total area of SAV within Lake Pontchartrain decreased by approximately 90 percent between 1954 and 1998 (Darnell, 1961) (Burns, Poirrier, & Preston, 1993). Shoreline modification, increased water turbidity, and algal overgrowth contributed to this decline (Cho & Poirrier, 2000). A La Niña drought from 1998 to 2001 increased SAV densities to 80 percent of the 1953 level, but SAV declines occurred after the drought and Hurricane Katrina and other hurricanes between 2005 and 2012 caused extensive damage to Lake Pontchartrain SAV (Poirrier, Caputo, & Franze, 2017). Coverage in 2016 was about 10 percent of the 1953 level (Poirrier, Caputo, & Franze, 2017). Some isolated SAV beds existed on the south shore of Lake Pontchartrain in

2016 in the Lincoln Beach area to maximum depths of 1.2 meters (Poirrier, Caputo, & Franze, 2017).

The portion of the Mississippi River along the MRL is inherently low in primary productivity on a per acre basis because of high turbidity and has relatively poor benthic productivity because of shifting substrates and high current velocities in the area (USACE, 2010). The deep main river channel is the habitat of large predaceous fishes, some plankton feeders and a group of omnivorous species. Additionally, borrow pits excavated on the river-side of the existing MRL provide additional complexity of open water habitat for various species of wildlife, finfish, and shellfish (USACE, 2010e). These relatively stable water bodies support large populations of aquatic plants and animals. The growth of higher plants around these waters may reduce phytoplankton growth near the edges. The higher plants around these water bodies are also important primary producers in that a significant amount of leaf litter, branches, and other organic matter may wash into these lakes and borrow pits during high water conditions becoming a source of detritus (USACE, 2010).

4.4.1.3 FORESTED WETLANDS

The study area is in the southern portion of the Lower Mississippi Alluvial Valley, which extends from Cairo, Illinois, to the confluence of the Mississippi River with the Gulf of Mexico in Louisiana. Based on a recent forest inventory by the U.S. Forest Service, 28 percent of the land area within the Mississippi Alluvial Valley is in forest cover, with the least forest cover in the northern portions adjacent to the Mississippi River and the coastal parishes of Louisiana (which includes the study area) (see Figure 4-6).

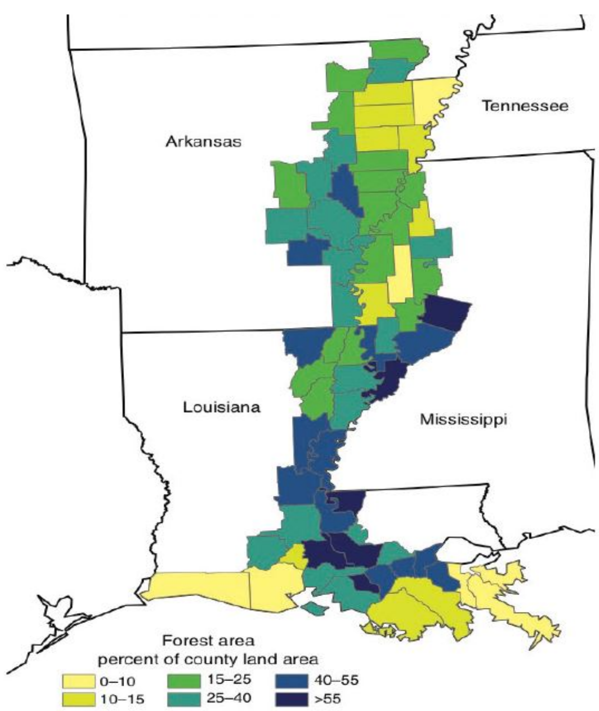

Figure 4-6. Percent of land area classified as forest by county in the Lower Mississippi Alluvial Valley, 2010 (Graphic from (Oswalt, 2013))

4.4.1.3.1 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 rumbrum var drummondii*), green ash (*Fraxinus pennsylvanica*), and black willow (*Salix nigra*) also occur. Water lily (*Nyphaea odorata*), pickerelweed (*Pontederia cordata*), smartweed (*Polygonum punctatum*), and non-native alligator weed (*Alternanthera philoxeroides*) are also common.

Most of the cypress-tupelo swamps were removed from Louisiana between 1876 and 1956, a period of intense logging (Keddy, et al., 2007).

4.4.1.3.2 BOTTOMLAND HARDWOOD FOREST

BLH forest is defined as forested alluvial wetlands typically occupying floodplain regions of large flooding water bodies and rivers (Cowardin, Carter, Golet, & LaRoe, 1979). It occurs 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 provides important foraging areas and habitat for a variety of wildlife, but because of the fragmented, disturbed, and secondary nature of the BLH within the study area, it is unlikely that many species would utilize the study area as a more expansive primary growth forest. Some areas classified as BLH in the study area 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 study area, including scrub/shrub habitat, is disturbed and contains large concentrations of invasive Chinese tallow trees.

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, 2019). Any remaining BLH forest within the study area has been dramatically impacted by alteration of natural hydrology due to extensive water control measures and development. This has led to the gradual deterioration of BLH through colonization by more upland species (Coastal Wetland Forest Conservation, 2005). In the last 100 years, a large portion of historical BLH habitat has been logged and converted into agricultural and urban lands (Dahl, Johnson, & Frayer, 1991).

In the study area, BLH occurs as both jurisdictional BLH habitat (i.e., regulated under Section 404 of the CWA) and non-jurisdictional (i.e., upland) BLH habitat. USACE mitigates for impacts on both jurisdictional and non-jurisdictional BLH habitat as required under WRDA 1986, Section 906, as amended.

4.4.2 WETLAND LOSS

Louisiana has lost wetlands due to relative sea level change, subsidence, storms, sediment deprivation and other factors at an average rate of approximately 22 square miles per year since 1932 (Couvillion, Beck, Schoolmaster, & Fischer, 2017). From 1932 to 2016, approximately 1,866 square miles of land was lost in coastal Louisiana, representing a decrease of approximately 25 percent (Couvillion, Beck, Schoolmaster, & Fischer, 2017). Louisiana experiences greater coastal wetland loss than all other states in the contiguous United States combined (Couvillion, Beck, Schoolmaster, & Fischer, 2017). The high rate of wetland loss in coastal Louisiana is directly related to the high rates of subsidence, as well as development of human infrastructure (USACE, 2007) (Boesch, et al., 1994). Some of the wetland 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, Bernier, & Morton, 2008). Figure 4-7 provides information on land change in the vicinity of the study area from 1932 to 2016.

Historically, a balance was maintained between wetland 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 R. , 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, 2004). 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, Adams, & Cunningham, 1980). The maintenance of the Mississippi River in its current course and subsequent changes to the delta cycle now because the majority of sediment and fresh water to be discharged off the continental shelf. Another problem is the intrusion of saltwater into historically less-saline marshes.

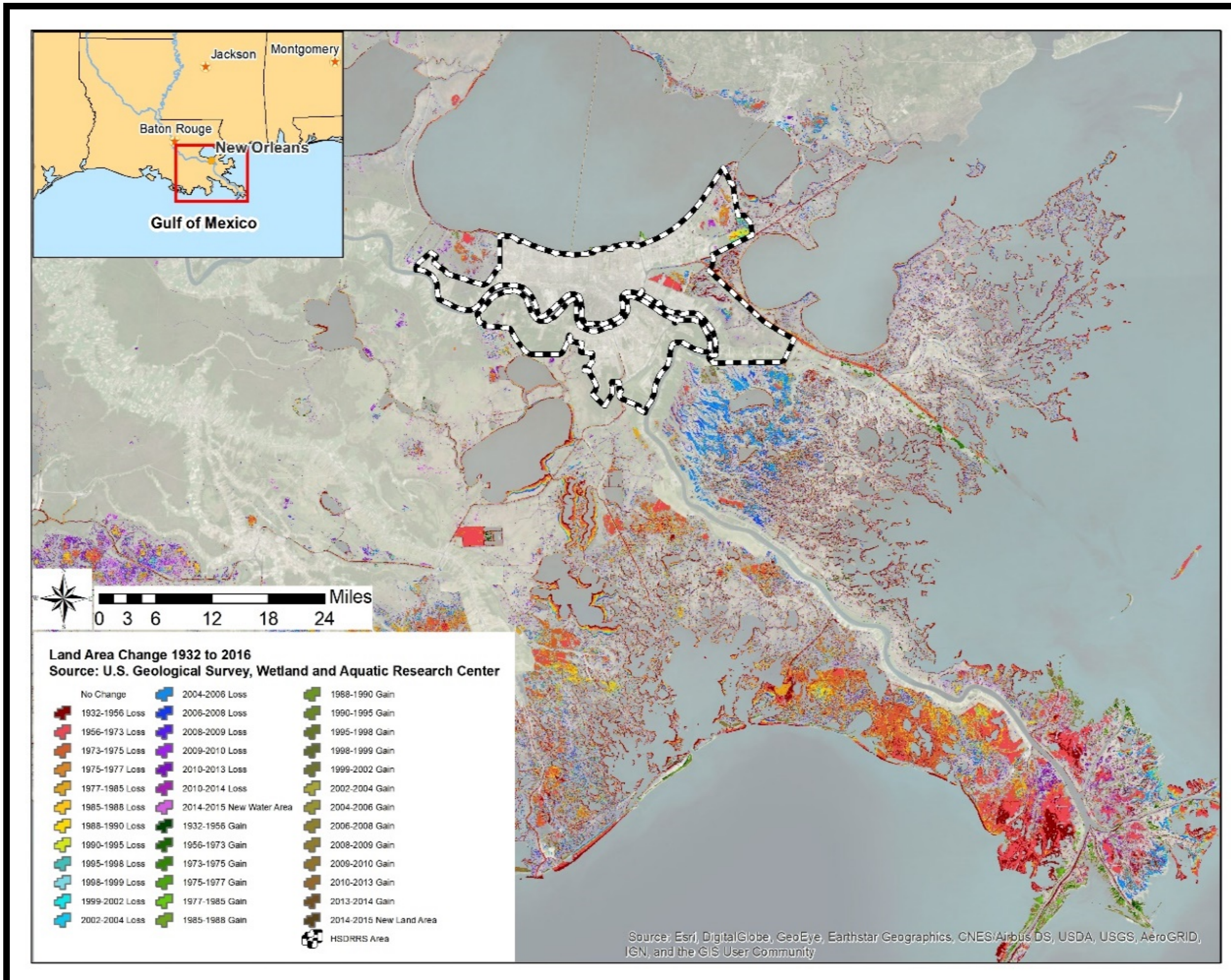

Figure 4-7. Land change in the vicinity of the Study Area from 1932 to 2016

4.5 UPLANDS

Within the study area, upland resources were considered to be lands that exhibit upland habitat characteristics. These could be areas that technically could be classified as wetlands (Figure 4-6 above), but due to draining or clearing function more like an upland resource, or they could be areas that are naturally occurring uplands. The converted wetland resources exhibiting upland characteristics within the study area consist of cleared and drained BLH forest lands used primarily as pasture lands, levees, roads, and commercial or residential use. Non-wetland areas within the study area consist of cleared and drained bottomland hardwood forest lands used primarily as pasture lands, levees, roads, and commercial or residential use. Although many of these areas within the vicinity of the study area could be classified as wetlands, some areas exhibit more upland characteristics. The existing levees within the study area are the only areas resembling any substantial upland habitat characteristics. Naturally occurring non-wetland upland resources are defined in areas naturally containing: (1) a prevalence of facultative or obligate upland plant species; (2) non-hydric soils; and (3) few or no occurrences of periodic inundation or soil saturation throughout the growing season.

The areas considered uplands are mostly converted wetlands due to deposition of soil fill for construction of infrastructure and residential and commercial development, spoil from dredging of waterways, landfill material, or the result of draining wetland habitat. Therefore, naturally occurring uplands are not a significant resource in the study area. Although natural uplands and non-wetlands are not a significant resource, there are significant land uses in the study area that are typically associated with upland habitats. Within the study area, these land uses are limited to agricultural production (e.g., cattle grazing and citrus orchards) on previously cleared and drained bottomland hardwood forest lands.

4.6 FISHERIES

Coastal wetlands provide essential habitat for commercially important marine and freshwater species and game species that are wetland-dependent at some stage in their life-cycle. Areas in and adjacent to the study area are important contributors to the local and regional fisheries. Freshwater fisheries within the HSDRRS are highly valued by sport fishermen who pursue freshwater species such as largemouth bass (*Micropterus salmoides*), alligator gar (*Atractosteus spatula*), channel catfish (*Ictalurus punctatus*), white crappie (*Pomoxis annularis*), 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 brackish estuaries 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 (*Micropogonias undulatus*) also inhabit the brackish water habitat. Additionally, estuarine habitat produces many species of fish that are not harvested for recreation or as commercial seafood, but contribute to the 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 (*Brevoortia patronus*), 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, Cashner, & Schieble, 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.

The estuarine area surrounding the study area creates prolific nursery grounds for white shrimp and brown shrimp, blue crab, oysters, and menhaden. These important fisheries contribute a significant portion of the annual commercial fish landings in Louisiana. Commercial fish landing data for Louisiana from 2008 through 2017, the most recent year for which data are available, were downloaded from NOAA Fisheries (NOAA, 2019) and used for the following analyses. Commercial fisheries landings in Louisiana averaged 1.02 billion pounds per year with an average value of $351 million. Table 4-9 presents the five species of fish and invertebrates that provided the greatest economic impact on Louisiana fisheries.

Table 4-9. Average Annual Value of Commercial Landings of Top Five Species in Louisiana from 2008 to 2017

Species	Average Annual Landings 2008 to 2017 (Millions of Pounds)	Average Annual Landings Value 2008 to 2017 (Millions of Dollars)
White Shrimp	65.3	$109.4
Menhaden	829.9	$70.9
Blue Crab	42.2	$45.6
Brown Shrimp	30.9	$34.8
Eastern Oyster	6.1	$27.5

Source: (NOAA, Office of Science and Technology Fisheries Information Query, 2019)

In Louisiana, coastal and offshore recreational fishing stimulates $757 million in economic output and creates 7,733 jobs (Southwick Associates, 2008). NOAA Fisheries recreational fishing data for Louisiana from 2008 through 2017, the most recent year for which data are available, indicate that the largest catch of marine recreational fish species by number in Louisiana were spotted seatrout (*Cynoscion nebulosus*), red drum (*Sciaenops ocellata*), hardhead catfish (*Arius felis*), Atlantic croaker (*Micropogonias undulatus*), sand seatrout (*Cynoscion arenarius*), black drum (*Pogonias cromis*), and sheepshead (*Archosargus probatocephalus*). These seven species represented approximately 88% of the recreational catch, by number, for the period analyzed (NOAA, 2019).

4.7 ESSENTIAL FISH HABITAT

The Magnuson-Stevens Fishery Conservation and Management Act, amended in 1996 by the Sustainable Fisheries Act and as reauthorized and amended in 2007 by the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006, requires the eight regional fishery management councils to describe and identify Essential Fish Habitat (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” (PL 94-265, as amended PL 109-479). The Magnuson-Stevens Fishery Conservation and Management Act requires the National Marine Fisheries Service (NMFS) to assist the regional fishery management councils with 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 study 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 activities. Marsh, oyster shell, SAV, and unvegetated bottom habitats that constitute EFH are found in the study area. Figure 4-8 displays EFH water bodies in the vicinity of the study area (NOAA, Essential Fish Habitat - Data Inventory, 2019).

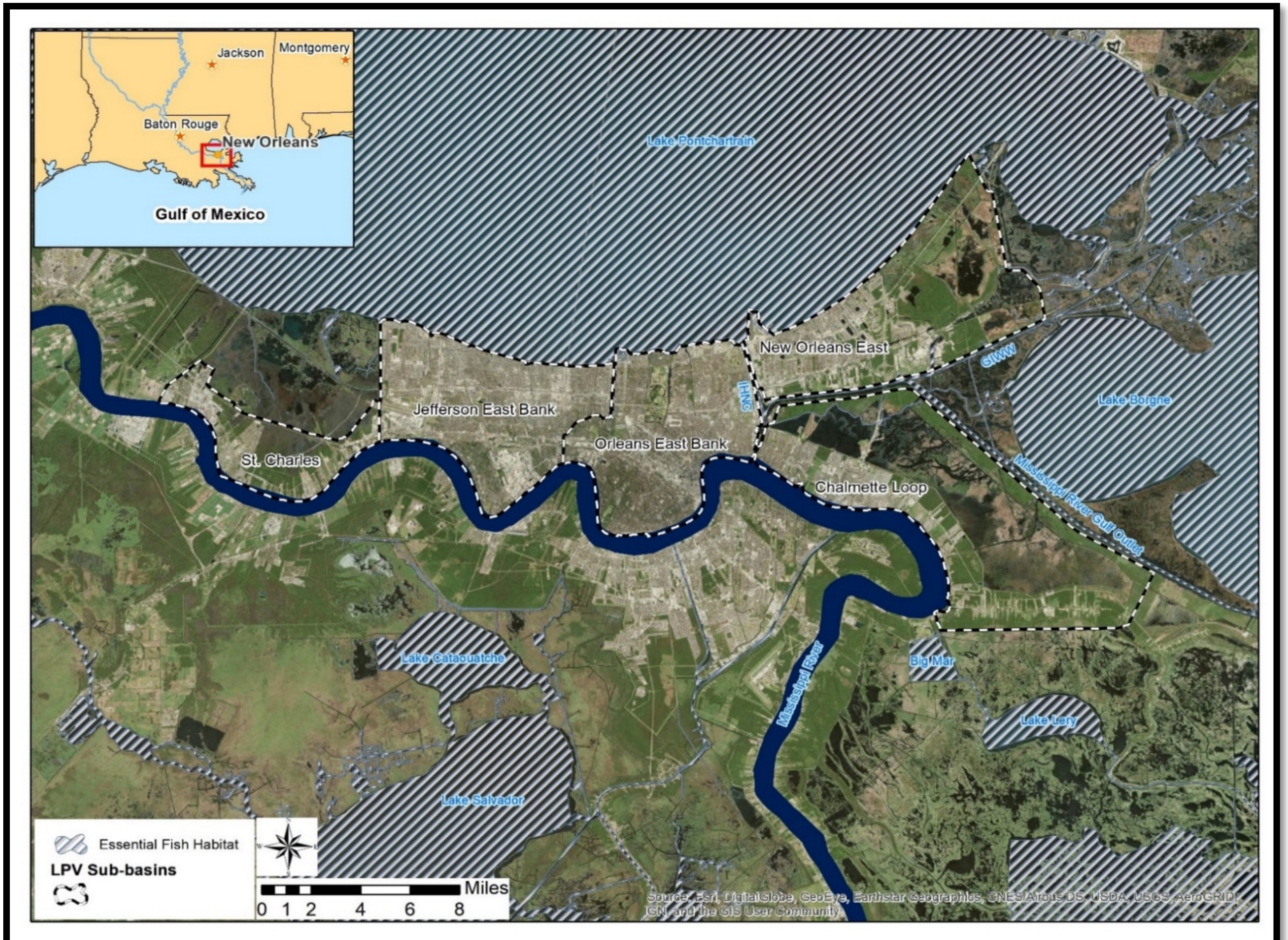

Figure 4-8. Essential Fish Habitat in the vicinity of the study area

4.7.1 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, gray snapper (*Lutjanus griseus*), lane snapper (*Lutjanus synagris*), Spanish mackerel (*Scomberomorus maculatus*), scalloped hammerhead shark (*Sphyrna lewini*), blacktip shark (*Carcharhinus limbatus*), bull shark (*Carcharhinus leucas*), and Atlantic sharpnose shark (*Rhizoprionodon terraenovae*) as known to exist in the estuaries near the project area. Table 4-10 presents a list of managed species found in the study area.

Table 4-10. Federally managed species in the vicinity of the study area

Managed Species	Life Stages	Designated EFH Potentially Impacted
Brown shrimp	Early juvenile	SAV, sand and shell bottom, mud/soft bottom
White shrimp	Early juvenile	mud/soft bottom
Pink shrimp	Early juvenile	SAV
Red drum	Larvae, post larvae, early juvenile, late juvenile, adult	SAV, sand and shell bottom, mud/soft bottom
Gray snapper	Adult	Sand and shell bottom, mud/soft bottom
Lane snapper	Early juvenile, late juvenile	SAV, sand and shell bottom, mud/soft bottom
Spanish mackerel	Early juvenile, late juvenile, adult	Water column
Scalloped hammerhead shark	Neonate	Estuaries
Blacktip shark	Neonate, juvenile, adult	Estuaries
Bull shark	Neonate, juvenile	Estuaries
Atlantic sharpnose shark	Neonate, juvenile, adult	Estuaries

Source: GMFMC 1998

4.7.1.1 ABUNDANCE OF FEDERALLY MANAGED SPECIES IN THE STUDY 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 study 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 (GMFMC, 1998).

Gray snapper occur in estuaries and shelf waters of the Gulf of Mexico. Postlarvae move into estuarine habitat and are typically found over grass beds. Juveniles are marine, estuarine, and riverine dwellers. Adults occupy bottom and mid-water habitats in marine, estuarine, and riverine environments (NOAA, 1985).

Lane snapper occur in the shelf area of the Gulf of Mexico from zero to 130 meters. Lane snapper occur over all bottom types, but is most common in coral reefs and sandy bottoms. Nursery areas include shallow areas with sandy and muddy bottom. Early and late juveniles appear to favor grass flats, reefs, and soft bottom areas to depths of 20 meters (NOAA, 1985).

Adult Spanish mackerel are not present in the study 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.

4.8 WILDLIFE

The diversity and abundance of wildlife in the study area are dependent on the quality and extent of suitable habitat present. Much of the study area is located in urban areas with industrial, commercial, and residential uses. Areas along the current floodwalls, canals, shoreline, and inshore areas of the lakes present a different habitat for wildlife as compared to previously disturbed urban areas and borrow sites. The bottomland forests, cypress-tupelo swamps, marshes, and tidal channels provide habitat for an abundance of birds, mammals, amphibians, and reptiles. The wetlands of coastal Louisiana fall within the Mississippi Flyway, a major migration corridor for the majority of all bird species found in North America, and provide critical nesting and breeding habitat for resident species. Table 4-8 above describes the habitat types found in and near the study area, and Figure 4-5 shows the various wildlife habitats in and within the vicinity of the study area

4.8.1 BIRDS

The study area is located within the Mississippi Flyway. More than 325 bird species make the round-trip each year along this important migration route, from their breeding grounds in Canada and the northern United States to their wintering grounds along the Gulf of Mexico and in Central and South America (National Audubon Society, 2019).

Wetland game birds that occur in the study area include the wood duck (*Aix sponsa*), common snipe (*Gallinago gallinago*), and American woodcock (*Scolopax minor*). Non-game birds in the study area include many species of shorebirds, songbirds (both migratory and non-migratory), and wading birds.

Numerous rare migratory birds utilize study area habitats as stop-over points during migration (e.g., peregrine falcon). Other species of concern utilize the habitat for breeding and raising young (e.g., bald eagles).

The Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act (BGEPA) protect migratory birds. Any activity resulting in the "take" of migratory birds or eagles is prohibited unless authorized by USFWS. Birds of conservation concern may be found within the study area.

Although the Bald Eagle (*Haliaeetus leucocephalus)* was removed from the federal list of threatened and endangered species in 2007, it continues to be protected under the Migratory Bird Treaty Act and the BGEPA. The BGEPA prohibits unregulated take of bald eagles, including disturbance. The National Bald Eagle Management Guidelines (USFWS, 2007) provide landowners, land managers, and others with information and recommendations regarding how to minimize potential project impacts to bald eagles, particularly where such impacts may constitute disturbance.

In Louisiana, the bald eagle typically nests from October to mid-May. Following nesting activities in autumn, egg laying/incubation and hatching/rearing of young typically occur between autumn and spring, with fledging of young as early as January and typically by mid-May. Bald eagle nests typically are in bald cypress trees near fresh and brackish marshes or open water in southeastern Louisiana parishes.

4.8.2 MAMMALS

Common mammals found within the study area include: nutria (*Myocastor coypus*), muskrat (*Ondatra zibethicus*), mink (*Mustela vison*), swamp rabbit (*Sylvilagus aquaticus*), cotton mouse (*Peromyscus gossypinus*), fox squirrel (*Sciurus niger*), and raccoon (*Procyon lotor)* (USACE, 2009a).

The study area supports a variety of game species including white-tailed deer (*Odocoileus virginianus*) and gray squirrel (*Sciurus carolinesis*) (USACE, 2009a).

4.8.3 AMPHIBIANS AND REPTILES

Common amphibians and reptiles use the study area, including frogs, toads, salamanders, lizards, turtles, and snakes. Amphibians likely to occur include the southern dusky salamander (*Desmognathus auriculatus*), dwarf salamander (*Eurycea quadridigitata*), central newt (*Notophthalmus viridescens louisianensis*), three-toed amphiuma (*Amphiuma tridactylum*), western lesser siren (*Sirens intermedia nettingi*), gulf coast toad (*Bufo valliceps*), and northern cricket frog (*Acris crepitans crepitans*) (USACE, 2009b). Reptiles likely to occur within the study area include the common snapping turtle (*Chelydra serpentina*), green anole (*Anolis carolinensis*), broadhead skink (*Eumeces laticeps*), and western cottonmouth (*Agkistrodon piscivorous leucostoma*) (USACE, 2009b).

4.9 THREATENED AND ENDANGERED SPECIES

The USFWS provided a list of federally-listed species that could potentially be found in the study area (St. Charles, Jefferson, Orleans, and St. Bernard Parishes, Louisiana) via a letter dated April 29, 2019 (Appendix G, *Environmental Compliance*). Federally-listed species include any plant or animal listed as endangered or threatened under the Endangered Species Act of 1973, as amended. *Endangered* species include any species that are in danger of becoming extinct. *Threatened* species include any species that are likely to become endangered in the foreseeable future. *Proposed* species include any species that are being reviewed by the

USFWS for possible addition to the list of endangered and threatened species (see Appendix G, *Environmental Compliance*, for more detail).

Table 4-11 lists the threatened and endangered species that may occur in St. Charles, Jefferson, Orleans, and St. Bernard Parishes within the study area under USFWS and NMFS jurisdiction. The study area contains designated Gulf sturgeon critical habitat. Under the Endangered Species Act, critical habitat is a specific geographic area containing features essential to the conservation of an endangered or threatened species and may require special management and protection. Gulf sturgeon critical habitat potentially affected by project features includes Lake Pontchartrain east of the Lake Pontchartrain Causeway. Coordination documentation with both USFWS and NMFS is provided in Appendix G.

Table 4-11. Federally-listed species potentially occurring in the study area

Species	Federal Status	Habitat	Parish of Occurrence	Potential to Occur in Study Area	Coordinating Agency
West Indian manatee (*Trichechus manatus*)	T	Open water	All	Yes, in Lakes Pontchartrain and Borgne, Bayou Dupre, Bayou Bienvenue, GIWW, and IHNC	USFWS
Leatherback sea turtle (*Dermochelys coriacea*)	E	No breeding habitat; feeding habitat in near shore, open water of Lake Pontchartrain and Lake Borgne	All	Yes, in Lakes Pontchartrain and Borgne, MRGO	NMFS
Loggerhead sea turtle (*Caretta caretta*)	T	No breeding habitat; feeding habitat in near shore, open waters of Lake Pontchartrain and Lake Borgne	All	Yes, in Lakes Pontchartrain and Borgne, and MRGO	NMFS
Kemp's ridley sea turtle (*Lepidochelys kempii*)	E	No breeding habitat; feeding habitat in near shore, open waters of Lake Pontchartrain and Lake Borgne	All	Yes, in Lakes Pontchartrain and Borgne, and MRGO	NMFS
Green sea turtle (*Chelonia mydas*)	T	No breeding habitat; feeding habitat in near shore, open waters of Lake Pontchartrain and Lake Borgne	All	Yes, in Lakes Pontchartrain and Borgne, and MRGO	NMFS
Hawksbill sea turtle	E	No breeding habitat; feeding habitat in near shore, open	All	Yes, in Lakes Pontchartrain	NMFS

Species	Federal Status	Habitat	Parish of Occurrence	Potential to Occur in Study Area	Coordinating Agency
(*Eretmochelys imbricata*)		waters of Lake Pontchartrain and Lake Borgne		and Borgne, and MRGO	
Gulf sturgeon (Acipenser oxyrhynchus desotoi)	T	Inhabits coastal rivers from Louisiana to Florida during the warmer months and overwinters in estuaries, bays, and the Gulf of Mexico	All	Yes, in Lakes Pontchartrain and Borgne, IHNC, and GIWW	NMFS
Pallid sturgeon (Scaphirhynchus albus)	E	Inhabits the Missouri and Mississippi Rivers from Montana to Louisiana.	All	Yes, in the Mississippi River	USFWS

4.10 INVASIVE SPECIES (EXECUTIVE ORDER 13112)

Presidential Executive Order 13112 addresses the prevention of the introduction of invasive species and provides for the control and minimization of the economic, ecological, and human health impacts caused by invasive species. Table 4-12 summarizes invasive species found in or near the study area.

Table 4-12. Invasive species found in or near the study area

Common Name	Scientific Name	Habitat
Coastal Plain toad	*Incilius nebulifer*	Freshwater
Greenhouse frog	*Eleutherodactylus planirostris*	Freshwater
Cuban treefrog	*Osteopilus septentrionalis*	Freshwater
Black Sea jellyfish	*Blackfordia virginica*	Freshwater-Marine
Copepod	*Mesocyclops pehpeiensis*	Freshwater
Chinese mitten crab	*Eriocheir sinensis*	Marine-Freshwater
Riverine grass shrimp	*Palaemonetes paludosus*	Freshwater
Asian tiger shrimp	*Penaeus monodon*	Marine
White sucker	*Catostomus commersonii*	Freshwater
Pacu	*Colossoma or Piaractus sp.*	Freshwater
Black tetra	*Gymnocorymbus ternetzi*	Freshwater
Convict cichlid	*Archocentrus nigrofasciatus*	Freshwater
Rio grande cichlid	*Herichthys cyanoguttatus*	Freshwater
Jaguar guapote	*Parachromis managuensis*	Freshwater
Oriental weatherfish	*Misgurnus anguillicaudatus*	Freshwater
Goldfish	*Carassius auratus*	Freshwater
Grass carp	*Ctenopharyngodon idella*	Freshwater
Common carp	*Cyprinus carpio*	Freshwater
Silver carp	*Hypophthalmichthys molitrix*	Freshwater
Rosy barb	*Pethia conchonius*	Freshwater

Common Name	Scientific Name	Habitat
Fathead minnow	*Pimephales promelas*	Freshwater
Paradise fish	*Macropodus opercularis*	Freshwater
Arapaima	*Arapaima sp.*	Freshwater
Green swordtail	*Xiphophorus hellerii*	Freshwater
Southern platyfish	*Xiphophorus maculatus*	Freshwater
Spotted green pufferfish	*Tetraodon nigroviridis*	Freshwater-Brackish
Nutria	*Myocastor coypus*	Freshwater
Asian clam	*Corbicula fluminea*	Freshwater
Giant applesnail	*Pomacea maculata*	Freshwater
Florida applesnail	*Pomacea paludosa*	Freshwater
Red-rim melania	*Melanoides tuberculatus*	Freshwater
Single-vein sweetflag	*Acorus calamus*	Freshwater
Alligatorweed	*Alternanthera philoxeroides*	Freshwater
Tidalmarsh amaranth	*Amaranthus cannabinus*	Brackish
Water lettuce	*Pistia stratiotes*	Freshwater
Smallflower umbrella sedge	*Cyperus difformis*	Freshwater
Giant water sensitive plant	*Aeschynomene fluitans*	Freshwater
Parrot feather	*Myriophyllum aquaticum*	Freshwater
Eurasian watermilfoil	*Myriophyllum spicatum*	Freshwater-Brackish
Brazilian waterweed	*Egeria densa*	Freshwater
Dioecious hydrilla	*Hydrilla verticillata [dioecious]*	Freshwater
Yellow iris	*Iris pseudacorus*	Freshwater
Big-foot water-clover	*Marsilea macropoda*	Freshwater
Large-flower primrose-willow	*Ludwigia grandiflora*	Freshwater
Rice	*Oryza sativa*	Freshwater
Floating waterhyacinth	*Eichhornia crassipes*	Freshwater
Curly-leaf pondweed	*Potamogeton crispus*	Freshwater
Triangle waterfern	*Ceratopteris richardii*	Freshwater
Watersprite	*Ceratopteris thalictroides*	Freshwater
Water spangles	*Salvinia minima*	Freshwater
Giant salvinia	*Salvinia molesta*	Freshwater
Peacock spikemoss	*Selaginella uncinata*	Freshwater
Zebra mussel	*Dreissena polymorpha*	Freshwater
Chinese tallow	*Triadica sebifera*	Forest; Swamp edges
Cogongrass	*Imperata cylindrical*	Sandy soils with low nutrients; non-cultivated areas; areas with some disturbance
Kudzu	*Pueraria lobata*	Any
Asian tiger mosquito	*Aedes albopictus*	Artificial and natural containers with water
Formosan termite	*Coptotermes formosanus*	Wooden structures, trees, insulation
Red imported fire ant	*Solenopsis invicta*	Open, sunny areas
Roseau cane scale	*Nipponaclerda biwakoensis*	Freshwater-Marine
Air potato	*Dioscorea bulbifera*	Disturbed habitats

Sources: (USGS, 2019), (Tulane/Xavier Center for Bioenvironmental Research, 2019), (LSU AgCenter, 2019)

4.11 CULTURAL AND HISTORICAL RESOURCES

The National Historic Preservation Act of 1966 (Public Law 89 80 655), as amended; NEPA of 1969 (Public Law 91-90), as amended; and other applicable laws and regulations require federal agencies to take into account the effects of their undertaking on the environment and any significant cultural resources, defined as historic properties, within the project area of the proposed undertaking, as well as its area of potential effects (APE). Typically, studies to inventory existing conditions require archival searches and field surveys to identify any cultural resources. When significant sites are recorded, efforts are made to minimize adverse effects and preserve the site(s) in place. If any significant sites cannot be avoided and would be adversely impacted, an appropriate mitigation plan would be implemented to recover data that would be otherwise lost due to the proposed undertaking.

For HSDRRS planning and construction, USACE completed studies of the potentially significant historic properties in the areas that would have been impacted by work associated with HSDRRS corridors. 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. Phase I cultural resource surveys were conducted in the form of pedestrian surface surveys with systematic shovel test pit excavations and delineations of site boundaries, when necessary. Where applicable, Phase II site evaluations were conducted for assessing the National Register of Historic Places (NRHP) eligibility. In all cases, the cultural resource survey areas exceeded the size of the preliminary APE, which allowed the USACE project archaeologists to adjust the APE, as needed, to avoid any damage to historic properties with potential eligibility for the NRHP.

Identified significant cultural resources within the project area range from the prehistoric to the historic periods of occupation. Within St. Charles Parish, two historic field drainage structures (16SC65 and 16SC67) were previously relocated. Site 16SC67 was found to be outside of the footprint of the LPV. Site 16SC65 was found to be not eligible for listing on the NRHP. No other sites were found within St. Charles Parish. Two prehistoric shell midden sites (16JE40 and 16JE04) located within Jefferson Parish were evaluated for National Register eligibility and found to be ineligible due to previous disturbance. Eight known cultural resource sites were identified to be within the Orleans Parish Section of the LPV area. These sites include prehistoric midden and occupation sites, such as sites 16OR70 and 16OR24, historic sites ranging from the 18th to the 20th century such as 16OR446 and 16OR19, and a historic structure the Port Pontchartrain Lighthouse. Within St. Bernard Parish, site 16SB84, the Battery Bienvenue a 19th century military fortification, is located adjacent to the LPV area and was avoided by all impacts. Two other historic sites, 16SB160 and 16SB161, a historic railway and artifact scatter respectively, were documented in St. Bernard Parish. Both of these sites are located outside of the LPV footprint. One site 16PL150, a historic artifact scatter, was determined to be within the LPV area in Plaquemines Parish. The site was determined to be ineligible for the NRHP.

The Chalmette National Historical Park (Chalmette Unit of Jean Lafitte National Historical Park Historic District) is located adjacent to the proposed section of levee lifts and floodwall modifications and replacements outside the HSDRRS along the Mississippi River in St. Bernard Parish (Figure ES-1). The Chalmette National Historical Park was listed in the NRHP in 1974. The district comprises approximately 143 acres and forms a rough rectangle that runs from south of Louisiana Highway 46/W. St. Bernard Highway to the east bank of the Mississippi

River. The Chalmette National Historical Park is nationally significant in the areas of archaeology, architecture, military, and social history. The district includes 16 historically significant sites and built resources.

For the HSDRRS construction, in letters sent to the Louisiana SHPO and THPOs of the 12 federally recognized tribes with an interest in the region, 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 avoidance measures. Section 106 consultation for the HSDRRS projects was then concluded. Compliance with NHPA Section 106 would also be achieved for the proposed LPV actions.

Through avoidance, minimization, monitoring and other mitigation, there were no known direct and long-term impacts to cultural resources as a result of the HSDRRS projects. 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.

A comprehensive summary of these studies, identified cultural resources, and previous Section 106 consultation for HSDRRS construction are presented in IERs #1, #2, #3, #4, #5, #6, #7, #8, #9, #10, #11, and #27 and complied and summarized in the Comprehensive Environmental Document Phase 1 and are incorporated herein by reference (USACE, 2013).https://www.mvn.usace.army.mil/Missions/Environmental/NEPA-Compliance-Documents/HSDRRS-Projects/.

4.12 AESTHETICS (VISUAL)

Environmental assessments and impact statements for USACE planning studies are supposed to focus on significant environmental considerations as recognized by technical, institutional and public sources. The Visual Resources Assessment Procedure for USACE (VRAP) (Smardon, et al., 1988) provides a method to evaluate visual resources affected by USACE water resources projects. The following VRAP criteria are used to identify significant visual resource considerations in the study area:

1. Important urban landscapes including visual corridors, monuments, sculptures, landscape plantings, and greenspace.
2. Area is easily accessible by a major population center.
3. Project is highly visible and/or requires major changes in the existing landscape.
4. Areas with low scenic quality and limited visibility.
5. Historic or archeological sites designated as such by the National Register or State Register of Historic Places.
6. Parkways, highways, or scenic overlooks and vistas designated as such by a federal, state, or municipal government agency.
7. Visual resources that are institutionally recognized by federal, state or local policies.
8. Tourism is important in the area’s economy.
9. Area contains parks, forest preserves, or municipal parks.
10. Wild, scenic, or recreational water bodies designated by government agencies.
11. Publically or privately operated recreation areas.

Much of the LPV 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. Significant visual resources in the study area include the New Orleans lakefront greenspace and the National Historical Landmark Vieux Carré Historic District, which is a major tourist destination. Lakes Pontchartrain, Borgne, and Catauatche and surrounding wetlands are visible from the levees, and the LPV corridor in Orleans and St. Bernard Parishes bisects wetlands and open water bodies of the Bayou Sauvage National Wildlife Refuge and the Central Wetlands Unit, respectively. Located in St Charles Parish are Bayou Trepagnier and Bayou LaBranche, which are part of the Louisiana Natural and Scenic River system. In Jefferson Parish, 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. Inland areas of Jefferson Parish are mostly developed, and include several parks that are administered by the Jefferson Parish Parks and Recreation Department, including Lafreniere Park, Linear Park, and the Bonnabel Boat Launch. The Chalmette National Historical Park (Chalmette Unit of Jean Lafitte National Historical Park Historic District) is located adjacent to the existing floodwall and levee system along the Mississippi River in St. Bernard Parish.

Construction of the HSDRRS LPV and excavation of borrow sites had short-term adverse impacts to visual resources in the project area. After construction, the project corridor returned, to the maximum extent practicable, to pre-construction conditions. Direct long-term impacts on visual resources from the construction of the LPV were negligible.

These significant visual resource considerations in the study area are described in the aesthetics, cultural and recreational resources sections of the CED Phase I (USACE, 2013) and are incorporated herein by reference (https://www.mvn.usace.army.mil/Missions/Environmental/NEPA-Compliance-Documents/HSDRRS-Projects/Comprehensive-Environmental-Document/).

4.13 RECREATIONAL RESOURCES

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. 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.

Although there is no existing trail system on the levee segments maintained for recreation, many levee segments of the LPV project provide recreational opportunities for walking, running, and bicycling. Additionally, the MRL is used extensively by passive and active recreationalists, including walkers, joggers, wildlife viewers, and cyclists. The Bonnet Carré Spillway, a potential source of borrow material, is a recreational area offering biking, hiking, horseback riding, picnicking, ATV areas as well as hunting and fishing. Finally, segments along Lake Pontchartrain in Jefferson and Orleans parishes are especially important components of outdoor recreation in the region and offer many parks and open green spaces for picnicking.

Numerous water bodies in the region provide boating and fishing opportunities. Within the LPV study area, 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. Lake Borgne is a regionally significant resource for recreational boating and fishing. Numerous boat launches provide direct access to this estuarine water body.

Lake Pontchartrain is a regionally significant resource providing recreational opportunities for Louisiana and out-of-state users. 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).

The National Park Service (NPS) has two properties within the study area located in the French Quarter. One is home to the New Orleans Jazz National Historic Park, which is dedicated to jazz and features concert and exhibit spaces plus workshops. The second is the Jean Lafitte National Historic Park and Preserve French Quarter Visitor's Center. Additionally, the NPS operates the Chalmette Battlefield and National Cemetery, located in St. Bernard Parish between Highway 46 and the Mississippi River, where the Battle of New Orleans took place in 1815.

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 LPV levees along the deauthorized MRGO and GIWW on the north and east sides and a local levee along the south side. Two hurricane and tropical storm surge gates, one located on Bayou Bienvenue and the other on Bayou Dupre, and another designated Louisiana Natural and Scenic River, allow for non-tropical storm exchanges of water to influence water levels in the Central Wetlands Unit.

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.

Louisiana has approximately 53,622 miles of river, of which 19 miles of one river (Saline Bayou) are designated as wild and scenic under the Wild and Scenic Rivers Act (16 U.S.C. 1271 *et seq.*) – less than 4/100ths of 1% of the state's river miles. No designated wild and scenic rivers occur within the study area.

4.14 AIR QUALITY

The USEPA sets national air quality standards for six common pollutants. These standards, known as National Ambient Air Quality Standards (NAAQS), include carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter (PM) 2.5, PM 10 and sulfur dioxide. Areas where air quality conditions violate these standards are classified as “non-attainment” and are subject to special air quality controls. St. Charles, Jefferson, and Orleans parishes are in attainment for all NAAQS. St. Bernard Parish is in attainment for all NAAQS except sulfur dioxide (SO_2) (USEPA, 2019).

The General Conformity Rule (40 CFR Part 93) ensures that the actions taken by federal agencies in nonattainment and maintenance areas do not interfere with a state’s plans to meet national standards for air quality. A conformity determination evaluates whether a federal action meets the requirements of the general conformity rule and must be performed when a federal action generates air pollutants that would exceed conformity threshold (“de minimis”) levels in a region designated as a non-attainment or maintenance area for one or more NAAQS. 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 if de minimis thresholds would be exceeded, the agency must prepare a general conformity determination demonstrating that project emissions would meet the requirements of the General Conformity Rule and would conform to the relevant state implementation plan before the action will be allowed to proceed. If the agency’s projected emissions would not exceed de minimis levels, a conformity determination is not required.

4.15 NOISE

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 adopted by most federal agencies (USEPA 1974). The U.S. Department of Housing and Urban Development (HUD) established acceptable DNL noise levels 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 construction 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. USEPA identified a DNL of 55 dBA 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.

Table 4-13 outlines the maximum permissible sound levels by land use category. 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 feet of any residential or noise-sensitive area between 9:00 pm and 7:00 am Monday through Saturday, and between 9:00 pm and 8:00 am on Sundays and holidays, except for emergency work (Section 20-102 Jefferson Parish Municipal Code). In St. Bernard Parish, construction activities directly connected with the abatement of an emergency are excluded from the noise provisions listed below. No exemptions exist for St. Charles Parish.

Table 4-13. Noise level limits by land use category in study area parishes

Receiving Land Use Category	Time	Maximum Permissible Sound Level Limit (dBA)				
		St. Charles	Jefferson	Orleans		St. Bernard
		L_{max}	L_{max}	L_{10}	L_{max}	L_{max}
Residential & Public Space	7:00 am – 10:00 pm	50	60	60	70	65
	10:00 pm – 7:00 am	45	55	55	60	60
Commercial	7:00 am – 10:00 pm	65	65	65	75	70
	10:00 pm – 7:00 am	60	60	60	65	65
Industrial	At all times	N/A	75	75	85	-
	7:00 am – 10:00 pm	-	-	-	-	85
	10:00 pm – 7:00 am	-	-	-	-	80

Sources: (Code of the City of New Orleans, Louisiana, Section 66, Article IV, 2020) (Code of Ordinances, Jefferson Parish, Louisiana, Section 20-102, 2020) (Code Parish of St. Charles, Louisiana, Section 24-4, 2020) (Code Revision of St. Bernard Parish, Louisiana, Section 11-132, 2020)
L_{10} = sound pressure level that is exceeded 10 percent of the time
L_{max} = maximum noise level of a particular event

4.16 TRANSPORTATION

Regional transportation in and around the study area includes air traffic systems, railroads, public transit, navigation channels, and roadway networks. Figure 4-9 shows the regional transportation features in the study area.

4.16.1.1 AIRLINE SERVICES

The Louis Armstrong New Orleans International Airport is located west of most projects in the HSDRRS and is the primary commercial airport for the New Orleans area and most of the greater New Orleans area. The New Orleans Lakefront Airport is located on the southern bank of Lake Pontchartrain along Hayne Boulevard and serves general aviation, 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, 2019).

4.16.1.2 PUBLIC TRANSIT

The Regional Transit Authority provides public transit within the New Orleans area. There are 34 bus routes, five streetcar lines, and two ferry routes that provide more than 19 million rides per year (New Orleans Regional Transit Authority, 2019). 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.

4.16.1.3 ROADWAY NETWORK

Roads and bridges compose the majority of the transportation network serving the study area. Included with this network are several Louisiana Department of Transportation and Development roadway classifications, including interstates, principal roads, and local roads.

4.16.1.3.1 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.

4.16.1.3.2 PRINCIPAL ROADS

There are several principal roads located throughout the study 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.

4.16.1.3.3 LOCAL ROADS

Local roads are also used throughout the study 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.

4.16.1.4 NAVIGATION CHANNELS

The Port of New Orleans, which moves about 500 million tons of cargo each year, is located on the Mississippi River 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).

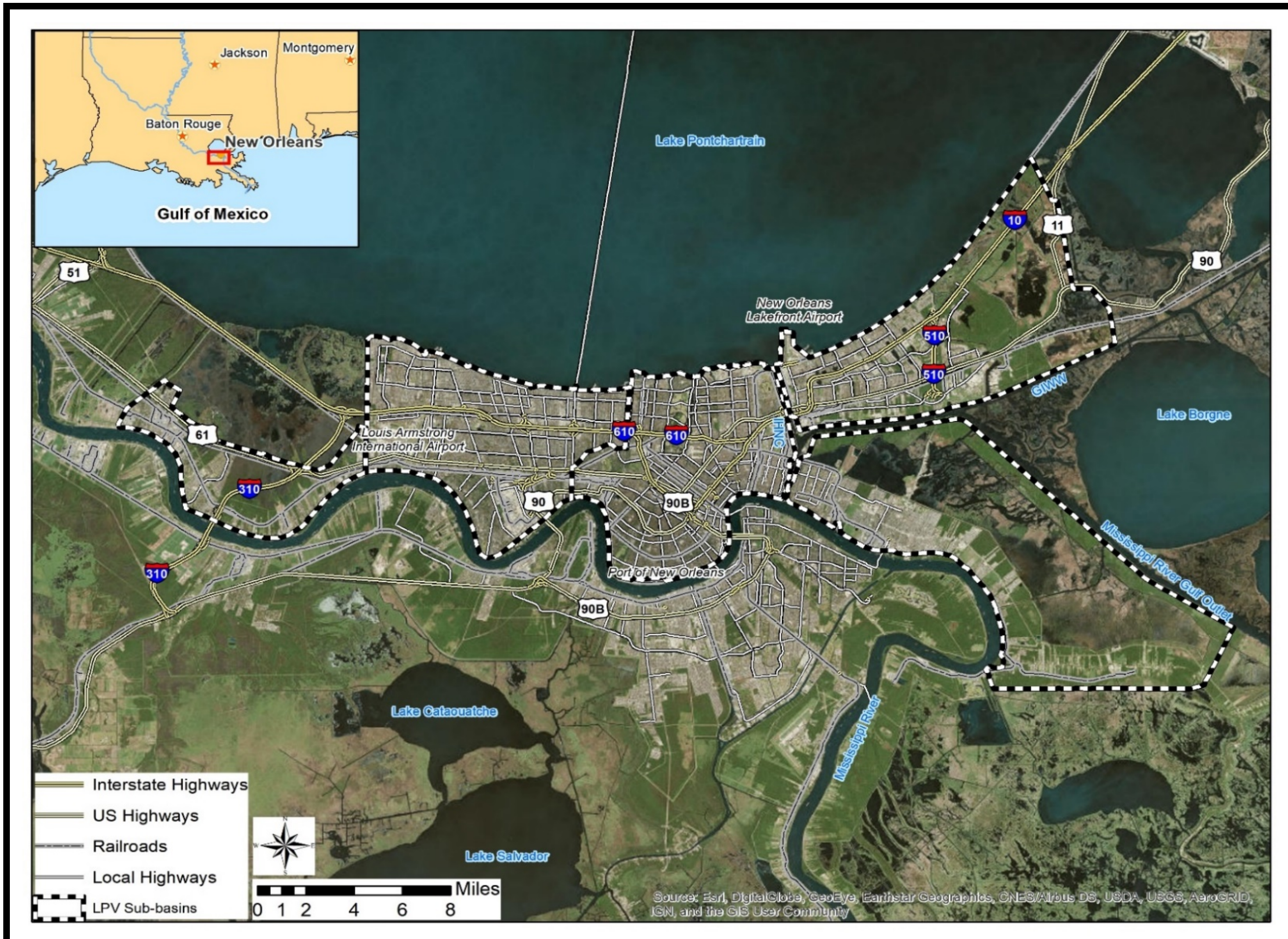

Figure 4-9. Locations of transportation systems in the study area

4.17 HUMAN ENVIRONMENT

The study area encompasses the entirety of four parishes: Jefferson, Orleans, St. Bernard, and St. Charles. The parish seats are Gretna, New Orleans, Chalmette, and Hahnville, respectively.

4.17.1 POPULATION & HOUSING

Table 4-15 and Figure 4-10 show the population trend in the four-parish area from 1970 to 2010 and projections through 2040. The U.S. Census Bureau predicts the state-wide population will rise over this period.

Table 4-14. Population Trend in the Study Area, Total Population in Thousands

Total Population (thousands)* U.S. Census Bureau (BOC); Moody's Analytics (ECCA) Forecast								
Parish	**Dec-1970**	**Dec-1980**	**Dec-1990**	**Dec-2000**	**Dec-2010**	**Dec-2020**	**Dec-2030**	**Dec-2040**
Jefferson Parish	338.75	456.62	448.57	454.75	432.75	447.04	466.71	478.88
Orleans Parish	594.38	558.43	495.74	485.61	347.90	399.23	416.80	427.67
St. Bernard Parish	51.26	64.51	66.72	67.28	36.81	46.53	48.58	49.84
St. Charles Parish	29.6	37.52	42.47	48.42	52.84	54.12	56.50	57.97
State of Louisiana	3,650.20	4,226.70	4,221.53	4,471.89	4,545.00	4,732.42	4,816.69	4,868.18

*Population trends are expected to continue through the end of the planning period.

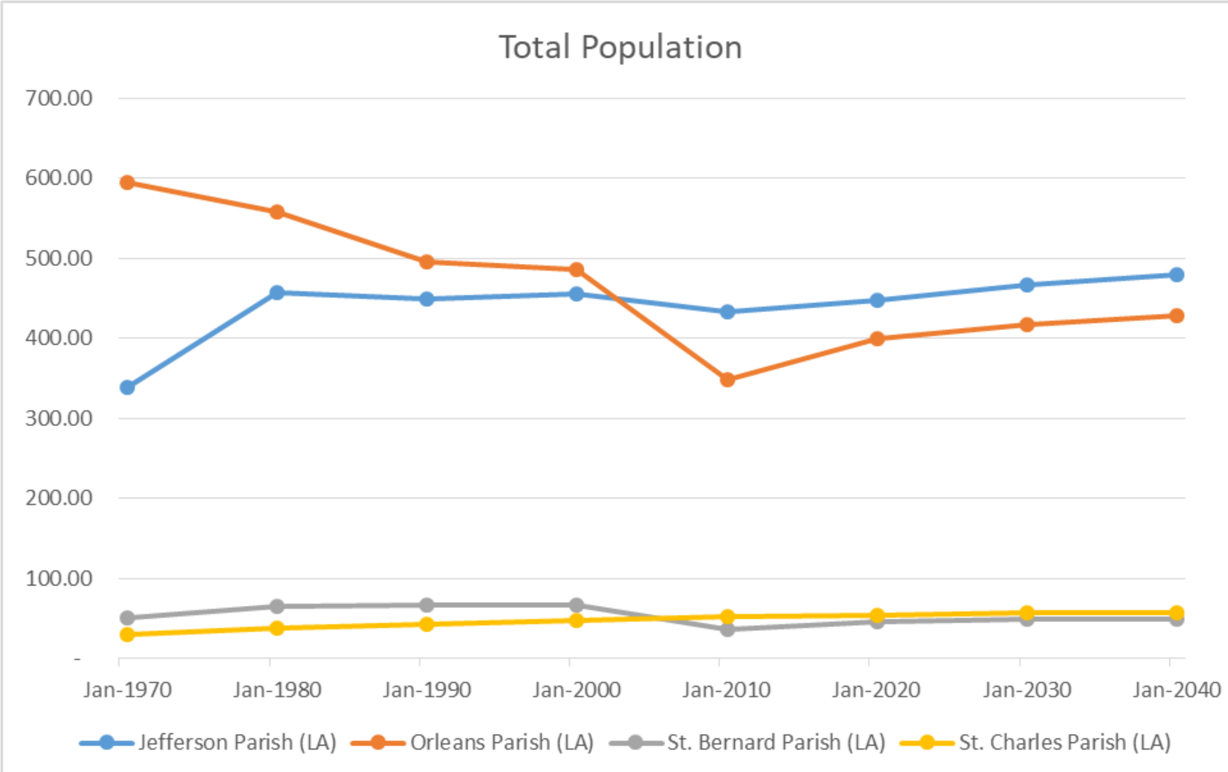

Figure 4-10. Total population trends for study area parishes

The trend in household formation, shown in Table 4-16 and Figure 4-11, is predicted to level off by 2020 and show little growth through the year 2040.

Table 4-15 Number of Households in the Study Area, Total Number in Thousands

Number of Households: Total (thousands)* U.S. Census Bureau (BOC); Moody's Analytics (ECCA) Forecast								
Parish	**Dec-1970**	**Dec-1980**	**Dec-1990**	**Dec-2000**	**Dec-2010**	**Dec-2020**	**Dec-2030**	**Dec-2040**
Jefferson Parish	95.75	156.40	166.50	176.41	469.89	184.40	201.34	213.79
Orleans Parish	191.46	206.80	187.79	189.02	143.98	173.18	188.68	200.03
St. Bernard Parish	13.72	20.73	23.19	25.20	13.57	18.08	19.79	21.06
St. Charles Parish	7.59	11.57	14.35	16.47	18.60	20.12	22.08	23.52
State of Louisiana	1,053.61	1,418.77	1,499.82	1,660.62	1,734.57	1,887.22	2,010.60	2,104.10

*Population trends are expected to continue through the end of the planning period.

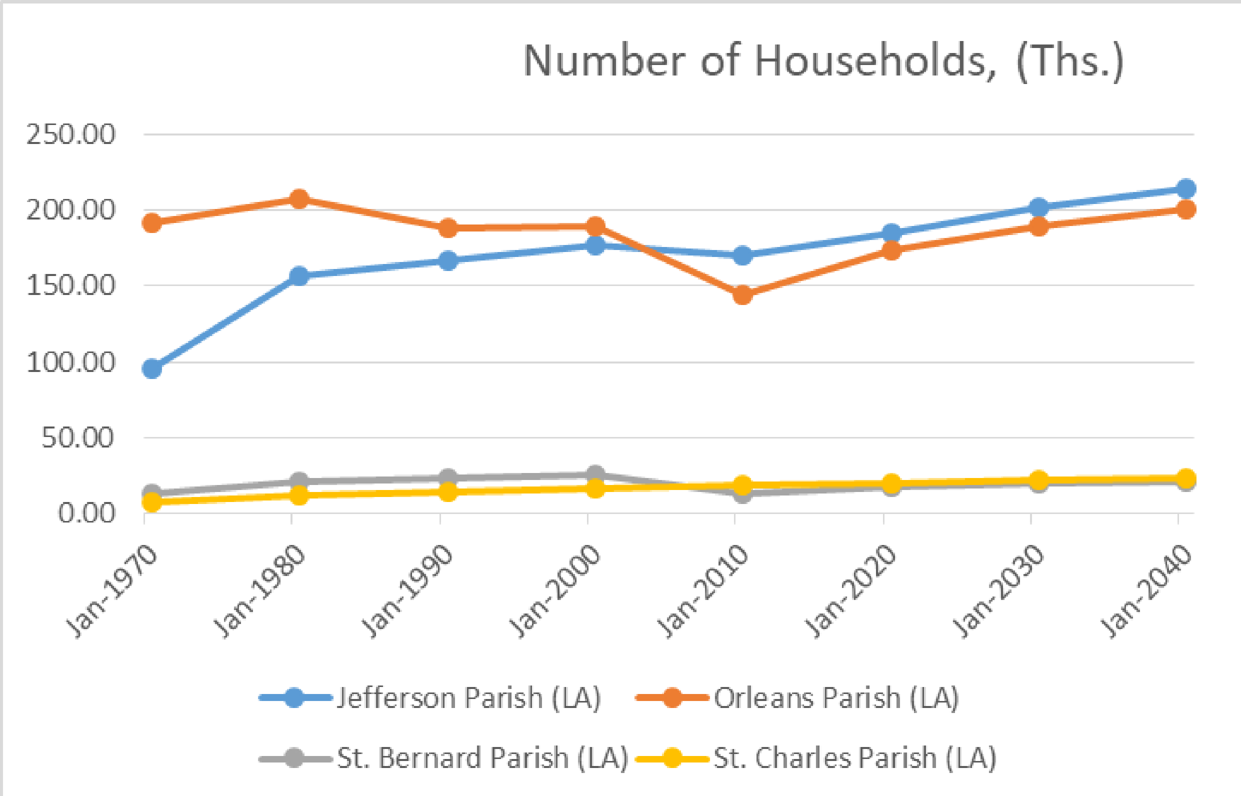

Figure 4-11. Trends in number of households for study area parishes

4.17.2 EMPLOYMENT, BUSINESS, AND INDUSTRIAL ACTIVITY

Table 4-17 shows the growth of non-farm employment over the last four decades which is predicted to decrease by the year 2040. The leading employment sectors are Trade, Transportation, and Utilities; Government, Local Government, and Office Using Industries. The Unemployment Rate in all three parishes is generally higher than the state of Louisiana Unemployment Rate (see Table 4-18).

Table 4-16. Employment trends for the study area

Employment by Industry (thousands)* U.S. Bureau of Labor Statistics: Census of Employment & Wages (QCEW – ES202); Moody's Analytics (ECCA) Forecast								
Industry	**Dec-1970**	**Dec-1980**	**Dec-1990**	**Dec-2000**	**Dec-2010**	**Dec-2020**	**Dec-2030**	**Dec-2040**
Total Nonfarm Payroll	338.19	489.48	474.46	529.83	415.28	463.63	494.48	531.48
Natural Resources and Mining	10.96	15.15	13.38	7.90	5.11	2.57	2.34	2.16
Construction	20.70	36.06	22.94	24.96	23.66	23.32	22.66	21.26
Manufacturing	42.04	49.77	38.19	35.55	24.20	18.29	16.21	14.52
Food; Beverage; and Tobacco Manufacturing	9.95	8.67	5.43	4.35	3.52	4.33	3.86	3.37
Textile; Fiber; and Printing Manufacturing	3.60	4.05	3.59	2.75	1.23	1.30	1.06	0.89
Chemical; Energy; Plastic; and Rubber Manufacturing	9.17	10.76	7.77	8.97	7.03	7.52	6.79	6.15
Metals and Mining Based Manufacturing	5.21	7.07	4.43	3.36	2.27	1.98	1.68	1.51
Machinery Manufacturing	1.61	1.90	2.02	2.58	1.25	0.86	0.73	0.66
Electronic and Electrical Manufacturing	0.60	0.76	0.76	0.98	0.89	0.75	0.64	0.55
Transportation Equipment Manufacturing	10.98	15.56	13.38	11.69	7.42	1.00	0.92	0.91
Furniture and Misc. Manufacturing	0.92	0.99	0.78	0.87	0.56	0.57	0.52	0.48
Trade; Transportation; and Utilities	102.89	130.07	117.67	107.77	80.32	92.10	100.69	110.38
Wholesale Trade	21.24	28.30	25.13	24.82	17.57	18.14	17.76	16.94
Retail Trade	47.56	60.96	61.53	57.94	42.67	52.13	62.32	74.43
Transportation; Warehousing; and Utilities	34.09	40.82	31.0	25.01	20.0/	21.8/4	20.61	19.00
Transportation and Warehousing	31.89	37.66	27.29	22.70	18.13	20.19	19.10	17.64
Utilities	2.20	3.15	3.71	2.31	1.77	1.65	1.51	1.36
Information	6.56	9.50	7.94	9.83	6.25	5.87	5.63	5.36
Financial Activities	21.59	32.00	34.48	30.08	20.70	22.94	22.04	20.95
Professional and Business Services	23.59	38.24	48.77	67.67	57.29	64.65	67.69	73.46
Education and Health Services	23.00	42.64	54.37	68.40	31.38	86.23	91.05	95.48
Leisure and Hospitality	28.18	48.36	51.31	71.16	56.90	74.33	85.93	100.79
Other Services (except Public Administration)	13.60	16.56	17.40	20.17	16.95	19.01	18.24	17022
Government	45.10	71.14	67.71	86.34	62.53	53.97	62.01	69.80
Federal Government	9.96	16.06	14.94	14.90	11.60	11.41	11.57	11.72
Local Government	22.65	35.04	33.58	49.06	33.00	31.98	38.35	44.61
State Government	12.49	20.04	19.19	22.38	17.93	10.58	12.09	13.47
Office-using Technologies	55.75	86.29	99.48	111.45	93.16	103.53	103.63	105.42
High Technology Industries	7.77	12.15	11.13	14.41	7.83	9.15	9.89	10.41

*Employment trends are expected to continue through the end of the planning period.

Table 4-17 Study Area Unemployment Rates

Unemployment Rate (%)* BLS; Moody's Analytics (ECCA) Forecast						
Parish	**Dec-1990**	**Dec-2000**	**Dec-2010**	**Dec-2020**	**Dec-2030**	**Dec-2040**
Jefferson Parish	5.60	4.60	7.38	6.69	6.83	6.39
Orleans Parish	7.07	5.45	8.69	7.44	7.58	7.10
St. Bernard Parish	778	5.46	8.34	7.75	7.90	7.40
St. Charles Parish	6.07	5.58	7.41	6.69	6.83	6.39
State of Louisiana	6.20	5.30	7.97	6.88	7.06	6.71

*Employment trends are expected to continue through the end of the planning period.

4.17.2.1 PUBLIC FACILITIES & SERVICES

Public facilities and services have historically grown to meet population demands. The area includes a mixture of community centers, schools, hospitals, airports, colleges, and fire protection.

4.17.2.2 COMMUNITY & REGIONAL GROWTH (INCOME)

Community and regional growth primarily track population and employment trends that were described in the preceding sections. Table 4-19 shows per capita growth in income since 1970 and predictions through the year 2040.

Table 4-18. Per Capita Income ($) within the study area

Income: Per Capita ($)* U.S. Bureau of Economic Analysis (BEA); U.S. Census Bureau (BOC); Moody's Analytics (ECCA) Forecast								
Parish	**1970**	**1980**	**1990**	**2000**	**2010**	**2020**	**2030**	**2040**
Jefferson Parish	3,962	10,427	18,086	28,376	42,033	53,808	75,451	111,512
Orleans Parish	3,774	9,553	17,500	26,386	41,769	53,296	76,039	112,316
Plaquemines Parish	3,189	9,659	15,589	21,536	42,074	52,930	74,587	109,724
St. Charles Parish	3,188	10,462	16,908	24,634	39,557	53,117	77,117	117,900

*Income trends are expected to continue through the end of the planning period.

4.17.2.3 TAX REVENUE & PROPERTY VALUES

Historically, damages from storm surge events have adversely impacted business and industrial activity, agricultural activity, and local employment and income, which then led to commensurate negative impacts to property values and the tax base upon which government revenues rely.

4.17.2.4 COMMUNITY COHESION

Community cohesion is based on the characteristics that keep the members of the group together long enough to establish meaningful interactions, common institutions, and agreed-upon behaviors. These characteristics include race, education, income, ethnicity, religion, language, and mutual economic and social benefits. The area is comprised of communities with a long history and long-established public and social institutions including places of worship, schools, and community associations.

4.18 ENVIRONMENTAL JUSTICE

An Environmental Justice (EJ) analysis focuses on the potential for disproportionately high and adverse impacts to minority and low-income populations during the construction and normal operation of the federal action – in this case, the proposed levee lifts to segments of the HSDRRS. The EJ assessment identified the minority and low-income communities in the LPV study area, including eight Census Designated Places (CDP) or cities as shown in Table 4-20. An impacts assessment, identifies EJ communities near project alternative alignments and compares the minority and low-income population to the Parish reference community or metropolitan area and determines if any high, adverse impacts are disproportionate. Additionally, if the impact is appreciably more severe or greater in magnitude on minority or low-income populations than the adverse effect suffered by the non-minority or non-low-income populations after taking offsetting benefits into account, then there may be a disproportionate finding. If disproportionately high and adverse effects were identified, the agency would address those effects to the extent practicable through avoidance and/or mitigation.

Methodology

Environmental Justice is institutionally significant because of Executive Order 12898 of 1994 (E.O. 12898) and the DoD's Strategy on Environmental Justice of 1995, which direct federal agencies to identify and address any disproportionately high adverse human health or environmental effects of federal actions to minority and/or low-income populations. Minority populations are those persons who identify themselves as Black, Hispanic, Asian American, American Indian/Alaskan Native, Pacific Islander, some other race, or a combination of two or more races. A minority population exists where the percentage of minorities in an affected area either exceeds 50 percent or is meaningfully greater than in the general population. Low-income populations as of 2019 are those whose income are below $25,750 for a family of four and are identified using the Census Bureau's statistical poverty threshold. The Census Bureau defines a "poverty area" as a census tract or block group with 20 percent or more of its residents below the poverty threshold and an "extreme poverty area" as one with 40 percent or more below the poverty level. This resource is technically significant because the social and economic welfare of minority and low-income populations may be positively or disproportionately impacted by the proposed actions. This resource is publicly significant because of public concerns about the fair and equitable treatment (fair treatment and meaningful involvement) of all people with respect to environmental and human health consequences of federal laws, regulations, policies, and actions.

The methodology to accomplish an EJ analysis, consistent with E.O. 12898, includes identifying low-income and minority populations within the study area using up-to-date economic statistics, aerial photographs, U.S. Census Bureau decennial data, and the 2015-2019 American Community Survey (ACS) estimates, as well as conducting community outreach activities such as public meetings. The analysis also includes information on Limited English Proficiency (LEP) populations in the study area in order to comply with Executive Order 13166. Executive Order 13166 requires federal agencies to examine the services they provide, identify any need for services to LEP communities, and develop and implement a system to provide those services so LEP communities can have meaningful access. The U.S. Census Bureau defines a limited English speaking household as one in which all members 14 years old and over have at least some difficulty with English. The ACS estimates provide the latest socioeconomic community characteristics, including minority and poverty level data and English proficiency, released by the U.S. Census Bureau and are based on data collected between January 2015 and December 2019.

The U.S. Census Bureau identifies and provides demographic data on eight cities or Census Designated Places in the LPV study Area. The LPV study Area includes the cities of Kenner and New Orleans and six Census Designated Places including River Ridge, Metairie, Chalmette, Meraux, Violet and Poydras. The largest community in terms of population is the City of New Orleans followed by Metairie. Only two of the areas have a majority minority population identifying as Black/African American, American Indian and Alaska Native, Asian, Native Hawaiian and Other Pacific Islander, Some Other Race, or Two or More Races and include the City of New Orleans and Violet CDP. Most of the minority population identifies as Black/African American. Hispanic ethnicity is between 4.9 percent and 25.6 percent of total population. Kenner, River Ridge and Metairie are located in Jefferson Parish while Chalmette, Meraux, Violet and Poydras are located in St. Bernard Parish. The City of New Orleans is synonymous with Orleans Parish. LEP households are below 10% in all communities within the study area. Kenner and Metairie have the highest rates of LEP with 7.7% and 6.2%, respectively. Less than 3% of households in River Ridge, New Orleans, Chalmette, Meraux, Violet, and Poydras are LEP households.

Table 4-19. Total Population and Racial/Ethnic/LEP Composition of Communities in the LPV Study Area

Subject	City of Kenner	River Ridge CDP	Metairie CDP	City of New Orleans	Chalmette CDP	Meraux CDP	Violet CDP	Poydras CDP	Jefferson Parish	St. Bernard Parish
Total Population	66,777	13,337	142,135	390,845	23,851	7,007	5,755	2,790	434,850	46,266
RACE										
One race	97.7%	98.9%	98.2%	98.1%	96.9%	98.8%	99.3%	96.5%	97.8%	97.6%
White	64.4%	85.5%	81.1%	33.9%	68.8%	80.9%	31.8%	88.2%	62.4%	69.4%

Subject	City of Kenner	River Ridge CDP	Metairie CDP	City of New Orleans	Chalmette CDP	Meraux CDP	Violet CDP	Poydras CDP	Jefferson Parish	St. Bernard Parish
Black or African American	23.8%	10.9%	10.2%	59.5%	22.2%	12.2%	64.5%	8.2%	27.0%	23.3%
American Indian and Alaska Native	0.5%	0.6%	0.2%	0.2%	0.5%	0.5%	0.0%	0.0%	0.4%	0.4%
Asian	3.7%	1.1%	4.0%	2.9%	3.4%	3.0%	0.0%	0.0%	4.2%	2.5%
Native Hawaiian and other Pacific Islander	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.1%
Some other other race	5.4%	0.8%	2.7%	1.5%	1.9%	2.1%	3.1%	0.0%	3.8%	2.0%
Two or more races	2.3%	1.1%	1.8%	1.9%	3.1%	1.2%	0.7%	3.5%	2.2%	2.4%
Minority	35.7%	14.5%	18.9%	66.0%	31.2%	19.0%	68.3%	11.7%	37.6%	30.7%
HISPANIC OR LATINO										
Total population	66,777	13,337	142,135	390,845	23,851	7,007	5,755	2,790	434,850	46,266
Hispanic or Latino (or any race)	25.6%	4.9%	15.5%	5.5%	10.6%	9.5%	7.6%	10.0%	14.5%	10.1%
LINGUISTIC ISOLATION										
Total households	24,891	5,546	59,845	153,819	7,544	2,184	1,816	944	169,452	15,005
limited English-speaking Households	7.70%	0.10%	6.20%	2.00%	2.1%	1.20%	0.00%	2.00%	5.50%	1.60%

Source: (US Census Bureau, 2019)

Four of eight of the Census areas in the LPV study area, including the City of New Orleans and the CDPs of Chalmette, Violet and Poydras, have 20 percent or more of individuals living below poverty. Less than 20 percent of the population lives below the poverty level in the Kenner, River Ridge, Metairie and Meraux CDPs (Table 4-21).

Table 4-20. Persons Living Below Poverty Level in Communities in LPV Study Area

Place	Estimate*	Below Poverty Level	Percent Below Poverty Level
City of Kenner	66,237	11,469	17.3%
River Ridge CDP	13,320	1,000	7.5%
Metairie CDP	141,497	16,741	11.8%
City of New Orleans	377,695	89,340	23.7%
Chalmette CDP	23,519	5,528	22.4%
Meraux CDP	6,996	841	12.0%
Violet CDP	5,755	1,289	22.4%
Poydras CDP	2,790	1,045	37.5%

*Population for whom poverty status is determined

Source: (U.S. Census Bureau 2019)

The HSDRRS CED Phase I study identifies EJ communities and EJ resource impacts from construction of the HSDDRS for LPV and those findings are incorporated into this analysis. The USACE New Orleans District website provides the IERs, the CED report and the EJ analysis for the five parish HSDRRS study area (USACE, 2019). The following is a brief summary of the EJ findings presented in the CED Phase I report.

St. Charles Parish consists of levee sections that are assessed in IER #1, and includes the low-income and minority communities of Norco, New Sarpy, Destrehan, and St. Rose, and IER #2 which does not have EJ communities adjacent to the proposed levee work. 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. Jefferson Parish consists of levee segments that were assessed in IER #3 which does not have minority communities along the levee corridor but there are several low-income neighborhoods. Orleans Parish consists of levee segments that were assessed in IER #4, #5, #6 and #7 and includes EJ communities meeting the minority and low-income criteria.

St. Bernard Parish consists of levee segments along the MRL which were not assessed in the CED Phase I report. The communities along the LPV MRL segment in St. Bernard include Chalmette, Meraux, Violet and Poydras. Violet, Chalmette and Poydras have a majority of population identifying as a minority or are low-income. EJ neighborhoods are near the proposed levee MRL lifts and all of the levee improvements that are on the protected side will be completed within the existing ROW.

Table 4-21. LPV MRL Minority/LEP Population

Subject	Chalmette CDP	Meraux CDP	Violet CDP	Poydras CDP	St. Bernard Parish
Total Population	23,851	7,007	5,755	2,790	46,266
Minority	31.20%	19.10%	67.90%	11.80%	30.60%
HISPANIC OR LATINO					
Hispanic or Latino (of any race)	10.6%	9.53%	7.60%	10.00%	10.00%
LIMITED ENGLISH PROFICIENCY					
All households	7,544	2,184	1,816	944	15,005
Limited English-speaking Households	2.1%	1.2%	0%	2.0%	1.6%

Note: Red font identifies minority population exceeding 50 percent, which is an Indicator of an EJ community.
Source: (US Census Bureau, 2019)

Table 4-22. LPV MRL Low-Income Population

Place	Estimate*	Below Poverty Level	Percent Below Poverty Level
Chalmette CDP	23,519	5,258	22.40%
Meraux CDP	6,996	841	12.00%
Violet CDP	5,755	1,289	22.40%
Poydras CDP	2,790	1,045	37.50%
*Population for whom poverty status is determined			

Note: Red font identifies low-income population exceeding 20 percent, which is an Indicator of an EJ community.
Source: (US Census Bureau, 2019)

4.19 HAZARDOUS, TOXIC AND RADIOACTIVE WASTE

USACE regulations (Engineering Regulation (ER) 1165-2-132 and ER 200-2-3) and USACE New Orleans policy require procedures be established to facilitate early identification and appropriate consideration of potential HTRW in feasibility, preconstruction engineering and design, land acquisition, construction, operations and maintenance, repairs, replacement, and rehabilitation phases of water resources studies or projects by conducting HTRW Phase I Environmental Site Assessments (ESAs). USACE specifies that these assessments follow the process/standard practices for conducting Phase I ESAs published by the American Society for Testing and Materials (ASTM). This assessment was prepared using the following ASTM Standards:

- E1527-13: Standard Practice for Environmental Site Assessments – Phase I Environmental Site Assessment process
- E1528-06: Standard Practice for Limited Environmental Due Diligence: Transaction Screen Process (interview questionnaires)

- E2247-08 Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process for Forestland or Rural Property

The purpose of a Phase I ESA is to identify, to the extent feasible in the absence of sampling and analysis, the range of contaminants within the scope of the USEPA Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and petroleum products.

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 $14.6 billion, with restoration, accelerated construction, improvements, and enhancements of various risk reduction projects and ecosystem restoration projects within southeastern Louisiana. With the completion of the levees, floodwalls, gates, and pumps that together form the LPV and WBV, 1% AEP level of hurricane and storm damage risk reduction was brought to the areas within LPV and WBV. At this time, Phase I ESAs were performed for the selected project features and Recognized Environmental Conditions (RECs) were identified and remediated or avoided prior to construction. Some RECs were identified in the Phase I ESAs within the Rights-of-Way (ROW) for the LPV, 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.

During the feasibility phase, an abridged Phase I ESA was performed to determine the potential for HTRW problems which could impact or be impacted by potential project features. This abridged Phase I ESA was conducted in the current HSDRRS levee and floodwall ROW and the results are presented directly below. The abridged Phase I ESA included the following tasks: 1) the review of previous HSDRRS HTRW Phase I ESAs to identify previously recorded RECs that may have been found prior to the construction of the HSDRRS features and 2) a field survey to determine if new RECs are within the HSDRRS levee and floodwall ROW.

The abridged Phase I ESA tasks and results are:

Task 1 Results – According to the 2013 HSDRRS CED Phase I Volume I, RECs were avoided and the probability of encountering HTRW in the project area was low, and 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. After a thorough review of previous Phase I ESAs related to the original HSDRRS construction, only one REC was found within the LPV floodwall ROW. This was an abandoned drum filled with unknown material located on the canal side of the West Return Levee Floodwall (drum coordinates: 30º00’29.8” N, 90º16’45.9” W). The contractor recommended the removal and disposal of all wastes and vehicles and soil sampling near drums and vehicles to confirm no impact from spills/leaks. These actions would have been completed prior to any construction activities. Other than this one abandoned drum, the previous Phase I ESAs indicate that no RECS fell within the LPV levee or floodwall ROWs.

Task 2 Results – USACE study team personnel made a site visit to the LPV levee and floodwall ROWs on 03 April 2019, 04 April 2019, and 10 April 2019. The LPV levee and floodwall ROWs were inspected for the presence of pipes, containers, tanks or drums, ponds or lagoons, car bodies, tires, refrigerators, trash dumps, electrical equipment, oil drilling equipment, gas or oil wells, discoloration of vegetation or water sheens, discoloration of soils, out-of-place dirt mounds or depressions in the landscape, evidence of fire, stressed soils with lack of vegetation, discoloration of vegetation, animal remains, unusual animal behavior, biota indicative of a disturbed environment, and odors indicative of poor water quality or chemical presence. None of the aforementioned indicators were found during the site visits. Specifically, the REC location discovered under Task 1 above was visited on 03 April 2019, and the abandoned drum filled with unknown material was no longer present at the location. As mentioned above, REC removal and/or remediation would have occurred prior to HSDRRS construction activities.

5 FUTURE WITHOUT PROJECT CONDITION

The Future Without Project (FWOP) Condition is developed to describe the most likely future conditions in the project area if no federal action is taken to address the identified problems. It is also sometimes referred to the Future Without Action Condition (FWAC) when a project already exists and the study is considering making modifications to the project. It forms the baseline for identifying the effects of the alternatives and is equivalent to the No Action alternative. The future is inherently uncertain and conditions change over time. For example, the levee risk may change if there are changes in the climate that affect storm frequency and intensity, storm surge elevations, and wave heights; and the condition of the levee system can degrade over time due to subsidence and settlement, even with adequate maintenance.

In order to identify the FWOP condition to be used for evaluation purposes, the study team began with the existing conditions information and considered where potential changes could occur in the future. Forecasted changes to the affected environment are summarized in Section 5.6 and are fully described under the “No Action” alternative in Section 7 when comparing environmental effects of each alternative. . This section provides a detailed discussion on future conditions related to flooding risks associated with levee overtopping.

A forecast period of 50 years was selected as a reasonable time frame for analyzing potential changes in the project area. This period of analysis begins in the year that project benefits begin to be realized, if a project were constructed. USACE policy requires a 50-year period of analysis except for major multipurpose reservoir projects (which can be evaluated for up to 100 years) or projects for which the beneficial or adverse effects will occur over less than 50 years. For this project, the effects are expected to extend beyond 50 years but it is not a reservoir project; therefore a 50-year period of analysis was chosen. For the purpose of alternatives comparison, this period of analysis begins in 2023 (the “base year”). USACE policy also requires consideration of a project’s engineering performance with regard to potential sea level change over 100 years, which is particularly relevant to this study, as the combined effects of subsidence, settlement and sea level change will continue beyond the 50-year period of analysis. Performance to this 100-year horizon is discussed in Section 8.4.

This section discusses six areas of potential changes during the forecast period which the team felt could result in a FWOP condition that differs from the existing conditions and, where needed, documents the differences. These six areas are levee system conditions, climate change, hydrology and hydraulics, economics, future conditions risk, and relevant natural resources.

5.1 FUTURE LEVEE SYSTEM CONDITIONS

This section contains detailed discussion about future settlement and subsidence. Additionally, the following general assumptions were made regarding future conditions related to levee system conditions:

- The sponsor will continue to operate and maintain all levee system components as described in the operation and maintenance manual(s). This includes general maintenance of the existing system and maintenance of the Section 408 levee lift alterations and the armoring already completed by CPRAB and Southeast Louisiana Flood Protection Authority - East and/or PLD. It does not include any lifts or other actions

to address settlement, subsidence and sea level rise and maintain the original design elevations.
- The MR&T levees will continue to be maintained at the authorized levels.

5.1.1 SETTLEMENT

Future levee settlement amounts will vary around the system, primarily based on the amount of time that has elapsed since construction. Survey data from 2018 was used to evaluate past settlement rates. Lift schedules previously developed to estimate lift needs through 2057 for the segments of each reach were compared to actual settlement and the curve that best represented actual settlement was selected to represent that reach. It should be noted that not all lift schedules were previously developed for all levee segments.

The 2018 average survey values of the control segment were then plotted on the lift schedules. Where armoring by articulated concrete blocks was completed, because the survey elevation was at the top of the blocks, the survey was lowered 6 inches to account for the concrete block. The settlement curve was then projected to 2073 following the general curvature of the curve to 2057, or following the trend of settlement from the actual lift to the survey elevation.

An MRL reach is typically raised to the 1973 required flowline plus freeboard. Freeboard is an increment of height added to a flood risk reduction feature to increase the likelihood of the design event being contained without overtopping. Since the levees were already previously constructed to those elevations and have already had many decades of settlement, the foundation for those levees are not anticipated to experience any additional settlement. Therefore, any lift required to bring the levee back to those elevations will also have minimal settlement. A 6-inch over-build is typically used on lifts to account for any potential settlement/shrinkage. The study estimates that the MRL levees above the existing cross-over points may settle up to 6 inches between 2023 and 2073, although if the levee settles below the MR&T authorized grade, then it is assumed to be lifted to the MR&T authorized grade under that program. In other words, the analysis assumes the MR&T levees remain at the authorized grade throughout the period of analysis.

Levee settlement values vary by location. Settlements ranged from 0.5 to 3.0 feet in LPV. Figure 5-1 shows projected levee settlement values by 2073. Levees are plotted as a green line. Floodwalls are grey lines. No settlement was assumed at floodwalls. Floodwalls were originally designed to limit long term settlement to 2" or less under HSDRRS. It was assumed that floodwalls may settle, but settlement slows down over time and some walls have reached a point where settlement is minimal.

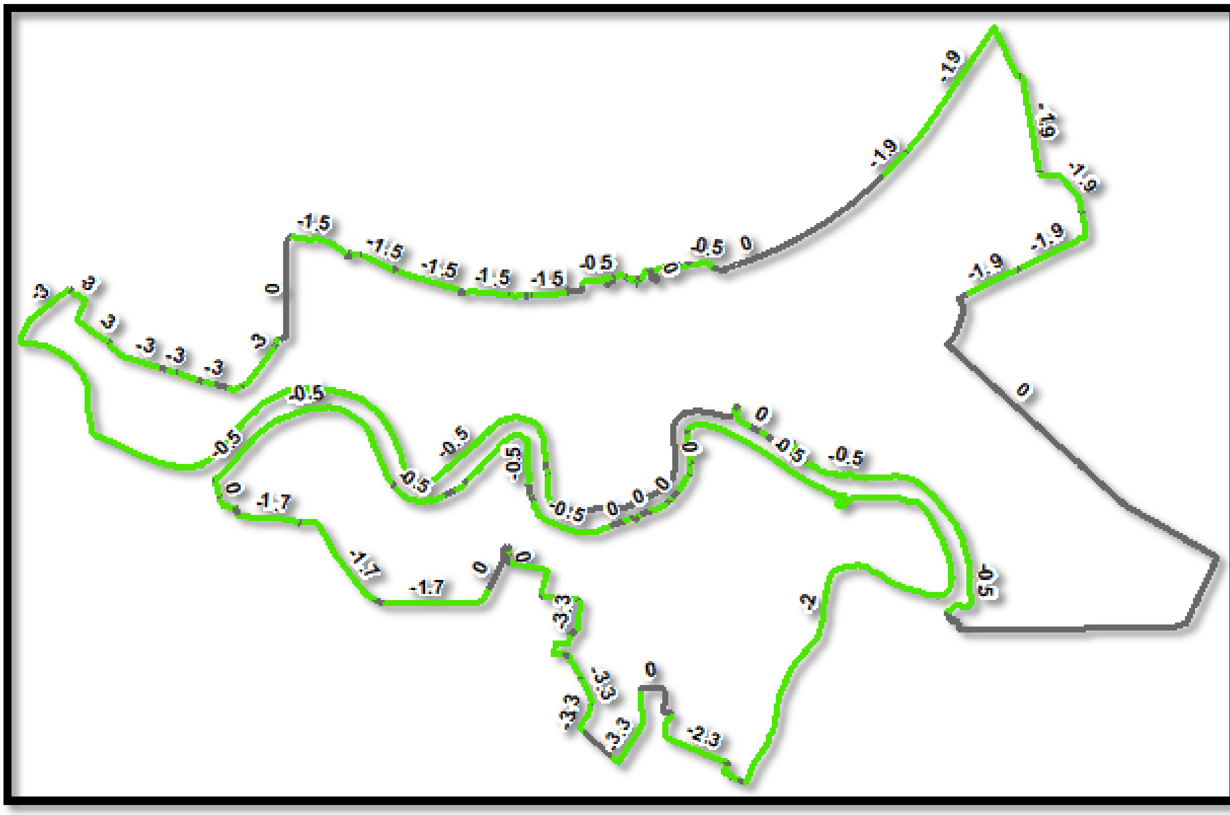

Figure 5-1. Projected Levee Settlement Values by 2073

5.1.2 SUBSIDENCE

Future subsidence was estimated as part of the relative sea level rise (RSLR) calculations. This is discussed in Section 5.2.1 as part of relative sea level change.

5.2 CLIMATE

USACE has an overarching climate preparedness and resilience policy and specific policies and guidance related to assessment of potential climate change impacts to inland hydrology and sea level change. This overarching policy requires consideration of climate change in all current and future studies to reduce vulnerabilities and enhance the resilience of communities. In support of its policies and guidance, USACE relies on climate change science performed and published by agencies and entities external to USACE. The conduct of science as to the causes, predicted scenarios, and consequences of climate change is not within the USACE mission as a water resources management agency.

ER 1100-2-8162 (Incorporating Sea Level Change in Civil Works Programs) applies to sea level change and calls for potential relative sea level change to be considered in every USACE coastal activity as far inland as the extent of estimated tidal influence. This ER requires a quantitative estimate of three sea level change scenarios (low, intermediate, and high) and also requires these scenarios to be utilized during the alternatives' formulation, evaluation, and comparison.

Engineering and Construction Bulletin (ECB) 2018-14 (Guidance for Incorporating Climate Change Impacts to Inland Hydrology in Civil Works Studies, Designs, and Projects) applies to inland hydrology. Due to observations of more extreme seasonal conditions of rainfall and runoff (flooding or drought) and altered snow volume and melt in some regions, assumptions of past trends continuing into the future are no longer appropriate in some locations. This ECB helps support a qualitative assessment of potential climate change threats and impacts that may be relevant to the particular USACE hydrologic analysis being performed.

5.2.1 RELATIVE SEA LEVEL CHANGE

RSLC is the local change in sea level relative to the elevation of the land at a specific point on the coast. RSLC is a combination of both global and local sea level change, as well as local and/or regional vertical land motion (subsidence or uplift).

Values were calculated for three RSLC scenarios: low, intermediate, and high. Per ER 1100-2-8162, the low sea level change scenario is the historic rate of sea-level change extended into the future plus local subsidence. The intermediate sea level change scenario uses the modified National Research Council (NRC) Curve I plus local subsidence, and the high sea level change scenario incorporates the modified NRC Curve III plus local subsidence. This high scenario exceeds the upper bounds of Intergovernmental Panel on Climate Change estimates from both 2001 and 2007 to accommodate potential rapid loss of ice from Antarctica and Greenland.

Local subsidence rates at 7 gages were entered into the USACE climate change website to determine the RSLC scenarios at each location. Figure 5-2 displays the location of the 7 gages relative to HSDRRS. Table 5-1 contains subsidence rates and the corresponding RSLC projections at the 7 gages.

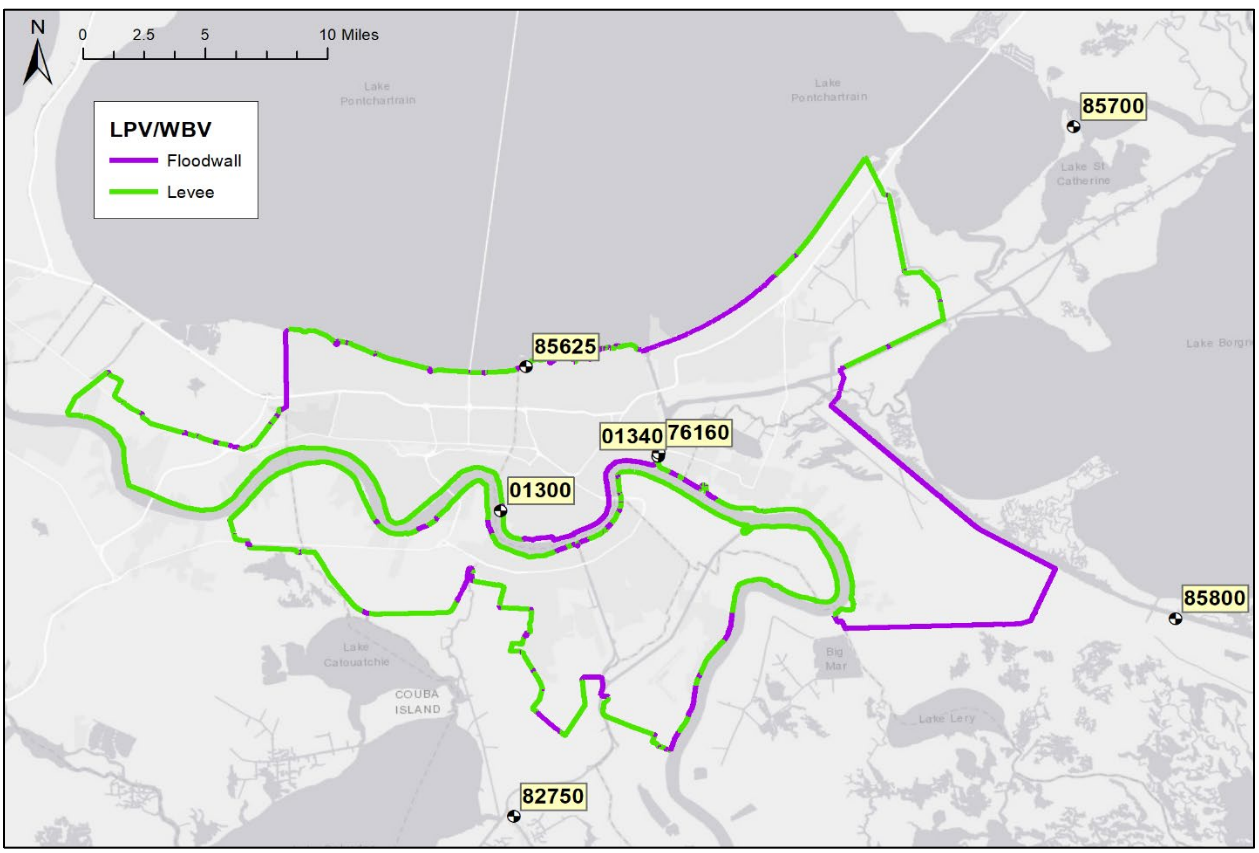

Figure 5-2. Location of Water Level Gages Used for RSLC Subsidence Projections

The study team averaged the results for each gage to obtain regional RSLC values to apply to the study area over the period of analysis. As seen in Table 5-1, the three average relative sea level change scenario values are: low (1.3ft), intermediate (1.8 ft.), and high (3.4 ft.). Additionally, Table 5-1 shows the three RSLC scenarios are all projecting relative sea level to rise. For the remainder of this report and to be clear about the direction of change, the RSLC scenarios will all use the term relative sea level rise (RSLR).

Table 5-1. RSLC Projections

Location	**Projected Subsidence (ft.) 2023-2073**	**Projected SLC 2023 to 2073**			**Projected RSLC 2023 to 2073**		
		Low (ft.)	**Int (ft.)**	**High (ft.)**	**Low (ft.)**	**Int (ft.)**	**High (ft.)**
Lake Pontchartrain West End (85625)	1.2	0.2	0.7	2.3	1.4	1.9	3.5
Rigolets (85700)	0.5	0.2	0.7	2.4	0.7	1.2	2.9
IHNC (76160)	1.4	0.3	0.8	2.4	1.7	2.2	3.8
Bayou Barataria (82750)	0.9	0.3	0.7	2.3	1.2	1.6	3.2
IHNC Lock (01340)	0.8	0.3	0.8	2.4	1.1	1.6	3.2
MS River at Carrolton (01300)	0.9	0.3	0.8	2.3	1.2	1.7	3.2
MRGO Shell Beach (85800)	1.4	0.3	0.8	2.3	1.7	2.2	3.7
Average:	**1.0**	**0.3**	**0.8**	**2.3**	**1.3**	**1.8**	**3.4**

Additionally, Corps policy requires consideration of relative sea level change for major infrastructure projects for a time period of 100 years, which would be the year 2123. Table 5-2 shows the results of these additional projections for the years 2073 to 2123.

Table 5-2. USACE Relative Sea Level Rise (feet) from 2023 to 2123. Average of 7 gages.

	Low	**Int**	**High**
2073	1.3	1.8	3.4
2078	1.4	2.0	3.8
2083	1.5	2.2	4.3
2088	1.7	2.4	4.7
2093	1.8	2.6	5.2
2098	1.9	2.8	5.7
2103	2.1	3.1	6.3
2108	2.2	3.3	6.9
2113	2.3	3.5	7.4
2118	2.4	3.8	8.0
2123	2.6	4.0	8.6

For the FWOP condition and alternatives development, the intermediate RSLR scenario was selected. An intermediate RSLR scenario accounts for future acceleration of global mean sea level rise without the significant ice melt projected in the high RSLR scenario. This is consistent with other USACE studies that have been performed in this area. Section 8.4 discusses the sensitivity of the alternatives to the low and high RSLR scenarios.

5.2.2 INLAND HYDROLOGY

One key assumption in the inundation modeling is a 400,000 cubic feet per second (cfs) Mississippi River discharge as a model boundary condition (just upstream of Baton Rouge) during hurricane season, which is an assumption carried forward from the previous ADCIRC modeling. The study team considered if this value should be maintained or adjusted for the study.

Observed hurricane-season daily flow records were checked for the entire period of record and the data shows that discharge in the river is, on average, lower than 400,000 cfs during the peak of hurricane season (August/Sept), but there are exceptions. The original HSDRRS analysis processed river discharges from 1976 to 2002. When the latest data through 2019 is added and statistics processed, there appears to be a small increase in the expected discharge during hurricane season. For example, the 50% or mean discharge during July was approximately 410,000 cfs with the data from 1976 to 2002. When the data is updated, the mean discharge during July becomes 450,000 cfs. Updating the assumed design discharge from 400,000 to 450,000 might change design water levels by 0.5 ft. to 1.0 ft. based on crude approximations. See Appendix C for additional information about river discharges.

Another assumption that can change stage-frequency information in the river is observed hurricane frequency by month. In the older HSDRRS analysis, a sample of 14 observed storms provided the hurricane probability by month. Since 2005, more storms have impacted New Orleans including Gustav, Ike, Isaac, Karen and Barry. Storms above Category 1 since 2005 were added to the dataset and an updated analysis was performed for the entire period of record. The results did not indicate a significant increase in storm frequency.

The latest hurricane frequency and river discharge data suggests that the assumptions made concerning hurricane frequency and discharge frequency are still valid for a feasibility level study. However, they have changed enough to warrant a revisit during later design assessments such as the design phase of this project.

5.3 FUTURE HYDROLOGY AND HYDRAULICS

The overtopping calculations, River Analysis System (RAS) simulation and Joint Probability-Optimal Sampling (JPM-OS) statistics were repeated for the 2073 future no-action condition. ADCIRC simulations of the future condition for various RSLR conditions were used to develop future condition surge and wave time-series.

The modeling of future surge and wave conditions took into consideration any potential effects from authorized but unconstructed USACE projects in the area. It did not consider potential effects from implementation of actions under the Gulf Spill Restoration Plan (such as the mid-Barataria Sediment Diversion), as the permitting, implementation timing and likely effects of these potential plans are uncertain.

Future condition overtopping calculations factor in levee settlement, subsidence and eustatic sea level rise over the 50-year period of evaluation (discussed in Section 5.1.1). Modeled future storm surge elevations for a range of events were plotted against the levee and floodwall elevation data to determine potential locations for surge overtopping. Additionally, in areas where surge or waves were estimated to overtop the levees or floodwalls, overtopping rates were calculated. The combined effects of levee settlement and RSLR result in larger overtopping volumes and more inundation in the HEC-RAS simulations. Figure 5-3 displays the resulting 1% AEP flood depths for the future no-action scenario assuming intermediate 1.8 ft. RSLR. Figure 5-4 displays the resulting 0.2% AEP flood depths for the future no-action scenario assuming intermediate 1.8 ft. RSLR. Maps depicting flood inundation under the low or high RSLR scenarios would reflect different inundation coverage and depths. All statistical water surfaces and depths were utilized in the economic damage evaluations.

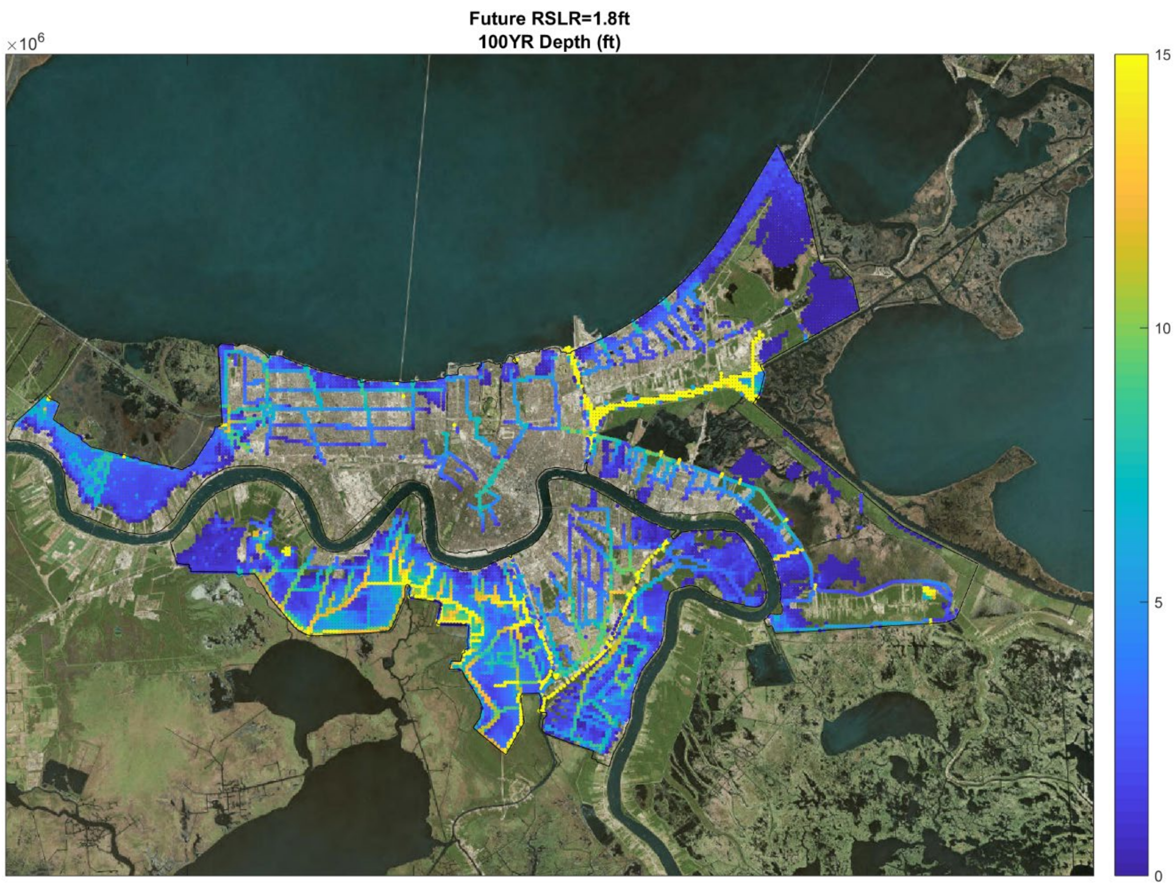

Figure 5-3. 1% AEP Peak Depths for Future 2073 Intermediate RSLR Conditions

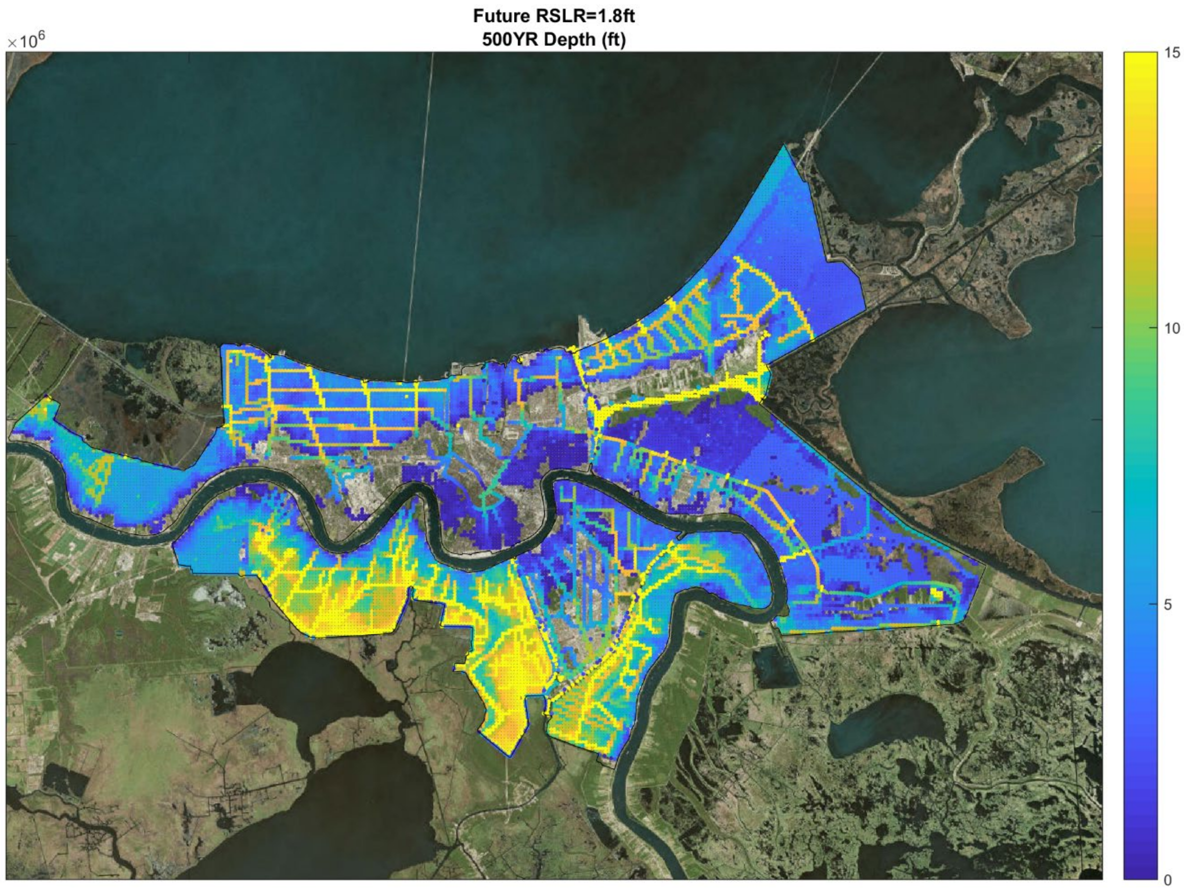

Figure 5-4. 0.2% AEP Peak Depths for Future 2073 Intermediate RSLR Conditions

These plots demonstrate that in a future 2073 without project scenario where an intermediate RSLR is experienced, there are many reaches where surge elevations for the 1% and 0.2% AEP events overtops levees/floodwalls. Additionally, the overtopping rates (including waves and surge) are above design requirements in most reaches for the 0.2% AEP event.

5.4 FUTURE ECONOMIC DAMAGES

The projected hydrologic conditions were entered into the HEC-FDA program to estimate potential future economic damages if no action is taken to address the combined effects of settlement, subsidence and sea level rise (intermediate scenario) on the LPV system. No other parameters were changed from the existing conditions modeling. Aside from the new airport terminal in Kenner, no new major construction is expected to occur in the near future. The current trend of repurposing existing retail and office buildings into residential units is expected to continue. Neither the new terminal nor the building repurposing was included in the structure inventory at this time because they would have only a very small effect on the overall damage calculations.

The future conditions damages by probability event are displayed in Table 5-3 and the expected annual damages and equivalent annual damages are displayed in Table 5-4 (by sub-basin).

Table 5-3. Future Conditions Damages by Probability Event

Lake Pontchartrain and Vicinity Damages by Probability Event 2073 $1000s	
100%	$0
10%	$0
5%	$0
2%	$0
1%	$1,335,000
0.5%	$35,886,000
0.2%	$81,902,000
0.1%	$99,531,000

Table 5-4. Future Conditions Economic Damages

Lake Pontchartrain and Vicinity Expected Annual and Equivalent Annual Damages FY19 Price Level; FY20 Discount Rate $1,000s		
Sub-basin	**Expected Annual Damages 2073**	**Equivalent Annual Damages 2023-2073**
Chalmette Loop	$12,684	$8,665
Jefferson East Bank	$243,978	$134,333
Orleans East Bank	$38,964	$20,126
New Orleans East	$137,109	$58,046
St. Charles	$19,910	$11,812
Total	**$452,646**	**$232,982**

5.5 FUTURE CONDITIONS RISK

For future conditions risk estimates, the risk team utilized the updated hydrology and hydraulics information to evaluate the future breach and non-breach risks due to overtopping. The life safety risk assessment did not include any increase or decrease in the population. As can be seen in Table 4-15 in Section 4.17.1.1, the population projections over the next 20 years show less than a 3% increase (the year 2040 is the last year for which we have projections). This small change would not materially affect the conclusions of the risk assessment and, therefore, the assessment utilized existing population and structure data.

5.5.1 RISK ASSESSMENT ASSUMPTIONS

The FWOP condition assumes both settlement of the levees and 1.8 feet of relative sea level rise. Levee settlement amounts ranged from 0.2 to 3.3 feet in LPV. Floodwalls were assumed to have no settlement. MRL levees were assumed to be maintained at authorized heights through the MR&T program.

5.5.2 CONSEQUENCES

Life loss consequences for the future condition were estimated using the LifeSim model at the 1% AEP and the 0.2% AEP events, respectively. No changes to the variable inputs for the LifeSim model were made for the future condition. Non-breach consequences were modeled for the FWOP because the combined effects of settlement and RSLR allows stillwater overtopping (when the surge elevation exceeds the top of the levee or floodwall) in the future. Breach consequences were also developed and the difference between the two numbers provides the incremental consequences. For LPV, the incremental life loss estimates varied by breach location and ranged from low to extremely high.

Critical infrastructure is included in the structure inventory and economic damages to those structures are accounted for in the total economic damage estimates provided in Section 5.4. However, when these particular structures are inundated to the point where they are no longer able to provide services to the community, there is also a potential for life safety risk. Critical infrastructure data was obtained from the Homeland Security Infrastructure Program (HSIP) Gold 2015 database, which is a data inventory assembled by the National Geospatial-Intelligence Agency in partnership with the Department of Homeland Security. Table 5-5 summarizes the number of critical infrastructure structures, by category, which are inundated in the FWOP scenario.

Table 5-5. Critical Infrastructure Inundated in the FWOP Scenario

Intermediate SLR Without-Project LPV - Critical Infrastructure	
Category	**Number**
Agriculture	0
Chemicals	51
Communications	7
Education	60
Emergency Services	15
Energy	65
Law Enforcement	2
Manufacturing	35
National Symbols	0
Public Venues	89
Transportation-Air	2
Transportation-Ground	498
Transportation-Water	48
Water Supply	1
Total	**873**

5.5.3 FUTURE RISK CHARACTERIZATION

The estimated total annual probability of failure (APF) for LPV future conditions is between 1E-04 and 1E-03 (0.0001 and 0.001) failures per year and the best estimate of the average annual incremental life loss is 3E-02 (0.03) lives per year. Life risks in the future conditions are above tolerable risk levels and are driven by overtopping with waves of the armored levees leading to breach in St. Charles Parish eastbank.

5.6 RELEVANT RESOURCES

Future conditions of the relevant resources are summarized in Table 5-6 and are more fully described in Section 7 under the No Action Alternative narratives, for ease of comparison with the action alternatives.

Table 5-6. Summary of Future Conditions of Relevant Resources

Resource	FWOP/ No Action Summary
Soils	Continued impacts from past and ongoing development, constructed levees, and other risk reduction structures. Actions by others to use soils for borrow would continue.
Water Quality Resources	Continued impacts to water resources in the vicinity due to population growth and industrialization.
Wetland & Forest Resources	Continued wetland and bottomland hardwood loss. No new impacts due to routine maintenance of existing risk reduction features.
Uplands	Actions by others to use uplands as borrow would continue.
Fisheries	RSLR and likely increase to saltwater intrusion would degrade fish habitat. Commercial and recreational fishing would continue. Maintenance of existing LPV system into the future would continue with no impacts to fisheries resources.
Essential Fish Habitat	RSLR would continue. Maintenance of existing LPV system into the future would continue with no impacts to EFH.
Wildlife	Maintenance of existing LPV system would continue. Wildlife that use the levees would continue to do so with negligible and temporary impacts. Actions by others would continue and RSLR would lead to habitat loss.
Threatened & Endangered Species	Degradation and loss of habitat would continue. Recovery plans would offset impacts. Maintenance of existing LPV system into the future would not likely adversely affected listed species.
Invasive Species	Continued threats of invasive species would continue. Existing invasive species would persist.
Cultural & Historical Resources	Existing LPV system would continue to be maintained and would have no effect on cultural resources. Structures within the protected side of the LPV system may have higher risk of damage during hurricane and tropical storms.
Aesthetics	Increasing risk of impacts to aesthetic resources with no action.
Recreation	Increasing risk of impacts to recreational resources with no action.
Air Quality	Existing maintenance of the LPV system into the future would continue. No changes to the attainment status for the study area is anticipated. Continued human development, industrialization, and urbanization.
Noise	Similar to existing conditions into the future.
Transportation	Routine maintenance of public roads would continue. Major transportation corridors within the study area would become more vulnerable to hurricane and tropical storm damage in the future.
Human Environment	The existing LPV system would not provide hurricane and storm damage risk for a 1% AEP storm, leading to increased perceived and actual risks to the communities. Potential for residents to re-locate.

Environmental Justice	The existing LPV system would not provide hurricane and storm damage risk for a 1% AEP storm, leading to increased perceived and actual risks to minority and/or low-income populations. Potential for residents to re-locate.
HTRW	Existing maintenance of the LPV into the future would continue. Continued human population growth and industrialization would have potential new HTRW impacts.

6 PLAN FORMULATION*

The guidance for conducting civil works planning studies, ER 1105-2-100, Planning Guidance Notebook, requires the systematic formulation of alternative plans that contribute to the federal objective. This section presents the results of the plan formulation process. Alternatives were developed in consideration of study area problems and opportunities as well as study objectives and constraints with respect to the four evaluation criteria described in the Principles and Guidelines (completeness, effectiveness, efficiency, and acceptability).

Reducing flood risk in conjunction with a levee system can be accomplished, in general, by four strategies:

1. Reducing the flood hazard or load on the levee system (magnitude and likelihood of the hazard);
2. Improving the performance or response of the levee system to the load (add to or modify features of the levee system to address failure modes or to promote system resilience and sustainability);
3. Reducing the exposure of the people and item(s) (property, infrastructure, etc.) at risk (for example by altering or limiting future land development or relocating current populations away from the leveed area); and
4. Reducing the vulnerability of the people and items at risk to harm (for example through actions such as strengthening emergency action and evacuation plans, improved warning systems, road improvements, enhanced building codes, and fostering effective response to such warnings by households and businesses, including vertical evacuation as appropriate).

When examining the four methods above, the study team concluded that while there may be no way to modify the source of the hazard (hurricanes), there may be ways to reduce the load on the system (#1) by considering actions to reduce surge elevations and wave heights. This could possibly be accomplished via structural measures (Section 6.2.1) or nature-based measures (Section 6.2.3)

Improving the performance or response of the levee system (#2) could be addressed via structural measures, which are discussed in Section 6.2.1.

While large-scale plans to limit development or relocate the population within the levee system would not likely be supported by the local population and governments, measures to reduce exposure (#3) are included in the plan formulation and are discussed in Section 6.2.2.

Finally, an assessment of existing emergency action and evacuation plans (#4) concluded that the existing plans are already at a very high level of effectiveness and the future condition is not expected to be significantly different even when using the "Best" present curves available in the LifeSim model. However, some minor improvements to risk communication may be possible. Measures to address this strategy were developed as non-structural measures and are discussed in Section 6.2.2.

6.1 ASSUMPTIONS

In the formulation of measures and alternatives, the study team utilized the following overarching scope assumptions:

1. The period of analysis is 50 years from 2023. All future without project and future with project analyses will estimate conditions in 2073.

2. A full range of flood frequencies will be considered at 2073.
3. Semi-quantitative risk assessments will evaluate existing conditions (baseline), future without project/action, and future with project/action for each alternative in the final array.
4. Estimates of RSLR, regional subsidence, and settlement were used to inform conceptual designs and evaluation of alternatives. The intermediate RSLR scenario was used, which also incorporated future subsidence rates. Finally, projected levee settlement rates were based on 2018 data.

6.2 MEASURE DEVELOPMENT

A management measure is a feature or activity that can be implemented at a specific geographic site to address one or more planning objectives. The study team developed and screened structural, non-structural, and nature based/natural measures utilizing information on existing infrastructure, existing reports, and subject matter expertise. Coastal risk reduction can be achieved through a variety of approaches, including natural or nature-based features, structural features, and nonstructural interventions. The two-dimensional representation (Figure 6-1) shows the variety of measures considered and the following sub-sections describe the measures in more detail. Numerous risk reduction measures can be combined to form alternative plans. Risk reduction in any given coastal area is achieved through a combination of approaches described in more detail below. Application of the full array of features in any coastal system must consider interactions among the features (e.g., the effects of seawalls on down-drift beaches) and the multiple objectives being sought for the system (e.g., erosion control, navigation, risk reduction).

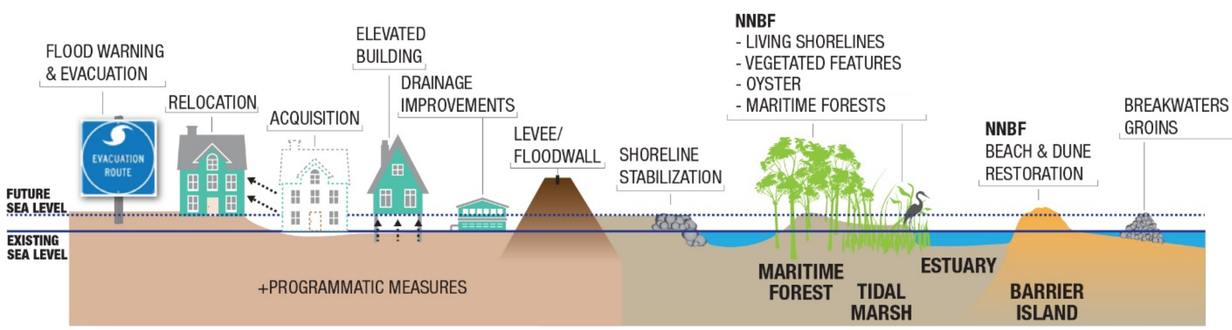

Figure 6-1. Two dimensional representation of measures considered

6.2.1 STRUCTURAL MEASURES

Structural measures can be designed to decrease shoreline erosion or reduce coastal risks associated with wave damage and flooding. Traditional structures include levees, floodwalls, storm surge barrier gates, seawalls, revetments, groins, and nearshore breakwaters. Structural measures were identified from the CPRA master plan, in addition to professional expertise.

LEVEE LIFT – Levees in coastal areas are typically onshore structures with the principal function of protecting low-lying areas against hurricane and tropical storm surge. Side slopes used by USACE for levee design vary by project. Front (flood side) slopes range between 3H: 1V (three horizontal feet for every one vertical foot) and 6H: 1V, while back (interior) slopes range between 3H: 1V and 4H: 1V. A top width of 10 feet was used for all levees as is typical of USACE earthen levee projects to provide reasonable access for maintenance after levee construction.

For levees over soft foundations such as those in the study area, engineers typically recommend construction in several lifts over a timeframe of several years due to cost, real estate, and constructability concerns associated with constructing a levee that would meet the full intended design height, after accounting for future subsidence and other factors over time. Levee lifts are conceptually illustrated in Figure 6-2.

A levee built without lifts would typically require either very costly stabilization measures to increase their strength or the project would require significantly more real estate to allow for construction of wide stability berms to support the higher levee. By constructing in lifts, the levee may be built to a height that meets the near term elevation requirements related to hydraulic design with a nominal overbuild, but the levee is allowed to settle over a period of time, which allows the foundation soils to consolidate and gain in shear strength. After a period of settlement, future lifts are constructed on the levee to reestablish either its original construction height or the current design height based on hydraulic and other factors. The design of levee lifts over time also attempts to account for the soil strength increase due to consolidation, which allows for additional loading (i.e., higher levee elevation), without an increased levee footprint. The thickness of future levee lifts is typically limited to a foot or so of additional fill so that stability concerns don't require increases in the levee footprint such as shallower slopes or berms. This method may require several lifts be constructed periodically over time, but it is a cost-effective method to assure the levee crown elevation will be at or above the design elevation.

This measure also includes any secondary levee features that are related to the robustness of the levees, such as landside armoring and foreshore protection, which are both already being utilized.

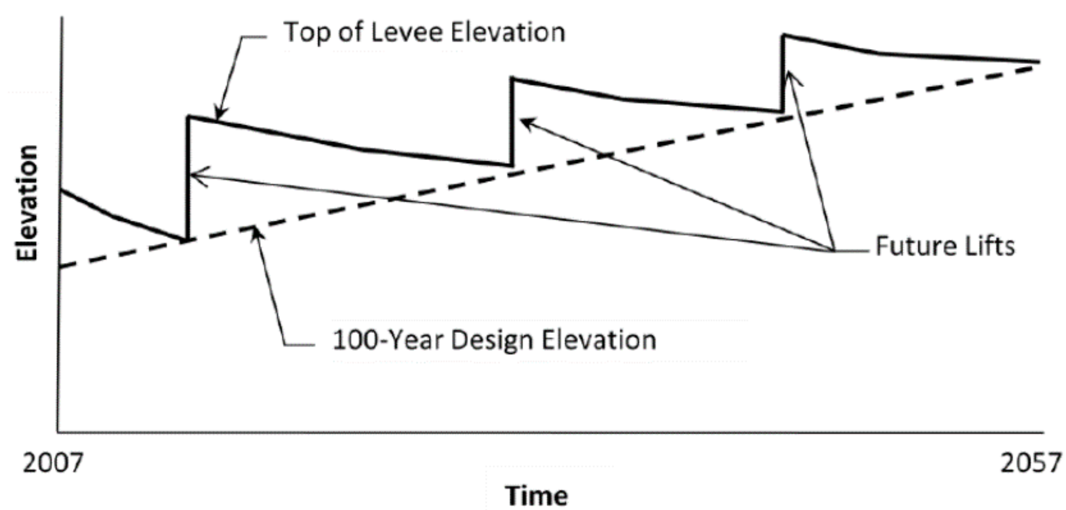

Figure 6-2. Conceptual Levee Lifts

BARRIER ISLAND/SURGE BARRIER – In most cases a surge barrier consists of a series of movable gates that normally stay open under normal conditions to let the flow pass but are closed when storm surges are expected to exceed a certain level. Storm surge barriers are often chosen as a preferred alternative to close off estuaries and reduce the required length of storm risk reduction measures behind the barriers. Storm surge barriers are often required within a levee system to prevent surge from propagating up navigable waterways and distributaries. Storm surge barriers are typically opened during normal conditions to allow for navigation and saltwater exchange with the estuarine areas landward of the barrier. Examples of moveable storm surge barriers include floating sector gates, sluice gates, barge gates, lift gates, stop log gates, and tainter gates.

A barrier island is a permanent offshore structure that is intended to dissipate storm surge before it approaches the shoreline. Island barriers reduce risk to estuaries against storm surge flooding and waves.

NEW OR MODIFIED FLOODWALLS – Floodwalls are onshore structures built parallel to the shoreline with the principal function of reducing flood risk due to storm surge and its overtopping, as well as consequent flooding of land and infrastructure behind them. Floodwalls are a structural risk reduction measure to reduce flood risk by acting as physical barriers against storm surge. Floodwalls can be permanent or temporary. However, because this is an existing system, there is little to no opportunity to consider implementation of temporary floodwalls and therefore all reference to floodwalls in this document refer to permanent floodwalls.

BREAKWATERS – Detached breakwaters are nearshore structures built parallel to the shore just seaward of the shoreline in shallow water depths, with the principal function of reducing beach erosion by reducing wave height and thus longshore and cross-shore sediment transport. They may or may not become inundated during a surge event and if inundated, become less effective. They are more typically used for everyday waves. Submerged detached breakwaters are used in some cases because they do not spoil the view, but they represent a serious non-visible hazard to boats and swimmers.

INTERIOR DRAINAGE IMPROVEMENTS – A drainage system can carry water away via conveyance systems and, during times of high water, may store water until it can be carried away. Conveyance systems utilize measures such as pump stations, culverts, drains, and inlets to remove water from a site quickly and send it to larger streams. Storage facilities are used to store excess water until the storm or flood event has ended.

ADD ARMORING ON THE FLOOD SIDE – Adding armoring or revetments to onshore structures has the principal function of protecting the shoreline from erosion. Revetments typically consist of a cladding of stone, concrete, or asphalt to armor sloping natural shoreline profiles. Armoring is designed to add resiliency to the earthen levees. Foreshore protection typically consists of placement of rock or a rock dike on or immediately in front of a levee wave berm or shoreline, it is intended to prevent erosion of earthen material during daily wave action. Floodside armoring is generally more effective against riverine flood events than tropical events and will only be utilized as appropriate

WAVE BERMS – Wave berms are generally earthen extensions on the floodside of a levee that are inundated during surge events and whose purpose is to reduce wave heights. By building up the land they cause these areas to be shallower and waves to become depth limited and break far enough from the levee crown that it reduces run-up and therefore design heights.

6.2.2 NON-STRUCTURAL MEASURES

Nonstructural measures essentially reduce the consequences of flooding, as compared to structural measures, which may also reduce the probability of flooding. Nonstructural measures addressed by the USACE National Nonstructural Floodproofing Committee include building acquisitions or relocations, flood proofing of structures, implementing flood warning systems, flood preparedness planning, establishment of land use regulations, development restrictions within the greatest flood hazard areas, and elevated development.

Nonstructural measures are most often under the jurisdiction of state and local governments (and individuals) to develop, implement, and regulate. They can be encouraged or incentivized but are usually not imposed by the federal government. As a result, the effective implementation of the full range of flood and coastal flood hazard mitigation actions relies on a collaborative, shared responsibility framework between federal, state, and local agencies and the public (Comfort et al. 2010).

RISK COMMUNICATION WITH THE PUBLIC/FLOOD WARNING – Flood warning systems and evacuation planning are applicable to vulnerable areas. Despite improved tracking and forecasting techniques, the uncertainty associated with the size of a storm, the path, or its duration necessitate that warnings be issued as early as possible. Evacuation planning is imperative for areas with limited access, such as barrier islands, high density housing areas, elderly population centers, cultural resources, and areas with limited transportation options. In general, risk communication in the New Orleans area is already at a high level (see discussion in Section 3.2). However, aspects of risk communication are essential for all alternatives.

BUYOUTS – Property acquisition and structure removal are usually associated with frequently damaged structures. Implementation of other measures may be effective but if a structure is subject to repeated storm damage, this measure may represent the best alternative to eliminating risks to the property and residents.

FLOOD-PROOFING – A non-elevated structure in the flood zone is prone to flooding. Dry floodproofing involves sealing the structure to make it watertight below the level that needs protection to prevent floodwaters from entering. Making the structure watertight requires sealing the walls with waterproof coatings, impermeable membranes, or a supplemental layer of masonry or concrete. Generally, dry floodproofing is used when the expected flood depths are low such as a few inches of water. Wet floodproofing is a design method that allows water to move in the enclosed parts of a structure (e.g., crawlspace or unoccupied area) and then out when water recedes.

ELEVATED BUILDINGS – An elevated building is a structure that has no basement and that has its lowest elevated floor raised above flood level by foundation walls, shear walls, posts, piers, pilings, or columns. Elevation of a structure is usually limited to smaller residential and commercial buildings. Whether a structure may be elevated depends on a number of factors including the foundation type, wall type, size of structure, condition, etc.

6.2.3 NATURE BASED / NATURAL MEASURES

The team also considered the full array of natural measures. Specific examples of coastal storm risk management nature based measures include marsh creation, mechanical beach or dune creation, and resilient living shorelines for stabilization and wave attenuation (see Figure 6-3). Nature-based features could be placed in different areas along the shoreline including upland, bank face, tidal marsh, or subtidal areas. Measures such as planting tidal wetland plants for marsh creation, submerged aquatic vegetation, or artificial oyster reefs address the risk associated with storm surge and flooding such as wave attenuation, wave height, water level, and storm duration. Natural and nature-based features can enhance the resilience of coastal areas challenged by sea level rise (Borsje et al. 2011) and coastal storms (e.g., Gedan et al. 2011, Lopez 2009).

MARSH CREATION (REHABILITATION) – Marsh creation establishes new wetlands in open water areas such as bays, ponds, and canals. This can be achieved through sediment dredging and placement, diversion, or hydrologic restoration. Diversions use channels and/or structures to divert sediment and fresh water from the Mississippi and Atchafalaya Rivers into adjacent basins. Hydrologic Restoration conveys fresh water to areas that have been cut off by man-made features or prevents the intrusion of salt water into fresh areas through man-made channels and eroded wetlands.

Coastal wetlands may contribute to coastal storm surge reduction through wave attenuation and sediment stabilization. The dense vegetation and shallow water in wetlands can slow the advance of storm surge somewhat and slightly reduce the surge landward of the wetland or slow its arrival time (Wamsley et al. 2009 and 2010). Wetlands can also dissipate wave energy, potentially reducing the amount of destructive wave energy propagating on top of the surge, though evidence suggests that slow-moving storms and those with long periods of high winds that produce marsh flooding can reduce this benefit (Resio and Westerlink 2008). The magnitude of these effects depends on the specific characteristics of the wetlands, including the type of vegetation and the wetlands' rigidity, structure, extent, and position relative to the storm track.

BEACH/DUNES/RIDGE RESTORATION – Beaches are natural features that can provide coastal storm risk reduction and resilience. The sloping nearshore bottom causes waves to break, dissipating wave energy over the surf zone. The breaking waves typically form an offshore bar in front of the beach that helps to dissipate the following waves.

Dunes that may back a beach can act as a physical barrier that reduces inundation and wave attack on the coast landward of the dune. Although the dune may erode during a storm, in many cases it provides a sediment source for beach recovery after a storm passes.

Ridge restoration uses dredging, sediment placement, and vegetative plantings to restore natural ridge functions in basins. Ridge restoration projects are intended to reestablish historical ridges through sediment placement and vegetative plantings to provide additional storm surge attenuation and restore forested maritime habitat.

The functions of engineered beaches, dunes, and ridges are similar to natural features. These measures can contribute to coastal storm risk reduction through breaking of offshore waves, attenuation of wave energy, and slow inland water transfer. Engineered beaches, dunes, and ridges are nature-based infrastructure specifically designed and maintained to provide coastal risk reduction services, although these features often require beach nourishment to mitigate ongoing erosion and other natural processes. Introducing additional sand into the system through beach nourishment reinforces the natural protection to the upland afforded by the beach.

LIVING SHORELINE - Living shorelines are essentially tidal wetlands constructed along a shoreline to reduce coastal erosion. Living shorelines can contribute to coastal storm surge reduction through breaking of offshore waves, attenuation of wave energy, and slow inland water transfer. Living shorelines maintain dynamic shoreline processes and provide habitat for organisms such as fish, crabs and turtles. An essential component of a living shoreline is constructing a nearshore rock structure (breakwater/sill) parallel to the shoreline to serve as protection from wave energy that would impact the wetland area and cause erosion and damage to or removal of the tidal plants. Oyster barrier reefs may be a component of a living shoreline, which are bioengineered to improve oyster propagation and serve as breakwaters to attenuate wave energies.

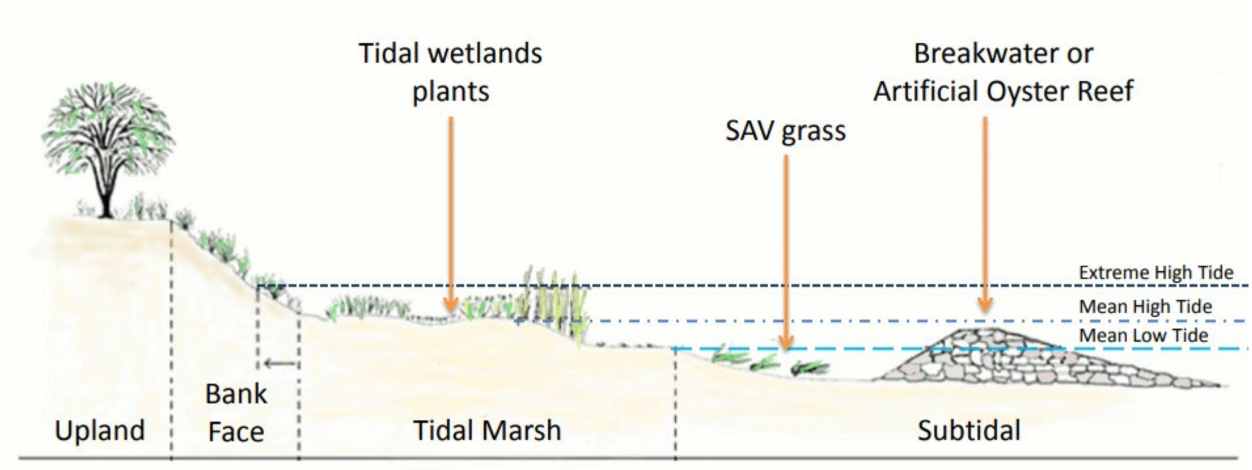

Figure 6-3 Nature-Based Measures (Image adapted from Burke Environmental Associates)

6.3 SCREENING OF MEASURES

Screening is the process of eliminating, based on planning criteria, those measures that will not be carried forward for consideration. Criteria are derived for the specific planning study based on the planning objectives, constraints, and the opportunities and problems of the study/project area.

6.3.1 SCREENING CRITERIA

The study team developed and screened the following measures seen in Table 6-1. Screening criteria included whether the measure meets planning objectives (described in Section 2.5) and avoids constraints (described in Section 2.6) as well as qualitative assessments of effectiveness, efficiency, and acceptability. More detail on rationale for elimination of specific measures is outlined in Section 6.3.2, below.

Table 6-1. Measures and Screening

Measure	Structural, Non-Structural, Nature/Natural	Meets Objective	Retained for further evaluation
Levee Lift	Structural	1,2	Yes
Surge Barrier	Structural	1,2	No
New or Modified Floodwalls	Structural	1,2	Yes
Breakwaters	Structural	1,2	No
Interior Drainage Improvements	Structural	1,2	Yes
Add Armoring at the Flood Side	Structural	1,2	Yes
Wave Berms	Structural	1,2	Yes

Measure	Structural, Non-Structural, Nature/Natural	Meets Objective	Retained for further evaluation
Risk Communication with the public/Flood Warning System	Non-structural	1,2	Yes
Buyouts	Non-structural	1,2	Yes
Floodproofing	Non-structural	1,2	Yes
Elevation	Non-structural	1,2	Yes
Marshes	Nature-based/Natural	1,2	No
Dunes/Beaches	Nature-based/Natural	1,2	No
Living Shore Line	Nature-based/Natural	1,2	Yes

6.3.2 SCREENING RESULTS

As described above, screening criteria included whether the measure meets planning objectives and avoid constraints. In addition, qualitative assessments of effectiveness and efficiency were also used to evaluate measures at this stage.

The surge barrier measure meets planning objectives and is effective at providing coastal storm risk management benefits. However, this measure was screened out primarily because it is less efficient than other measures. The 2017 Coastal Master Plan estimated the cost of a protective barrier across the mouth of Lake Pontchartrain at approximately $2.4 billion. In addition, evaluation of this plan raised concerns about induced flooding to other parts of coastal Louisiana and Mississippi which would result in additional damages of up to $48 million per year in some areas (Fischbach et. al 2017). Finally, this measure was previously planned for implementation as part of the originally authorized LPV project from 1965 but was abandoned after concerns were raised regarding significant negative environmental impacts including a reduction of the natural flow of ocean water into the lake, which would damage habitat for shellfish and aquatic life. Overall, this measure was determined to be less effective and less efficient at providing risk reduction benefits compared to other measures and was ultimately screened out.

Breakwaters were also screened out due to information from prior investigations indicating this measure has both high costs and high environmental impacts. The 2017 Coastal Master Plan evaluated a range of breakwater alternatives with costs as high as $495 million. Potential environmental impacts include disrupted sediment transport patterns which could damage nearshore habitat areas.

The marsh creation measure was screened out due to low effectiveness and low efficiency. In addition, this measure is already being implemented across the region by local entities. The 2017 Coastal Master Plan includes the nation’s largest investment in marsh creation using dredged material and sediment diversion projects. Because this measure establishes new wetlands in open water areas, the areas for it to be successfully implemented within the highly-developed project area are substantially limited. Implementation of this measure within the project area would have a high cost per acre for a relatively low effect due to land acquisition costs associated with wetland or marsh creation in urban areas. Finally, marsh creation would not provide substantial risk reduction benefits compared to other structural measures that enable broader risk reduction in urban areas. As such, marsh creation was screened out from further analysis.

Finally, the dunes/beaches measure was screened out because the measure would be located too far from the study area to effectively reduce storm and flood risk within the project area. Creation of dunes or beaches would be more effective at restoring or augmenting offshore barrier islands and headlands in coastal regions beyond the project area.

6.4 FORMULATION CONSIDERATIONS

As described above, a management measure is a feature or activity that can be implemented at a specific geographic site to address one or more planning objectives. The management measures carried forward are all intended to be potentially implemented in combination with one another (i.e., not standalone). It is anticipated that a combination of measures can function as viable components of an integrated system to address overtopping flood risk in the study area.

In addition to these considerations about the combinability of measures, the following considerations also guided the development of the initial array of alternatives.

6.4.1 LIMITS OF AUTHORIZING LANGUAGE

The authority for this study and any subsequent construction limits the Secretary of the Army to "carry out measures that address consolidation, settlement, subsidence, sea level rise, and new datum to restore Federally authorized hurricane and storm damage reduction projects that were constructed as of the date of enactment of this Act to the authorized levels of protection of the projects…shall only apply to those projects for which the executed project partnership agreement provides that the non-Federal interest is not required to perform future measures to restore the project to the authorized level of protection of the project to account for subsidence and sea-level rise as part of the operation, maintenance, repair, replacement, and rehabilitation responsibilities." This language has two impacts on the formulation of alternatives.

First, there are only five categories of changed or changing conditions that can be addressed. Any other potential system concerns which do not fall into one of these five categories are not within the scope of the study authority.

Second, while the study can consider many alternatives of varying levels of risk reduction, the recommendation is limited to restoration of the currently authorized level of risk reduction at the perimeter of the system (1% AEP). Therefore, the study cannot recommend higher levels of risk reduction and is not required to consider lower levels if restoring the authorized level is found to be "technically feasible, environmentally acceptable, and economically justified." It also limits the ability to recommend some measures that are not part of the perimeter system.

Given the limits of the authorizing language, the study team closely coordinated with the study sponsor throughout the formulation process and sought agreement on the range of measures and alternatives to be considered, as well as feedback on whether a locally preferred plan may be identified. A locally preferred plan is one that is not recommended by the study but is desired by the local sponsor.

6.4.2 TOLERABLE RISK GUIDELINES (TRG)

USACE Planning Bulletin 2019-04 (Incorporating Life Safety into Flood and Coastal Storm Risk Management Studies) requires that studies identify at least one alternative that addresses TRG 1 and TRG 4, defined below.

Per Planning Bulleting 2019-04 (Incorporating Life Safety into Flood and Coastal Storm Risk Management Studies), study teams will use the USACE TRGs for levee systems throughout the study including problem identification and study objectives, conceiving solutions to the identified problems in order to achieve study objectives, evaluating alternatives, and finally support decisions about risk management activities. The following paragraphs explain each TRG. TRG 1 was the primary focus during formulation of measures and alternatives because it establishes a threshold for life safety risk tolerability. Because the study's authorization focused on addressing the combined effects of consolidation, settlement, subsidence and sea level rise, this standard was applied only to the risks associated with overtopping risk. Due to this limitation, TRG determinations reflect only the tolerability of the overtopping risk and do not reflect the tolerability of total levee system risk as experienced by the residents of the leveed area.

TRG 1 – The first TRG involves determining that society is willing to live with the risk associated with the levee system to secure the benefits of living and working in the leveed area. USACE will consider the life safety, economic and environmental risk for TRG 1.

Life safety risk is considered in relation to TRGs: societal life risk and individual life risk. The societal life safety tolerable risk line shown in Figure 6-4 reflects that society becomes more averse to risk as the number of life loss increases. Total risks that plot above the societal life risk line are considered unacceptable except in extreme circumstances. USACE has chosen to use 1 in 10,000 (i.e. 1.0 E-04) per year for the tolerable probability of life loss for an individual or group of individuals most at risk. This tolerable risk guideline is also shown on Figure 6-4.

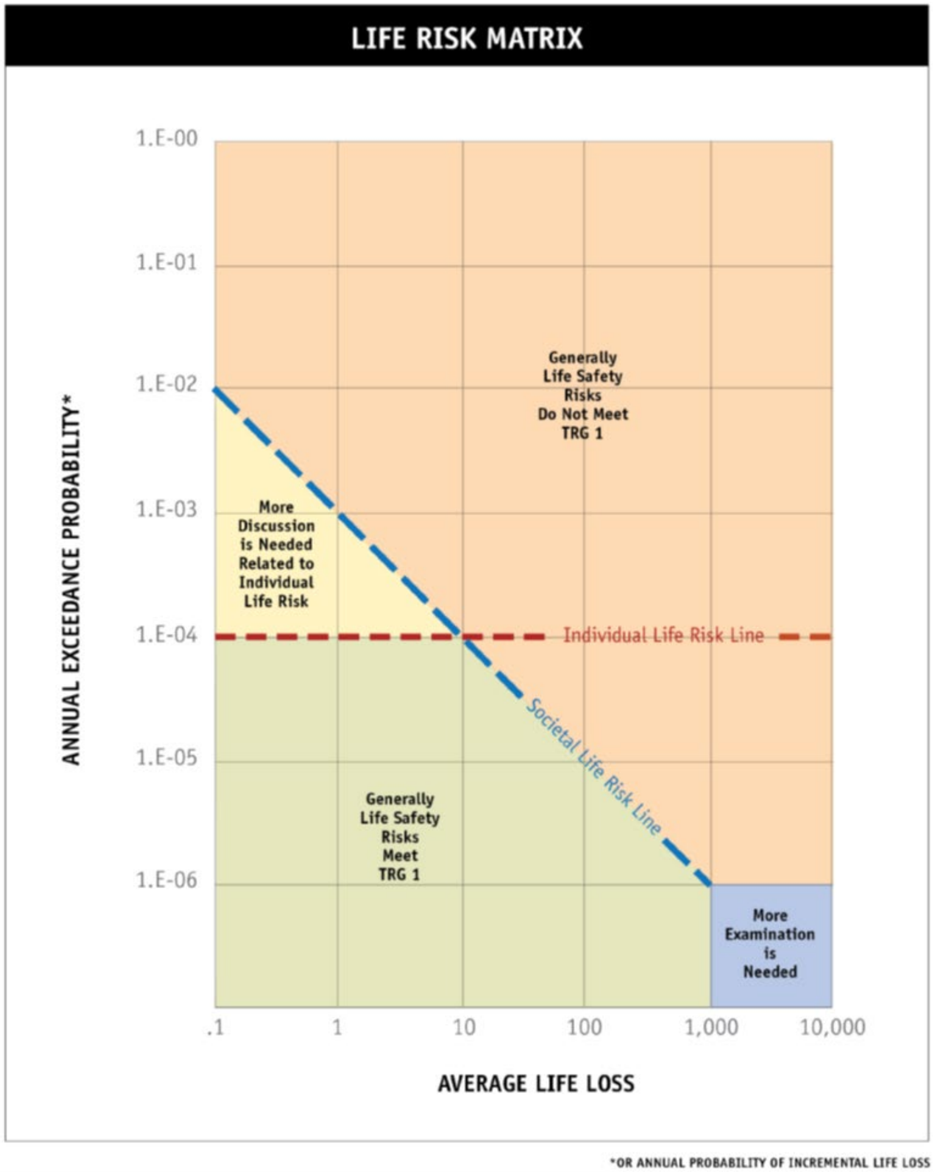

Figure 6-4. USACE Life Risk Matrix

TRG 2 – The second TRG involves determining that there is a continuing recognition of the levee risk because the risk associated with levee systems are not broadly acceptable and cannot be ignored. The rationale for meeting TRG 2 will be determined qualitatively and may consider if the levee sponsor has access to and is aware of the best available levee risk information, if the community in the leveed area has been provided the best available risk information associated with the levee system, and if flood risk (residual risk) and potential changes to flood risk over time have been communicated to the community.

TRG 3 – The third TRG involves determining that the risks associated with overtopping of the levee system are being properly monitored and managed by those responsible for managing the risk. The rationale for meeting TRG 3 will be determined qualitatively and may be met through demonstrated monitoring and risk management activities. This would include an active operation and maintenance program, visual monitoring (documented regular inspections), updated and tested emergency plans, an instrumentation program, and a best available risk characterization.

TRG 4 – The fourth TRG involves determining that those responsible for managing the risk associated with a levee system continue to reduce the risk still further as practicable. The rationale for meeting TRG 4 will be determined qualitatively and USACE will take into account the level of life safety risk in relation to the societal and individual tolerable risk lines; the disproportion between implementing the risk reduction measures and the subsequent risk reduction achieved; the cost-effectiveness of the risk reduction measures; and societal concerns as revealed by consultation with the community and other stakeholders.

The plan formulation and evaluation during the study focuses on achieving risks that society is willing to live with to secure certain benefits (TRG 1). At a minimum, there will be at least one alternative that addresses TRG 1 identified during the study. TRGs 2-4 primarily will be met through life-cycle OMRR&R requirements and the required floodplain management plan. Activities of the levee safety program may be identified and used to determine if and how TRGs 2-4 will be met. All requirements must be identified and accounted for in the benefits and costs in order for the alternative plans to be considered effective and complete. Actions necessary to make the project complete, including consideration of TRGs 2-4, will be included in the report.

Contributions to meeting TRGs 1 and 4 will be identified as being fully, partially, or not met. The TRGs will be considered in the context of the four Principles and Guidelines criteria (completeness, acceptability, efficiency, and effectiveness) and the four evaluation accounts (NED, Regional Economic Development (RED), Other Social Effects (OSE), and Environmental Quality (EQ)), as appropriate.

6.4.3 2057 DESIGN

As described throughout the report, this GRR will re-evaluate the performance of the LPV project to determine if additional actions are recommended to sustain the authorized level of risk reduction for hurricanes and tropical storms. As previously discussed, the existing project design elevations for floodwalls and hardened structures were intended to provide 1% AEP risk reduction in the year 2057 (the “2057 design”) as estimated at the time they were designed. Alternatives will consider increasing, maintaining, or decreasing these elevations and this level of risk reduction in order to ensure all reasonable alternatives have been evaluated.

Additionally, the original design of the perimeter hard structures may have used projections for subsidence, sea level rise and other variables that are different from those used in this study. Therefore, this study may find that some LPV features do not achieve the originally intended level of risk reduction. Cost concerns related to modifying or re-building of hard structures may limit the overall achievable level of risk reduction.

6.5 INITIAL ARRAY OF ALTERNATIVES

This section summarizes the strategies utilized to identify the initial array of structural and non-structural alternative plans based on initial data collection and professional judgment. At this stage of the planning process, the potential alternatives do not consist of any particular structures, structural modifications, or non-structural alternatives.

The initial array of alternatives includes:

- No Action Alternative

- Alternative 1: System Levee Lifts to the Projected 1% AEP Event at 2057
- Alternative 2: System Levee Lifts to the Projected 1% AEP Event at 2073
- Alternative 3: System Levee Lifts at 2073 that Maximize Benefits
- Alternative 4: Selective Levee Lifts
- Alternative 5: Non-Structural

The term “levee lifts” in this initial array of alternatives is used to indicate that levee lifts are anticipated to be the primary measure in those alternatives but is not meant to imply the exclusion of other measures. No minimum lift amount was assumed for alternatives; levee lifts are planned to occur when the previous lift settles to the project grade (i.e., the design elevation at the top of the levee, which varies across the system). Conducting a “lift” at this stage will ensure that the system maintains the intended level of risk reduction. As described in Section 6.2.1, the levee will be built to a height that meets the immediate elevation requirements related to hydraulic design. After a period of settlement, future lifts are constructed on the levee to reestablish the levee to either its original construction height or the current design height based on hydraulic and other factors. This method may require several lifts be constructed periodically over time, but it is a cost-effective method to assure the levee crown elevation will be at or above the design elevation.

At this stage of the planning process, alternatives were conceptually formulated to include a number of placeholder measures (e.g., interior drainage improvements) for possible inclusion. For most alternatives, levee lifts or floodwall modifications/replacements were determined to be integral features of any structural alternative and were the foundation of the formulation strategy at this stage. The other remaining measures (e.g., floodside armoring, wave berms, etc.) could provide ancillary benefits as secondary measures. As such, the descriptions of the initial array of alternatives focus on the primary features (levees/floodwalls) that provide risk reduction for varying events (e.g., 1% AEP at 2057). These descriptions focus on the overall strategy to provide risk reduction rather than a detailed overview of each measure considered for inclusion. The need for other remaining measures (e.g., interior drainage improvements) will be considered following selection of the recommended plan.

The structural alternatives described below (all alternatives except the No Action Alternative and Alternative 5, Non-Structural) were formulated to address the level of risk reduction provided at the existing system perimeter of this large area. Three of them provide a uniform level of risk reduction at the perimeter (which would reduce the risk of interior flooding uniformly but not reduce flood depth uniformly, due to variations in interior topography) while one considers less comprehensive, site-specific structural improvements (e.g., levee lifts in targeted areas). Section 6.7.1.3 provides more information on the formulation and evaluation of non-structural measures in site-specific locations.

6.5.1 NO ACTION

The No Action Alternative assumes the FWOP conditions in the absence of any additional federal action beyond the non-federal sponsor’s operation and maintenance (O&M) of existing authorized features. Levee lifts are not currently specified as O&M requirements under the Project Partnership Agreements (PPAs) for the LPV project. Any specified O&M and any reasonable activities to be pursued by state and local interests in the future are assumed to be undertaken. The No Action Alternative forms the basis against which all other alternatives plans are measured.

6.5.2 ALTERNATIVE 1. SYSTEM LEVEE LIFTS WITHOUT HARD STRUCTURE MODIFICATION

The first alternative would incrementally raise the elevation of levees over time but not modify the hard structures. This alternative is anticipated to be less costly than other alternatives which require both levee lifts and floodwall modifications, as there are significant costs associated with the modification or re-building of hard structures. The hard structures were designed for the 1% AEP event at the year 2057 (as calculated in 2006 following project authorization) and would be a limiting factor to the amount of risk reduction achievable under this alternative. Therefore, this alternative includes levee lifts only and could include the addition of co-located levees along the Mississippi River. Note that this alternative would result in less than 1% AEP risk reduction at the end of the 2073 period of analysis because some hard structures would not meet the height requirements.

6.5.3 ALTERNATIVE 2. SYSTEM LEVEE LIFTS TO THE PROJECTED 1% EVENT AT 2073

The second alternative would incrementally raise the elevation of levees and floodwalls (if needed) over time to restore the system's ability to provide risk reduction from the projected future (2073) 1% AEP coastal storm event. Existing LPV authorization is to construct the level of risk reduction required for participation in the NFIP at the time of construction, which requires a levee be accredited to the 1% AEP level of risk reduction. However, absent additional construction, that 1% AEP LORR would be lost sometime during the study's period of analysis due to subsidence and sea level rise. Alternative 2 would extend that 1% AEP level of risk reduction to 2073, which is the end of this GRR study's 50-year period of analysis.

6.5.4 ALTERNATIVE 3. SYSTEM LEVEE LIFTS AT 2073 THAT MAXIMIZES BENEFITS

The third alternative would seek to identify the maximum benefits achievable in the 50-year period of analysis (which may be more or less than the 1% AEP event). This alternative considers whether higher net benefits could be achieved by either 1) adding measures to Alternative 1 or Alternative 2 that would improve project performance or reduce costs or 2) considering different levels of risk reduction.

6.5.5 ALTERNATIVE 4. SELECTIVE LEVEE LIFTS UP TO THE 1% AEP EVENT

The fourth alternative considers the possibility that there may be no need or possibly insufficient benefits to raise the entire system. For this "selective lifts" alternative, consideration would be given to the feasibility of constructing features to maintain a consistent level of risk reduction across the system or reducing risk in areas where life safety risk associated with overtopping is highest and/or where economic damages are greatest.

6.5.6 ALTERNATIVE 5. NON-STRUCTURAL

Alternative 5 is a non-structural plan that avoids levee modifications as much as possible. While non-structural measures may be included as part of any of the structural plans, Alternative 5 is the only standalone non-structural alternative formulated for the study.

6.5.7 SUMMARY: INITIAL ARRAY OF ALTERNATIVES

Table 6-2 provides a high level indication of how the alternatives were initially conceptualized as summarized above. All structural alternatives include levee lifts (and floodwall measures if needed). Other measures were added to each structural alternative to demonstrate how each is conceptually different from the others. The non-structural alternative consists of purely nonstructural measures.

Table 6-2. Initial Array of Alternatives

		Alternatives				
Type[1]	**Measures**	1 1% to 2057	2 1% to 2073	3 2073 Max Benefits	4 Selective Raise 1%	5 Non-Structural
S	Levee Lift	X	X	X	X	
S	New or Modified Floodwalls		X	X	X	
S	Interior Drainage Improvements		X	X	X	
S	Add Floodside Armoring			X		
S	Wave Berms			X		
N	Risk Communication w/ Public					X
N	Buyouts					X
N	Floodproofing					X
N	Elevations					X
NB	Living Shore Line			X		

[1]S = structural, NS = nonstructural, NB = nature-based

6.6 SCREENING OF INITIAL ARRAY OF ALTERNATIVES

6.6.1 SCREENING CRITERIA

Because the initial array of alternatives were developed to satisfy criteria for completeness (having all features needed to achieve the anticipated benefits) and acceptability (viable with respect to acceptance by state and local entities, tribes, and the public and compatible with existing laws, regulations, and public policies),the initial array of alternatives was qualitatively or semi-quantitatively evaluated and screened based on preliminary H&H, life safety risk, and economic damages information (effectiveness and efficiency). First, existing and FWOP H&H conditions were modeled and preliminary economic damages were assessed using HEC-FDA. In addition, a semi-quantitative risk assessment of existing conditions was completed to identify relevant potential failure modes and evaluate overtopping performance of the systems as well as assess potential life loss and economic consequences for different conceptual breach locations across the system.

For all of these analyses, an intermediate RSLR scenario was utilized. The low RSLR scenario was not selected because the low 2073 projection is very similar (within 6 inches) of the intermediate RSLR projection. While the high RSLR scenario was not selected at this stage, it will be used as a comparison tool when the recommended plan is optimized.

At this stage of the study, economic benefits (estimated damages and associated flood risk management benefits) were the primary factor used to screen smaller-scale alternatives from further consideration. Table 6-3 below presents the results of the screening process.

Table 6-3. Evaluation of Initial Array

#	Alternative Details	Status
No Action	No Action	Final Array
1	System levee lifts without hard structure modification	Screened from further analysis: Preliminary analysis shows there are sufficient benefits to justify floodwall improvements, so this alternative is too narrow in scope.
2	System levee lifts to the projected 1% AEP event at 2073	Final Array
3	System levee lifts at 2073 that maximizes benefits	Final Array
4	Selective levee lifts up to the 1% AEP event	Screened from further analysis: Preliminary benefits show no justification to consider selective areas.
5	Non-Structural	Final Array

6.6.2 SCREENING RESULTS

The No Action Alternative was carried forward as the basis against which all other alternatives plans are measured.

Alternative 1 was formulated as a smaller-scale plan that would be constrained by current floodwall heights (i.e., in case the potential economic benefits would not support the cost of modifying the floodwalls). This would maintain the 1% AEP level of risk reduction until sometime in the future when sea level rise would cause the floodwall design to be exceeded. While the exact time that the floodwall design elevations would be exceeded was not estimated, initial modeling indicated it would be within the 50-year period of analysis. Preliminary economic analysis indicated that there are sufficient potential benefits to include floodwall modifications or replacements in an alternative that provides the 1% AEP level of risk reduction at the end of the period of analysis. Thus, Alternative 1 was screened out; other alternatives that include floodwall modifications were carried forward.

Similar to Alternative 1, Alternative 4 envisioned a scenario where the cost of raising the whole system to a single uniform perimeter 1% AEP level of risk reduction would not be justified and selective levee lifts in targeted areas would need to be pursued. This would create an uneven level of risk reduction around the systems and would constrain the level of risk reduction to something less than 1% AEP in the future as un-raised reaches continued to be impacted by the combined effects of subsidence, settlement, and potential sea level rise. However, based on the magnitude of potential economic benefits across the entire system, alternatives that implement system-wide levee lifts appeared to be justified. As such, Alternative 4 was screened out; other alternatives that include system-wide levee lifts were carried forward.

6.7 FINAL ARRAY OF ALTERNATIVES

Features recommended in USACE decision documents are generally presented at a 35% design level, utilizing existing data (such as topography and subsurface conditions) as much as possible. Design is completed during the Preconstruction Engineering and Design (PED) phase, when detailed data is acquired and final design calculations are performed. The non-federal sponsor and others have completed some Section 408 levee lift alterations independently from the federal project, which may require the recommended project features to be adjusted in those reaches.

Based on the evaluation of the initial array as described above, the following alternatives were carried forward into the final array for further development and evaluation:

- No Action Alternative
- Alternative 2: System Levee Lifts to the Projected 1% AEP Event at 2073
- Alternative 3: System Levee Lifts at 2073 that Maximizes Benefits
- Alternative 5: Non-Structural

All alternatives were developed and evaluated utilizing the intermediate RSLR projection at 2073.

6.7.1 INITIAL EVALUATION OF FINAL ARRAY OF ALTERNATIVES

6.7.1.1 ALTERNATIVE 2: SYSTEM LEVEE LIFTS TO THE PROJECTED 1% AEP EVENT AT 2073

When 1% AEP design heights were calculated for this alternative (see Appendix C – Hydraulics for a description of design process), it became apparent that levee lifts alone would not be sufficient and many floodwalls would also have to be modified or replaced to achieve the elevations required by current HSDRRS design criteria. This resulted in much higher than anticipated project costs, but there continued to be sufficient economic benefits to support those costs. Additionally, by maintaining the current level of risk reduction, this alternative was anticipated to return the future life safety risk due to overtopping to tolerable levels, thus satisfying the policy requirement to have at least one alternative which addresses TRG 1 and TRG 4.

6.7.1.2 ALTERNATIVE 3: SYSTEM LEVEE LIFTS AT 2073 THAT MAXIMIZES BENEFITS

As described above, Alternative 3 was originally formulated to potentially capture greater benefits than Alternative 2 by either 1) identifying measures in addition to levee lifts that could provide additional economic benefits (reduce overall cost and/or improve project performance), or 2) considering other levels of risk reduction. During preliminary analyses it became clear that levee lifts (and, later, floodwall modifications or replacements) would be integral to any structural alternative. The other remaining measures (e.g., living shoreline, flood side armoring, interior drainage improvements, etc.) would be insufficiently effective (alone or in combination with each other) if there were no levee or floodwall modifications or replacements.

To consider ways to reduce costs, the study team evaluated potential locations for wave berms in the project area. Wave berms would have the effect of causing waves to break far enough from the levee crown that it reduces runup and therefore decreases design heights. However, there were few technically feasible locations to place wave berms in the project area and thus no significant improvements in overall project performance were determined to be likely.

Although the authorizing language limits the recommendation to the 1% AEP level of risk reduction, in order to consider a reasonable range of alternatives, the team then considered if a higher (greater than 1% AEP) level of risk reduction may yield greater net benefits. To determine this, a 0.5% AEP design was developed and net economic benefits were estimated. While both alternatives still produced significant positive net benefits, the 0.5% AEP yielded fewer net benefits than the 1% AEP design. Given that net benefits declined between the 1% AEP and 0.5% AEP designs (see Table 8-7), no additional levels of risk reduction were considered.

6.7.1.3 ALTERNATIVE 5: NON-STRUCTURAL ALTERNATIVE EVALUATION

The study team completed a targeted economic evaluation of Alternative 5 (Non-Structural). To evaluate the viability of the non-structural alternative, an equivalent annual damage (EAD) value for each structure was compared to an annualized cost for a generic non-structural measure. This assessment helped the study team determine the number of structures within the structure inventory that are economically justified for a non-structural action. A non-structural measure would be economically justified if the expected storm damages to a structure (Expected Annual Damages – EAD) or group of structures are greater than the cost of a non-structural improvement to the structure or structure group.

First, the EAD was calculated for each structure in the inventory using output files from the HEC-FDA model. Next, the EAD per structure was compared against the average annualized cost of applying a non-structural measure (e.g., house raising and dry floodproofing). Average costs for non-structural measures were identified using the Southwest Coastal study as a proxy reference. In this instance, similar per-structure costs (approximately $150,000) were used as a commensurate estimate for this screening-level assessment.

Using this methodology, approximately 1,600 structures would be economically justified for the non-structural alternative for LPV, meaning the EAD for each of the 1,600 structures was greater than the approximate $150,000 cost to implement a non-structural solution at each structure. This total is 0.7% of the total structure inventory in the study area and 1% of the subset of structures damaged from inundation. Eight smaller economically justified aggregations of structures were identified, roughly corresponding to a city block; no large economically justified aggregations of structures were identified.

The study then considered whether a focus on reducing overtopping flood risk to critical infrastructure could be justified based on reductions to life risk. Critical infrastructure includes emergency services such as hospitals, fire stations, schools, refineries, and other high value facilities (see Section 5.5.2). After a qualitative evaluation of the type and location of the critical infrastructure affected in the future with-out project conditions it was determined that

reducing damage to only critical infrastructure using non-structural measures without addressing the significant economic damages discussed in Section 5.4 and risk to life discussed in Section 5.5.2, does not meaningfully address the objectives of the study.

Based on this assessment, the stand-alone non-structural alternative is not considered sufficiently effective to consider further. Implementation of a stand-alone non-structural alternative would not provide comprehensive flood risk management solutions in the study area and would result in a large residual flood risk in the system. A more likely application of non-structural and flood proofing techniques to reduce flood risks could be implemented for individual buildings that still exhibit substantial residual flood damages once a more comprehensive solution is in place. Possible improvements to risk communication could also be considered as part of a structural plan.

6.7.2 SUMMARY: FINAL ARRAY OF ALTERNATIVES

Based on the evaluations summarized above, Alternatives 2 and 3 were the only action alternatives that were found to be complete, effective, efficient, and acceptable while meeting study objectives. The study sponsor indicated that these alternatives met their needs and requested no additional alternatives.

Figure 6-5 depicts the general footprint for both Alternatives 2 and 3. It should be noted that both alternatives are located in generally the same footprint as the existing LPV project area and existing MRL levees. Project features for both alternatives include levee lifts along the existing levee alignment as well as floodwall modifications and replacements along the existing alignment. It should be noted that not all reaches of the existing LPV project require levee lifts or floodwall replacement in order to meet the design height requirements. Existing landside armoring and foreshore protection along Lake Pontchartrain would be restored following levee and floodwall modifications, which will require limited dredging to provide access to deliver and place the stone protection. The primary difference between Alternatives 2 and 3 is the height of the levees and floodwalls to be lifted and the amount of co-located levee to be added to the project. These alternatives are compared to each other in Section 8.

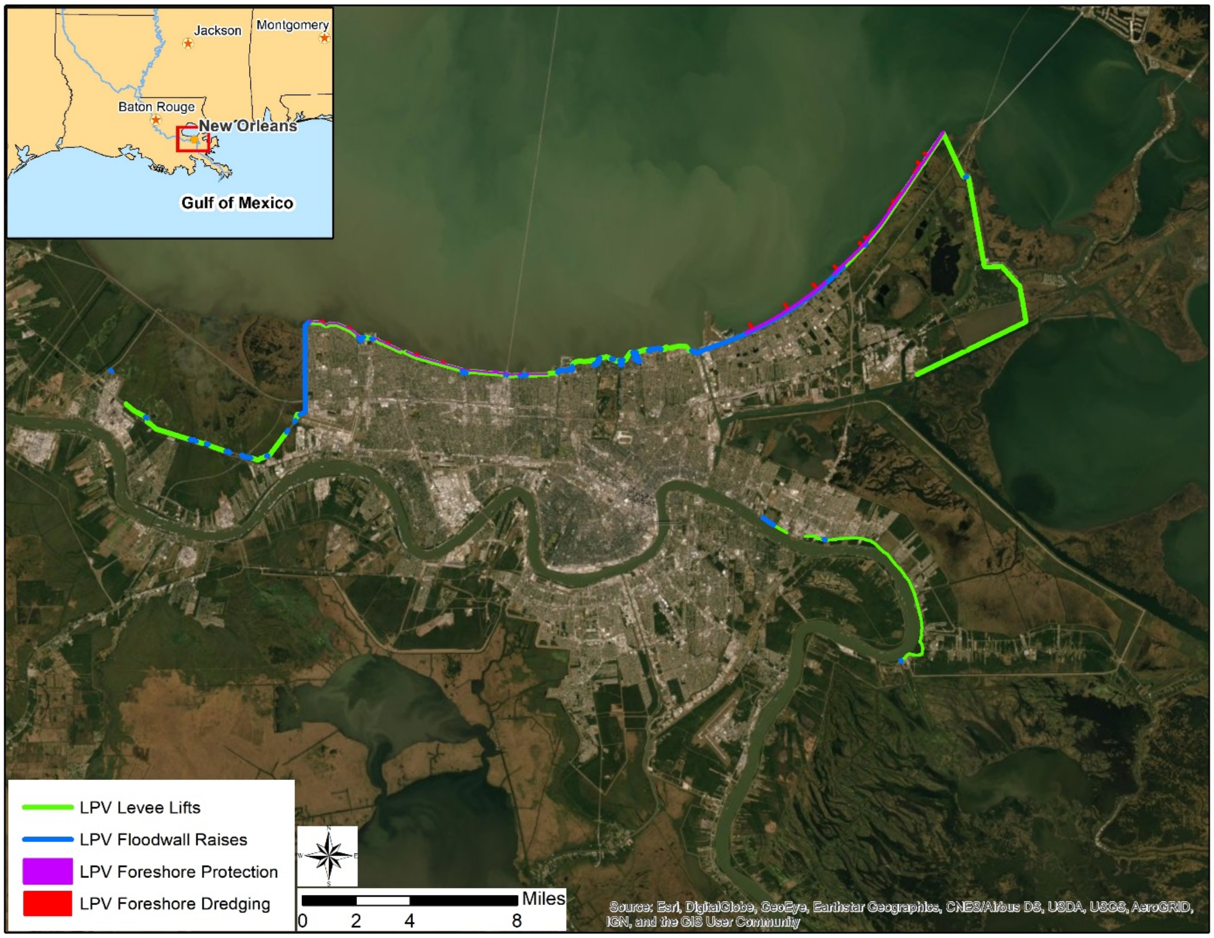

Figure 6-5. LPV Alternatives 2 and 3 - General Footprint

7 ENVIRONMENTAL CONSEQUENCES*

7.1 INFORMATIONAL BACKGROUND

In accordance with NEPA, this section includes the scientific and analytic basis for comparison of the considered alternatives identified in Section 6 – Plan Formulation. This section discusses the important environmental resources located in the study area and describes those resources impacted, directly or indirectly, by the proposed actions (Table 7-1). The impact analysis follows CEQ (1978) Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act since the Notice of Intent was issued (2 April 2019) before the effective date (14 September 2020) of the CEQ 2020 Final Rule. *Direct impacts* are those actions that are a result of the implementation of an action alternative and occur at the same location and time. *Indirect impacts* are those impacts that occur later in time and/or farther removed from the study area but are still reasonably foreseeable. *Cumulative impacts* are defined as the "impact on the environment, which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such action" (40 Code of Federal Regulations [CFR]. § 1508.7). Cumulative impacts are discussed in Section 7.1.3 and at the end of each resource section within this section of this EIS.

The resources described in this section are those recognized as significant by laws, EOs, regulations, and other standards of national, state, or regional agencies and organizations; technical and scientific agencies, groups, or individuals; and the general public. The environmental impacts discussed are summarized and incorporate by reference the previous IERs, CED Phase I (USACE, 2013), and draft Phase II associated with the HSDRRS Emergency Alternative Arrangements[1].

The relevant resources discussed in detail include: soils, water quality resources, wetlands, uplands, fisheries, essential fish habitat, wildlife, threatened and endangered species, noise, transportation, recreation, aesthetics, and the human environment (*i.e.,* socioeconomics). Although invasive species, cultural and historical resources, air quality, EJ, and HTRW have negligible impacts from proposed actions, they are nonetheless discussed in the following sections to demonstrate compliance with applicable laws.

7.1.1 DETERMINATION OF SIGNIFICANCE

Pursuant to NEPA, this section addresses the impacts in proportion to their significance (40 CFR § 1502[b]). *Significance* requires consideration of context and intensity[2]. To determine whether an action has the potential to result in significant impacts, the context and intensity of the action must be considered. *Context* refers to impact timing and duration. Context is estimated as either short-term or long-term. *Short-term* effects include those impacts that would occur during implementation of the project, as well as transient ecological effects that can be expected to occur during the first one to three years. *Long-term* effects might be expected to persist for up to ten years and beyond. *Intensity* refers to the area and severity of the impact.

[1] These documents are available online at: https://www.mvn.usace.army.mil/Missions/Environmental/NEPA-Compliance-Documents/HSDRRS-Projects/ Accessed 9 July 2019

[2] Context means the significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality. Intensity refers to the severity of impact (40 CFR § 1508.27).

For purposes of this analysis, intensity definitions (*i.e.,* negligible, minor, moderate, and major) have been developed to assess the magnitude of effects for all of the affected resource categories resulting from implementing of either Proposed Action Alternative.

From the purpose of this analysis, the intensity of impacts are classified as negligible, minor, moderate, or major and defined as the following:

- ***Negligible*****:** A resource was not affected or the effects were not appreciable; 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 and determined to be less than significant.
- ***Moderate*****:** Effects on a resource were readily detectable, long-term, localized, and measurable and determined to be significant.
- ***Major*****:** Effects on a resource were obvious, long-term, and had substantial consequences on a regional scale and were determined to be significant.

7.1.2 PROPOSED ALTERNATIVES

This chapter compares the effects of use of generalized borrow areas (explained in Section 7.1.4) and the following Proposed Alternatives:

- **No Action Alternative**
- **Alternative 2:** Raising floodwalls and system levee lifts to the projected 1% AEP event at year 2073 with intermediate relative sea level rise (1.8 feet)
- **Alternative 3:** Raising floodwalls and system levee lifts to the projected 0.5% AEP event at year 2073 with intermediate relative sea level rise (1.8 feet)

It should be noted that Alternative 3 was not included in feasibility level of design efforts because Alternative 2 is the Recommended Plan. Only Alternative 2 designs, quantities, etc. have been updated since the draft report was submitted for public review and those updated numbers for Alternative 2 are presented in the impact analyses in this chapter. However, Alternative 3 is still included as part of this feasibility study and Environmental Impact Statement to facilitate comparison of alternatives by decisionmakers and the public. For resources where the lack of updated information for Alternative 3 is important to the analysis, information as such is provided in the discussion for that resource.

Table 7-1. Magnitude of Impacts for the Lake Pontchartrain and Vicinity Proposed Alternatives and Generalized Borrow Areas

Resource	Proposed Alternative	Less than Significant		Significant	
		Negligible Impacts	Minor Impacts	Moderate Impacts	Major Impacts
Soils	No Action	☑			
	Alt 2				☑
	Alt 3				☑
	Borrow Areas				☑
Water Quality Resources	No Action	☑			
	Alt 2		☑		
	Alt 3		☑		
	Borrow Areas	☑			
Wetlands & Forest Resources	No Action		☑		
	Alt 2			☑	
	Alt 3			☑	
	Borrow Areas		☑		
Uplands	No Action	☑			
	Alt 2		☑		
	Alt 3		☑		
	Borrow Areas			☑	
Fisheries	No Action	☑			
	Alt 2		☑		
	Alt 3		☑		
	Borrow Areas	☑			
Essential Fish Habitat	No Action	☑			
	Alt 2		☑		
	Alt 3		☑		
	Borrow Areas	☑			
Wildlife	No Action	☑			
	Alt 2			☑	
	Alt 3			☑	
	Borrow Areas		☑		
Threatened & Endangered Species	No Action	☑			
	Alt 2		☑		
	Alt 3		☑		
	Borrow Areas	☑			
Invasive Species	No Action		☑		
	Alt 2		☑		
	Alt 3		☑		
	Borrow Areas	☑			
Cultural & Historical Resources	No Action			☑	
	Alt 2	☑			
	Alt 3	☑			
	Borrow Areas	☑			
Aesthetics	No Action	☑			
	Alt 2		☑		
	Alt 3		☑		
	Borrow Areas	☑			

Resource	Proposed Alternative	Less than Significant		Significant	
		Negligible Impacts	Minor Impacts	Moderate Impacts	Major Impacts
Recreational	No Action				☑
	Alt 2	☑			
	Alt 3	☑			
	Borrow Areas	☑			
Air Quality	No Action	☑			
	Alt 2	☑			
	Alt 3	☑			
	Borrow Areas	☑			
Noise	No Action	☑			
	Alt 2		☑		
	Alt 3		☑		
	Borrow Areas		☑		
Transportation	No Action				☑
	Alt 2			☑	
	Alt 3			☑	
	Borrow Areas			☑	
Human Environment	No Action		☑		
	Alt 2		☑		
	Alt 3		☑		
	Borrow Areas	☑			
Environmental Justice	No Action			☑	
	Alt 2		☑		
	Alt 3		☑		
	Borrow Areas	☑			
HTRW	No Action		☑		
	Alt 2	☑			
	Alt 3	☑			
	Borrow Areas	☑			

7.1.3 CUMULATIVE IMPACTS ANALYSIS

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. Cumulative impacts are defined 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 the actions. Representative past, present, and future regional projects were utilized in the cumulative impacts analysis.

Cumulative impacts result from the proposed action when added to other past, present and reasonably foreseeable projects or actions. Cumulative impacts are not caused by a single project but include the effects of a particular project in conjunction with other projects (past, present and future) on the particular resource. Cumulative effects are studied to enable the public, decision-makers and project proponents to consider the “big picture” effects of a given project on the community and the environment. In a broad sense, all impacts on affected resources are probably cumulative; however, the role of the analyst is to narrow the focus of the cumulative impacts analysis to important issues of national, regional and local significance (CEQ, 1997).

The CEQ issued a manual entitled *Cumulative Effects Under the National Environmental Policy Act* (CEQ, 1997). This manual presents an 11-step procedure for addressing cumulative impact analysis. The cumulative impacts analysis for the LPV GRR followed these 11 steps, shown in Box 7-1. The cumulative impacts analysis concentrated on whether the actions proposed for this study, combined with the impacts of other projects, would result in a significant cumulative impact and if so whether this study's contribution to this impact would be *cumulatively considerable*.[3]

Future levee lifts conducted by USACE have been discussed in CED Phase I as part of HSDRRS 2057. In summary, the impacts discussion for each resource incorporates by reference the impacts previously described in the CED Phase I Volumes I, II, and III[4] and that are described in the CED Phase II, which is currently in draft and will be released for initial public review in Spring 2021 and for final public review in late 2021.

7.1.3.1 BOUNDING CUMULATIVE IMPACTS ANALYSIS

Cumulative impacts analysis requires expanding the geographic boundaries and extending the time frame to include additional effects on the resources, ecosystems, and human communities of concern.

The cumulative impacts geographic boundary is not restricted to the project impact area. Rather it is based on cumulative cause-and-effect relationships wherein the action's direct and indirect effects on resources no longer measurably contribute to cumulative impacts (Shipley, 2016).

GEOGRAPHIC SCOPE OF THE HUMAN ENVIRONMENT – The geographic scope of the human environment for the LPV study lies within the greater New Orleans area and includes portions of St. Charles, Jefferson, Orleans, and St. Bernard parishes. The future borrow sites would be located within 11 parishes in Louisiana; these include, in addition to the aforementioned parishes

Box 7-1. Approach to Cumulative Impacts

Scoping

1. Identify resources
2. Define the study area for each resource
3. Define time frame for analysis

Describing the Affected Environment

4. Identify other actions affecting the resources
5. Characterize resources in terms of its response to change and capacity to withstand stress
6. Characterize stresses in relation to thresholds
7. Define baseline conditions

Determining the Environmental Consequences

8. Identify cause-and-effect relationships
9. Determine magnitude and significance of cumulative effects
10. Assess the need for mitigation of significant cumulative effects
11. Monitor and adaptive management, accordingly

[3] Cumulatively considerable means that the incremental effects of an individual action are significant when viewed in connection with the effects of past, present, and probable future actions.
[4] Available online at: https://www.mvn.usace.army.mil/Missions/Environmental/NEPA-Compliance-Documents/HSDRRS-Projects/Comprehensive-Environmental-Document/ accessed 29 Aug 2019.

(excluding St. Bernard), Ascension, East Baton Rouge, Lafourche, St. James, St. John the Baptist, Iberville, and St. Tammany parishes.

GEOGRAPHIC SCOPE OF THE NATURAL ENVIRONMENT – Figure 7-1 displays the ecoregions in the vicinity of the LPV study area and potential future borrow areas. Ecoregions denote ecosystems similar in type, quality, and quantity of environmental resources that are critical for structuring and implementing ecosystem management strategies across federal and state agencies and nongovernment organizations. Ecoregions stratify the environment recognizing the capacities and potentials of ecosystems by their probable response to disturbance. Ecoregions are characterized by their geology, physiography, vegetation, climate, soils, land use, wildlife, and hydrology. For example, the proposed actions along the Mississippi River affect the Level III ecoregion Mississippi Alluvial Plain that extends north into Arkansas. More specifically, this area is characterized as Level IV ecoregion 73k (Southern Holocene Meander Belts), a subcomponent of the larger Level III ecoregion. This Level IV ecoregion is dominated by flat plains and river meander belts with levees, with prominent land cover and land use of forested wetlands, croplands, and urban and industrial areas (Daigle, 2006).

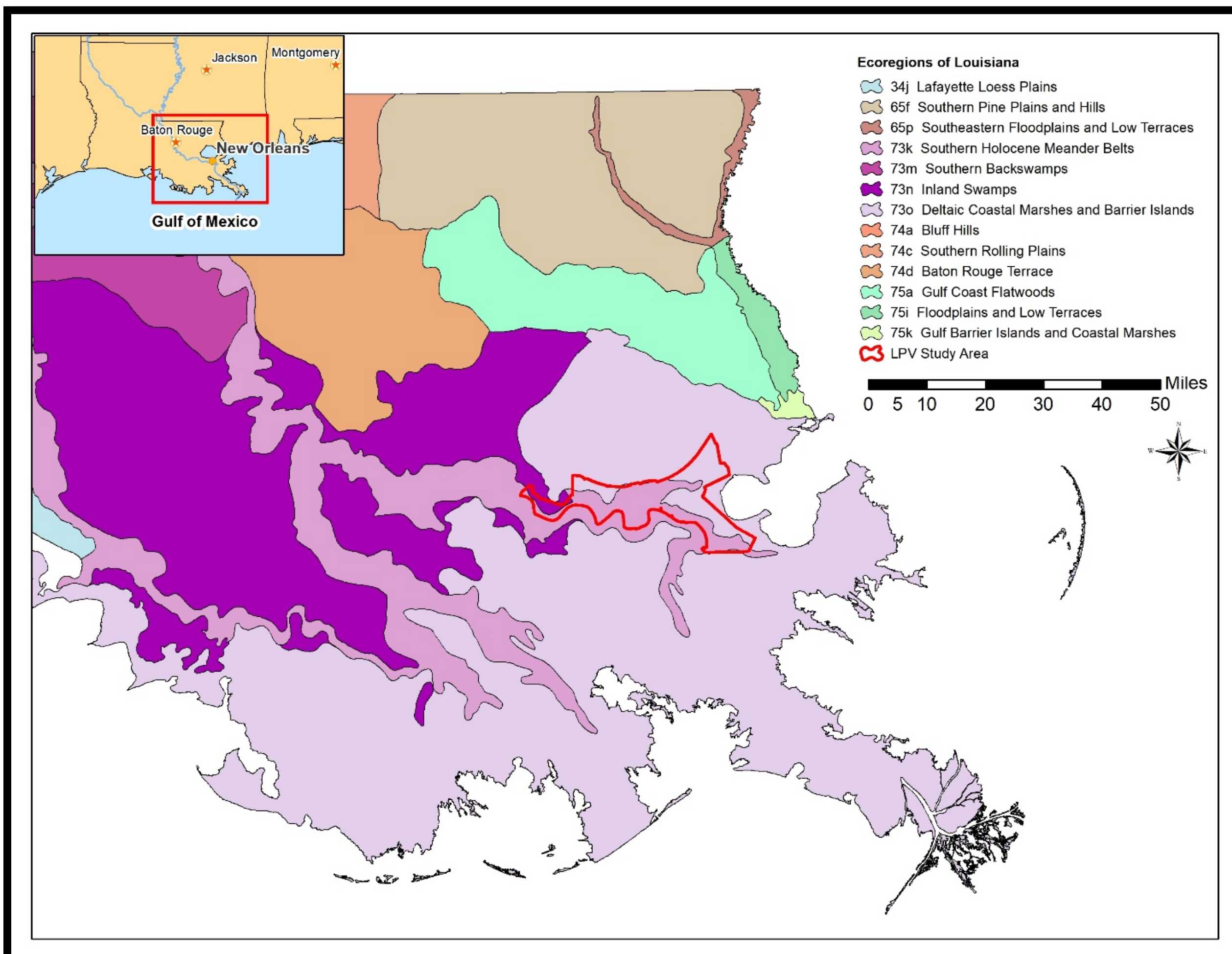

Figure 7-1. Ecoregions of Louisiana in the vicinity of the LPV Study Area.
Source: **https://www.epa.gov/eco-research/ecoregions**

TIMEFRAME FOR THE ANALYSIS – The timeframe for the cumulative impacts analysis for each considered resource begins when past actions began to change the status of the resource from its original condition, setting the long-term trend currently evident and likely to continue into the reasonably foreseeable future. Historic or past actions are those occurring before October 2018 (the start of this GRR study). The present includes actions from October 2018 to the present date of GRR study report. The reasonably foreseeable future includes the 50-year period of analysis which extends from the present through 2073.

7.1.3.2 IDENTIFYING PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE ACTIONS

Section 4 discusses the existing condition of each resource by describing the present condition and providing historical context (*i.e.,* the past condition) for how the resource was altered to the current conditions. The study team used information from field surveys, discussions with the project sponsor and subject matter experts, scoping comments, and literature searches to assess the past and existing conditions of the resource and to identify present and reasonably foreseeable future actions.

"Reasonably foreseeable actions" are defined as actions or projects with a reasonable expectation of actually happening, as opposed to potential developments expected only on the basis of speculation. Other present and future regional projects and programs that are applicable for the LPV study human environment and natural resources have been previously described in the IERs, supplemental IERs, and CED Phase I[5] and are not repeated here. Only those past, present, and reasonably foreseeable future actions that overlap in space and time with the direct and indirect effects are considered, with the boundary for cumulative effects expanded to the point at which the action's direct and indirect effects no longer measurably contribute to cumulative effects.

7.1.3.3 CUMULATIVE IMPACTS BY RESOURCE

The cumulative impacts for each resource considered are discussed within each relevant resource below. Table 7-2 is a checklist identifying potential incremental cumulative effects on the resources affected by the LPV DEIS-GRR. Table 7-3 summarizes the cumulative impact analysis which includes the past, present, and reasonably foreseeable actions that might impact each resource category identified to have an incremental cumulative effect.

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[5] Previous NEPA documents available online at https://www.mvn.usace.army.mil/Missions/Environmental/NEPA-Compliance-Documents/HSDRRS-Projects/ . Accessed on 23 September 2019

Table 7-2. Checklist for Identifying Potential Cumulative Impacts

Resource	Past Actions	Other Present Action	Other Future Actions	Without Project	With Project		Project's Incremental Cumulative Impact
					Construction	Operation	
Soils	●	●	●	●	●	⊙	●
Water Quality Resources	●	●	●	⊙	●	⊙	⊙
Wetland & Forest Resources	●	●	●	⊙	⊙	⊙	⊙
Uplands	●	●	●	●	⊙	❍	⊙
Fisheries	●	⊙	⊙	⊙	❍	❍	❍
Essential Fish Habitat	●	⊙	⊙	❍	❍	❍	❍
Wildlife	●	⊙	⊙	❍	⊙	❍	⊙
Threatened & Endangered Species	●	⊙	⊙	❍	❍	❍	❍
Invasive Species	●	⊙	⊙	❍	❍	❍	❍
Cultural & Historical Resources	●	⊙	⊙	❍	❍	❍	❍
Aesthetics	●	⊙	⊙	❍	❍	❍	❍
Recreational Resources	●	⊙	⊙	❍	❍	❍	❍
Air Quality	●	⊙	⊙	❍	❍	❍	❍
Noise	●	⊙	⊙	❍	❍	❍	❍
Transportation	●	⊙	⊙	●	⊙	⊙	⊙
Human Environment & Environmental Justice	●	⊙	⊙	❍	❍	❍	❍
HTRW	●	⊙	⊙	❍	❍	❍	❍

KEY: ❍= Less than Significant Impact ⊙ = Moderate, Significant Impact ●= Major, Significant Impact

Table 7-3. Cumulative Effects Summary for Identified Resources

Resource	Past Actions	Present Actions	Future Actions	No Action Alternative	Proposed Action Alternatives
Soils	Previous levee construction for hurricane and coastal storm risk reduction and flood risk reduction projects had significant impacts on soils, including prime farmland, throughout SE Louisiana due to the need for borrow. The HSDRRS projects resulted in significant impacts on prime farmland soils.	Ongoing levee modifications for hurricane and coastal storm risk reduction and flood risk reductions projects within the study area are continuing to impact soils, including prime farmland, due to the need for borrow.	Future actions in SE Louisiana will continue to need borrow to construct/maintain levees for hurricane and coastal storm risk reduction and flood risk reduction projects. These future actions would likely require borrow and likely come from prime farmland.	Continued impacts from past and ongoing development, constructed levees, and other risk reduction structures. The area within the HSDRRS would have increased flood risk resulting in prime farmlands and soils being more prone to flooding into the future. Existing borrow areas would continue to be used by private individuals, non-federal, and federal agencies for other construction activities.	Alternative 2 would require 4.6 million cubic yards of fill material. Alternative 3 would require 9.3 million cubic yards of fill, likely impacting prime farmland (Alternative 3 quantities were not updated during feasibility level design). Significant impacts on soils are expected from the proposed actions due to the need for borrow likely coming from prime farmland soils. See Sections 7.2.2 and 7.2.3 for further details.

Resource	Past Actions	Present Actions	Future Actions	No Action Alternative	Proposed Action Alternatives
Water Quality Resources	Clean Water Act of 1977, NEPA of 1966, Coastal Zone Management Act, and institutional recognition to restore and protect waters. Past industrial use and channelization of water bodies for oil and gas exploration and all past actions to the water bodies have significantly impaired water quality. Construction of levees along the Mississippi River to reduce riverine flooding into adjacent wetlands have reduced nutrient retention; excess nutrients from the Mississippi River watershed entering the Gulf of Mexico contributing to the Dead Zone formation.	Continued impacts to water resources due to population growth, oil & gas exploration, and industrialization. Continued regulation enforcement, and societal recognition help reduce water degradation. Programs by state and non-profit agencies as well as private citizens to improve water quality; continued localized dumping	Continued impacts to water resources due to population growth, oil & gas exploration, and industrialization. Continued regulation enforcement, and societal recognition help reduce water degradation. Programs by state and non-profit agencies as well as private citizens to improve water quality; continued localized dumping	Continued impacts to water resources due to population growth and industrialization. The existing levees and flood walls would continue to be operated and maintained into future. Existing borrow areas would continue to be operated.	Construction-related impacts to water resources likely to occur due to increased turbidity and sedimentation, decreased DO, and increased water body temperature. The foreshore protection would impact 75.1 acres of shoreline in Lake Pontchartrain. The levee expansions along the MRL and filling in of BLH-Wet habitat permanently eliminating the affected wetlands' ability to perform water quality functions. Less than significant impacts to water quality resources are expected from the proposed actions. See Sections 7.3.2 and 7.3.3 for further details.

Resource	Past Actions	Present Actions	Future Actions	No Action Alternative	Proposed Action Alternatives
Wetland & Forest Resources	Numerous natural (e.g., hurricanes, subsidence, erosion) and human-induced sources (e.g., coastal excavation, construction of canals and levees, drainage, invasive species), of wetland loss in southeast Louisiana, and conversion to other land use	Wetland loss and conversions to other land use. Mitigation projects and bank credits offset adverse impacts to wetlands due to constructed projects.	Wetland loss and conversion to other land use. Mitigation will continue to be used to offset wetland damages due to future actions	Wetland loss in coastal Louisiana is expected to continue related to subsidence, sea level rise, and human development. Existing borrow areas would continue to be operated. Maintenance along existing LPV levee reaches would continue to occur. No impacts to wetlands are expected due to routine maintenance.	No permanent impacts to marsh or Cypress-Tupelo swamp habitats are anticipated with the proposed actions. Wetland impacts would occur due to MRL flood side levee shifts, impacting BLH-Wet. These impacts would be offset through mitigation (Appendix K). The flood side shift would impact approximately 20 acres for Alternative 2 and 28 acres for Alternative 3 (Alternative 3 quantities were not updated during feasibility level design). The proposed actions are anticipated to have significant impacts to wetland resources. See Sections 7.4.2 and 7.4.3 for further details.

Resource	Past Actions	Present Actions	Future Actions	No Action Alternative	Proposed Action Alternatives
Uplands	Past construction of levees and risk reduction structures have resulted in highly disturbed areas along the levee reaches. Upland habitats have been adversely impacted due to uplands being used for borrow areas for construction activities.	Continued use of upland habitats for borrow areas for construction activities. Existing levees would continue to be maintained as grass turf with routine maintenance of mowing along the levee as necessary.	Continued use of upland habitats for borrow areas for construction activities. Existing levees would continue to be maintained as grass turf with routine maintenance of mowing along the levee as necessary.	Actions by others on uplands would continue. Maintenance of existing LPV levee system would continue, but no new borrow impacting uplands would occur.	Existing levees would be cleared of turf during construction and then re-vegetated with turf. Uplands associated with the levee footprints would stabilize following construction. Upland habitat associated with borrow areas would likely come from upland areas. Impacts to uplands within the proposed footprint of the levee lifts and floodwall raises would be less than significant, but uplands associated with required borrow would likely be significantly impacted. Exact impacts would be analyzed upon selection of borrow sites in the future. See Sections 7.5.2 and 7.5.3 for further details.

Resource	Past Actions	Present Actions	Future Actions	No Action Alternative	Proposed Action Alternatives
Fisheries and Essential Fish Habitat	Institutional recognition of decline in EFH quality; passage of Magnuson-Stevens Fishery Conservation and Management Act, as amended; formation of NMFS, and Louisiana Department of Wildlife and Fisheries (LDWF); Fish and Wildlife Coordination Act; Marine Mammal Protection Act; decline in fish and EFH due to overharvesting and loss of habitat from natural conditions and human induced changes.	Institutional recognition of natural resources and fish resources and its habitats. Continued loss of habitat due to conversion and subsidence. Authorized ecosystem restoration construction projects offset some of the impacts to habitat loss.	Continued loss of fish and EFH resources due to habitat loss. Sea level rise and subsidence expected to continue. Authorized ecosystem restoration construction projects offset some of the impacts to habitat loss.	Actions by others would continue to affect fisheries and EFH. Sea level rise will likely increase saltwater intrusion and exacerbate ongoing conversion of wetlands to shallow open water resulting in loss of existing fish habitats. The existing levee maintenance would not impact existing fisheries or EFH.	Less than significant construction-related impacts on fisheries and aquatic habitat are anticipated to occur at discrete levee lift and floodwall raise construction sites. The placement of foreshore protection would lead to direct burial of immobile species. Despite some adverse impacts to fisheries and EFH, the proposed action is expected to result in only minor, less than significant short-term effects. See Section 7.6.2, 7.6.3, 7.7.2, and 7.7.3 for further details.

Resource	Past Actions	Present Actions	Future Actions	No Action Alternative	Proposed Action Alternatives
Wildlife	Institutional recognition through formation of LDWF; Endangered Species Act, Fish and Wildlife Coordination Act; Bald and Golden Eagle Protection Act; Marine Mammal Protection Act; Migratory Bird Treaty Act; decline in wildlife due to overharvest and loss of habitat from natural conditions and human induced changes.	Institutional recognition of natural resources and wildlife resources and its habitats. Continued loss of habitat due to conversion and subsidence. Authorized ecosystem restoration construction projects offset some of the impacts to habitat loss.	Continued loss of wildlife resources due to habitat loss. Authorized ecosystem restoration construction projects offset some of the impacts to habitat loss.	Existing maintenance of the LPV levees would continue. Wildlife that currently use the levees would continue to do so with negligible, temporary, less than significant impacts. Continued loss of wildlife resources due to habitat loss and sea level rise. Actions by others would continue.	Wildlife would be directly impacted during construction and due to loss of BLH-Wet habitat adjacent to the MRL. During construction, mobile wildlife likely to avoid the area. Significant impacts to wildlife are expected due to loss of BLH-Wet habitat along the MRL. See Sections 7.8.2 and 7.8.3 for further details.
Threatened & Endangered Species	Institutional recognition through Endangered Species Act; decline in listed and protected species due to overharvest and loss of habitat from natural conditions and human-induced changes.	Continued impacts to listed and protected species habitat by natural conditions such as hurricane storm surge, saltwater intrusion and subsidence, and man-made conditions such as agriculture, human development, and industrialization.	Continued impacts to listed and protected species habitat by natural conditions such as hurricane storm surge, saltwater intrusion and subsidence, and man-made conditions such as agriculture, human development, and industrialization.	Degradation and loss of habitat would continue and adversely impact the listed species in and near the vicinity of the study area. Recovery plans for the listed species would offset, to some degree, the adverse cumulative impacts on listed species. Continued maintenance of the LPV levees is not likely to adversely affect listed species.	The listed species may be affected, but not likely adversely affected, during construction and future operation of the proposed actions. These effects are considered to be temporary and less than significant. See Sections 7.9.2 and 7.9.3, and Appendix G for more details.

Resource	Past Actions	Present Actions	Future Actions	No Action Alternative	Proposed Action Alternatives
Invasive Species	Introduction and spread of invasive species degraded native habitats. Institutional recognition through EO 13112 and EO 13751	Continued threat of invasive species. Invasive species management and eradication programs conducted by other entities offset some damage to native habitats.	Continued threat of invasive species. Invasive species management and eradication programs conducted by other entities would offset some damage to native habitats. New invasive species likely to expand into study area.	Threats of invasive species would continue. Existing invasive species would persist.	Existing invasive species would persist in the study area. Implementation of best management practices (BMPs) to reduce the spread of invasive species would be followed during construction. Less than significant impacts on invasive species are expected. See Section 7.10.2 and 7.10.3 for further details.

Resource	Past Actions	Present Actions	Future Actions	No Action Alternative	Proposed Action Alternatives
Cultural & Historical Resources	Institutional recognition through National Historic Preservation Act, EO 13007, EO 11593, Native American Graves Protection and Repatriation Act, National Register of Historic Places.	Construction of levee and risk reduction structures would continue to disturb ground and unknown archaeological sites may be uncovered. Erosion and ground deposits during hurricane and coastal storm events would continue to damage known sites.	Continued construction activities would occur and unknown sites may be uncovered. Erosion and ground deposits during hurricane and coastal storm events would continue and could damage/destroy known sites.	Existing levees and floodwalls would continue to be maintained and would have no effect on cultural resources. With LORR reduced, known and unknown sites within the protected side of the LPV system may have higher risk of damage/destruction during hurricane and coastal storm events.	The proposed action of levee lifts and floodwall raises are not expected to impact cultural resources due to previous surveys already being performed. If any unrecorded cultural resources are determined to exist, then no work will proceed in the area until final coordination with SHPO and THPO has been completed. Added level of flood risk reduction to known and unknown archaeological sites within the protected side of the LPV system, reducing damage caused by flood events. Less than significant impacts are anticipated. See Sections 7.11.2 and 7.11.3 for further details.

Resource	Past Actions	Present Actions	Future Actions	No Action Alternative	Proposed Action Alternatives
Aesthetics & Recreational Resources	Technical recognition via 1988 Visual Resources Assessment Procedure. Institutional recognition via Wild and Scenic Rivers Act, Louisiana Scenic River Act, Scenic Byways and others. Aesthetic and recreational resources negatively impacted by past hurricanes.	Continued institutional recognition. Visual resources destroyed, enhanced, or preserved by human activities and natural processes. Continued wetland loss and damages from hurricanes may have an adverse effect on the visual complexity and recreational resources within SE Louisiana.	Continued institutional recognition. Continued human population growth and development and other human activities have the potential to destroy, enhance, or preserve aesthetic and recreational resources.	Continued institutional recognition. Aesthetic and recreational resources would not change from existing conditions.	Aesthetics and recreational resources would be temporarily impacted by construction activities. However, the proposed action impacts on aesthetics and recreational resources would be less than significant. See Section 7.12.2., 7.12.3, 7.13.2, and 7.13.3 for further details.

Resource	Past Actions	Present Actions	Future Actions	No Action Alternative	Proposed Action Alternatives
Air Quality	Institutional recognition through the Clean Air Act; General Conformity Rule; industrialization, urbanization, and human development.	Continued human development, industrialization, and urbanization have the potential to adversely impact air quality; Continued regulation enforcement and societal recognition help reduce air quality degradation.	Continued human development, industrialization, and urbanization have the potential to adversely impact air quality; Continued regulation enforcement and societal recognition help reduce air quality degradation.	Continued maintenance of the existing LPV system would continue. No changes to the attainment area status for the study area are anticipated. Continued human development, industrialization, and urbanization have the potential to adversely impact air quality. Continued regulation enforcement and societal recognition help reduce air quality degradation.	During construction probable direct impacts to air quality would include temporary diesel and gasoline emissions. Air emissions from the proposed action would be temporary and less than significant. No violation of federal or state ambient air quality standards are expected. Less than significant impacts to air quality are expected. See Section 7.14.2 and 7.14.3 for further details.

Resource	Past Actions	Present Actions	Future Actions	No Action Alternative	Proposed Action Alternatives
Noise	Institutional recognition through the Noise Control Act and local noise ordinances. Human development, urbanization, and industrialization.	Continued human development, industrialization, and urbanization have the potential to adversely impact noise quality; Continued regulation enforcement and societal recognition help reduce noise.	Continued human development, industrialization, and urbanization have the potential to adversely impact noise quality; Continued regulation enforcement and societal recognition help reduce noise.	Noise impacts would be similar to existing conditions. Continued maintenance of the LPV system would have minor noise related to mowing of existing levees. Local and temporary noise related to human activities would continue.	Noise levels associated with construction activities would have the potential to temporarily impact noise. Future maintenance activities could result in slight increase in noise levels from equipment and associated activities; however, these increases are expected to be temporary. The noise impacts associated with the proposed action alternatives would be less than significant. See Sections 7.15.2 and 7.15.3 for further details.

Resource	Past Actions	Present Actions	Future Actions	No Action Alternative	Proposed Action Alternatives
Transportation	The transportation infrastructure includes major roads, highways, railroads, and navigable water ways that have developed historically to meet the needs of the public. Interstate 10 (I-10), an east-west bicoastal thoroughfare that connects Houston to Baton Rouge, is a primary route for hurricane evacuation and post-storm emergency response.	The transportation infrastructure continues to meet the needs of the public. I-10 is the primary route for hurricane evacuation and post-storm emergency response.	Portions of I-10 and other highways and roads would continue to be periodically damaged by hurricane storm surge.	The routine maintenance of public roads around the study area would continue. Major transportation corridors within the study area likely would become more vulnerable to storm damage in the future. Transportation associated with existing borrow areas would continue.	Use of the area's roads would increase during construction. Truck hauling of borrow would temporarily impede vehicle traffic, increase local congestion, and adversely impact roads. These impacts would be significant. See Sections 7.16.2 and 7.16.3 for further details.

Resource	Past Actions	Present Actions	Future Actions	No Action Alternative	Proposed Action Alternatives
Human Environment & Environmental Justice	Institutional recognition of Environmental Justice (EO 12898) and the DoD's Strategy on EJ of 1995.	High poverty rates negatively impact the social welfare of residents and resource limitations undermine the community's ability to provide assistance to residents in times of need.	Institutional recognition of EJ would continue.	Institutional recognition of EJ would continue. LPV system would not provide hurricane and storm damage risk reduction for a 1% AEP storm; the perceived and actual risks to minority and/or low-income population groups would increase resulting in a significant impact to low income and minority communities. Potential for residents to re-locate to areas with higher levels of flood risk reduction.	The proposed actions would not adversely impact socioeconomic or EJ resources within the study area. Flood side shifts of the MRL would spare impacts to the human environment. No permanent disproportionate impacts are expected to occur on any minority or low-income community. Less than significant impacts to the human environment and EJ are expected. See Sections 7.17.2, 7. 17.3, 7.18.2, and 7.18.3 for further details.

Resource	Past Actions	Present Actions	Future Actions	No Action Alternative	Proposed Action Alternatives
HTRW	Institutional recognition thru Resource Conservation and Recovery Act; CERCLA; Solid Waste Disposal Act; Industrialization and urbanization	Continued human population growth and industrialization with the potential of new HTRW impacts. Continued cleanup efforts to offset past HTRW impacts.	Continued human population growth and industrialization with the potential of new HTRW impacts	Continued maintenance of the LPV system would have low risk of encountering RECs. Should HTRW concerns or RECs arise at any time during future maintenance, USACE would coordinate with the appropriate federal and state authorities to implement an approved response action.	Phase 1 Environmental Site Assessment completed during feasibility. New Phase 1 would be required within a 6-month period prior to start of construction to ensure that no RECs are present. Less than significant impacts to HTRW are expected. See Section 7.19.2 and 7.19.3 for further details.

7.1.4 GENERALIZED BORROW AREA IMPACT ANALYSIS

Extended construction windows throughout the 50-year period of analysis would be required for implementation of the multiple levee lifts associated with the project. Borrow areas available for use now may not be available when future levee lifts are needed. Accordingly, an analysis of borrow area impacts has been conducted on a "typical" borrow pit that could be chosen for use. Anticipated impacts of excavation and use of such "typical" borrow areas for the action alternatives were evaluated using the below assumptions. The assumptions are based on extensive borrow area impact assessments performed for HSDRRS implementation. During HSDRRS construction post-Hurricane Katrina (2005), over 229 million cubic yards of borrow material was cleared for use by USACE and only 93 million cubic yards was used for construction (as of June 2012, which constituted the majority of levee construction). As such, it is reasonable to assume that sufficient borrow is known to be available within the identified area. The quantities of borrow that would be needed for each lift are estimates. Specific borrow areas would be identified during pre-construction engineering and design for each segment of project construction. Borrow area acquisition requirements will continue to be evaluated to determine whether temporary or permanent easements are most advantageous to the Government. Additional NEPA documentation and associated public review would be conducted, as necessary, to address impacts associated with those borrow areas. Additionally, if a proposed borrow area contains upland bottomland hardwood forests or another significant resource that requires mitigation, a mitigation plan would be prepared in compliance with WRDA 1986, Section 906, as amended (33 U.S.C. §2283). See Appendix A for construction schedule and estimated borrow quantity for each levee lift.

Table 7-4. Borrow Area Assumptions and Requirements Incorporated into Borrow Area Analysis

Resource	Assumptions and Requirements
Locations	Borrow sites would be located within one or more of the following parishes: • Orleans Parish • Plaquemines Parish • Jefferson Parish • St. Charles Parish • Lafourche Parish • St. John the Baptist Parish
Socioeconomics	Borrow sites with potential EJ impacts or potential impacts to sensitive receptors would be avoided.

Resource	Assumptions and Requirements
Soils	Based on the estimated 4.6 million cubic yards of material needed for construction and based on an assumed 20-ft depth of borrow areas, Alternative 2 would require approximately 177 acres of borrow area. Based on the estimated 9.3 million cubic yards of material needed for construction, Alternative 3 would require approximately 361.5 acres of borrow area (Alternative 3 quantities were not updated during feasibility level design). Suitable clay material would meet the following requirements: • Soils classified as fat or lean clays are allowed • Soils with organic content greater than 9% 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% sand content Significant impacts to prime farmland soils would be anticipated given the strong correlation between suitable borrow soils and prime farmland soils.
Transportation	The same transportation corridors used during HSDRRS would be used, as described in *Transportation Report for the Construction of the 100-year Hurricane and Storm Damage Risk Reduction System* prepared in 2009 and incorporated by reference (USACE, 2009)[6].Moderate to major impacts to transportation would be anticipated.
Jurisdictional Wetlands	Suitable borrow areas that avoid jurisdictional wetland impacts would be used. No impacts to wetlands would be anticipated.
Non-Jurisdictional (i.e. upland) Bottomland Hardwoods	Suitable borrow areas that avoid non-jurisdictional bottomland hardwood (BLH-dry) impacts would be used. No impacts to bottomland hardwoods would be anticipated.
Water Quality	Water quality impacts would be minimized through the use of Best Management Practices (BMPs). Minor impacts to water quality would be anticipated during construction, dissipating upon completion.
Fisheries/Essential Fish Habitat	No impacts to fisheries or EFH would be anticipated due to the use of inland sites
Wildlife	Some permanent impacts to wildlife would be anticipated due to permanent removal of habitat.
Threatened and Endangered Species	No impacts to T&E species would be anticipated as no T&E species are present in upland areas in the target parishes.

[6] Available online in Appendix F at https://www.mvn.usace.army.mil/Portals/56/Users/194/42/2242/CED%20Volume%20II%20Compiled.pdf; accessed 12 January 2021

Resource	Assumptions and Requirements
Cultural Resources	Cultural resource surveys would be conducted on potential borrow sites; sites with cultural resources would be avoided; no impacts to cultural resources would be anticipated.
Recreational Resources	No impacts to recreational resources would be anticipated as borrow sites would likely be located on private property away from recreational areas
Aesthetics	Minor impacts to aesthetics would be anticipated due to conversion of habitat.
Air Quality	Minor impacts during construction would be anticipated, dissipating upon completion; borrow areas would avoid non-attainment areas
Noise	Minor impacts during construction would be anticipated and minimized through compliance with local noise ordinances; temporary impacts to wildlife in adjacent habitat would be anticipated during construction; avoidance of construction areas may cause carrying capacity of adjacent habitats to be temporarily exceeded.
HTRW	HTRW surveys would be conducted on potential borrow sites; sites with HTRW would be avoided; no impacts would be anticipated.

During scoping, the USFWS provided a recommended protocol for identifying borrow sources. The recommendations in descending order of priority are:

1. *Permitted commercial sources, authorized borrow sources for which environmental clearance and mitigation have been completed, or non-functional levees after newly constructed adjacent levees are providing equal protection.*
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., Chinese tallow-trees) or non-forested wetlands(e.g., wet pastures), excluding marshes;*
    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., Chinese tallow-trees) or non-forested wetlands(e.g., wet pastures), excluding marshes;*
    c. *disturbed wetlands (e.g., hydrologically altered, artificially impounded).*

Notwithstanding this protocol, the location, size, and configuration of borrow sites within the landscape is also critically important. Coastal ridges, natural levee flanks, and other geographic features that provide forested/wetland habitats and/or potential barriers to hurricane surges should not be utilized as borrow sources, especially where such uses would diminish the natural functions and values of those landscape features.

USACE would follow this recommended protocol to the extent practicable during borrow area selection. In addition, USACE will select borrow areas in the parishes listed in Table 7-4 that fall within the types of areas provided by USFWS that contain suitable soils and that do not contain significant resources to avoid a need for potential mitigation (see Figure 7-2). USACE would utilize information on suitable soils in conjunction with information on existing borrow areas to select parcels that likely meet the geotechnical and environmental requirements for borrow. Additional factors to be considered would be whether the parcels are likely to contain sufficient borrow quantity to be economically viable, whether the location minimizes the time/distance travelled between the source and the project site, and NFS preferences or information on willing landowners. USACE would then request right-of-entry for investigations from the NFS, perform borings and HTRW/cultural investigations, and validate assumptions about the material. If the location is determined to be suitable, appropriate NEPA documentation and coordination would be conducted with the goal of covering the next 5-10 years of borrow needs for the project. Upon completion of all environmental compliance requirements, USACE would request acquisition of the parcel by the NFS, which bears responsibility for acquisition of necessary lands and easements under the Project Partnership Agreement.

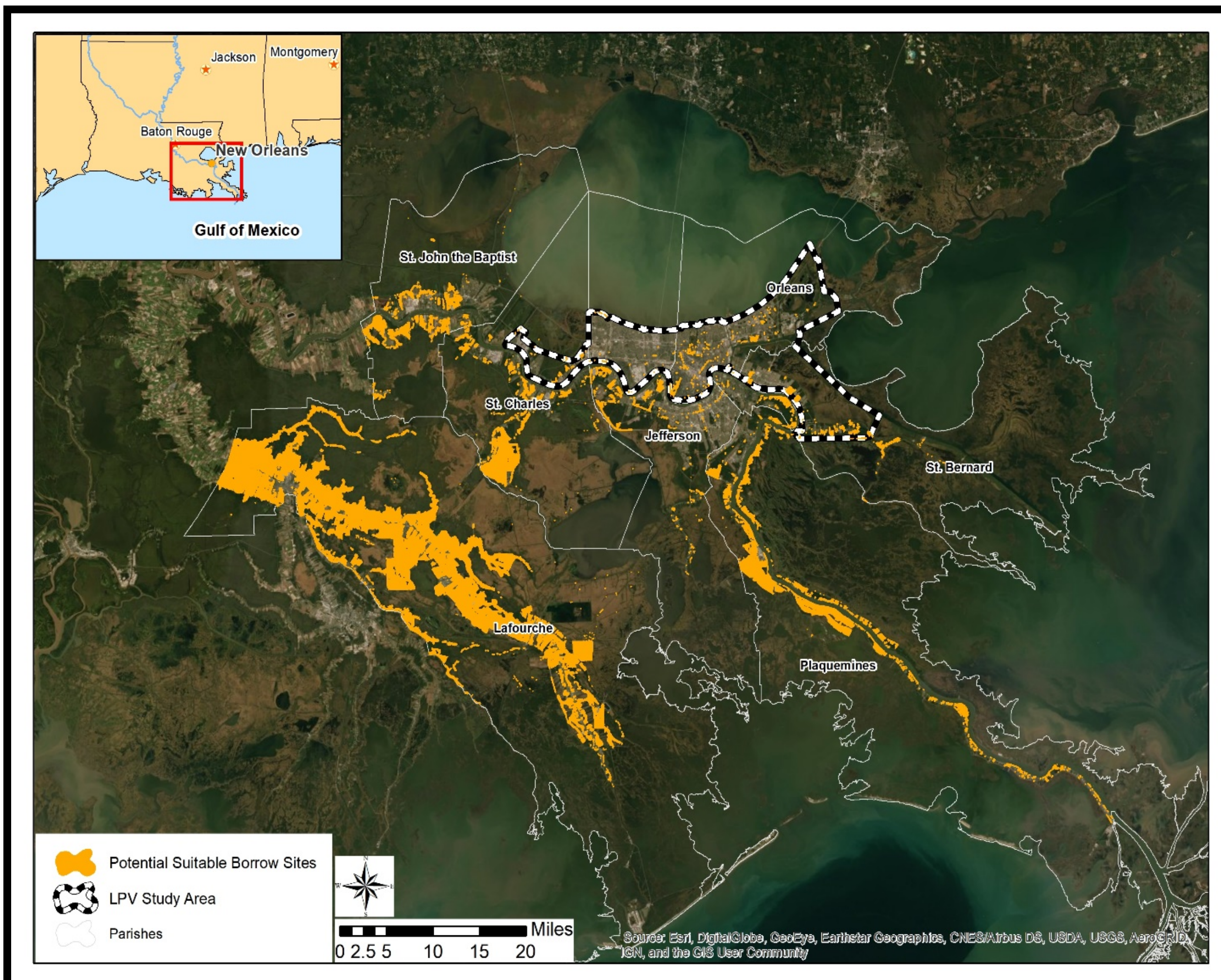


Figure 7-2. Potential Suitable Borrow Sites Based on Soil Types and Avoidance of Potential Mitigation

(data provided by USFWS, 2019; based on 2016 National Land Cover Database and National Resources Conservation Service (NRCS) soil surveys)

7.2 SOILS

7.2.1 REGULATORY FRAMEWORK

This soils resources section addresses compliance for the following applicable environmental laws and regulations:

- Farmland Protection Policy Act of 1981 (7 USC 4201 *et seq.*) 7 CFR 657-658
- 7 USC 4201, Prime and Unique Farmland
- Soil Conservation Act (16 USC 590(a) *et seq.*)
- Section 402 Clean Water Act

Impacts to soils would be considered significant if an alternative resulted in substantial conversion or loss of prime farmland soils.

7.2.2 IMPACTS OF CONSIDERED ALTERNATIVES

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 proposed actions contain soils that have previously been impacted by development, constructed levees, and other risk reduction structures.

NO ACTION ALTERNATIVE – Soils in the study area are expected to continue to be impacted from previous development, constructed levees, and other risk reduction structures. The 2011 HSDRRS projects resulted in significant impacts on prime farmland soils, which were relatively undisturbed. Impacts were both adverse due to a permanent loss of the soils and beneficial due to a reduction in risk of future flooding. Under the no action alternative, the area within HSDRRS would have increased overtopping flood risk resulting in prime farmlands and soils within the HSDRRS being more prone to flooding into the future, leading to continued significant impacts to soils. Soils located along the flood-side of the MRL would continue to be flooded and receive nutrients and sediment from the Mississippi River. Under the no action alternative, any existing borrow areas would continue to be used by private individuals, non-federal, and federal agencies for other construction activities. Prime farmland soils within these borrow areas would continue to be adversely impacted under the No Action Alternative.

PROPOSED ACTION ALTERNATIVES – For soil resources, the proposed action alternatives have similar impacts; they only differ in the amount of fill material needed for construction:

- **ALTERNATIVE 2** would require approximately 4.6 million cubic yards of fill material for construction activities. Assuming a 20-foot average depth of borrow areas this would require approximately 177 acres of borrow.
- **ALTERNATIVE 3** would require approximately 9.3 million cubic yards of fill material for construction activities. Assuming a 20-foot average depth of borrow areas this would require approximately 362 acres of borrow. (Alternative 3 quantities were not updated during feasibility level design.)

Direct Effects – 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. After construction, the disturbed soils would stabilize and re-vegetate. 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, and woody vegetation is not allowed on the levees or within a 15-foot vegetation-free zone past the levee toe. No significant impacts to prime farmland soils in the levee footprints are anticipated with implementation of the proposed alternatives since these soils have already been impacted by previous HSDRRS construction projects. Beneficial effects would be realized due to reduction in risk of future flooding.

***Indirect Effects* –** Eroded soils from construction sites are likely to damage adjacent vegetation by coating leaf surfaces and limiting transpiration and photosynthesis and disturbing adjacent wetland communities through increased suspended solids in the water column, which reduces light penetration and decreases overall water quality.

GENERALIZED BORROW AREAS – Specific borrow areas to be used for construction of levee lifts have not been identified. USACE compared suitable borrow areas (*i.e.,* suitable soil types in areas with no sensitive ecological resources) provided by USFWS to areas designated as prime farmland (USDA, 2019) and determined that the majority of suitable fill material occurs in areas of prime farmland. Accordingly, there is a high likelihood that borrow areas would be located in areas with prime farmland soils. Alternative 2 could lead to the loss of 177 acres of prime farmland soils and Alternative 3 could lead to the loss of 362 acres of prime farmland soils (Alternative 3 quantities were not updated during feasibility level design). This is a worst-case scenario that assumes that all potential borrow acres would be excavated, and that all soils in those borrow areas would be designated as prime farmland. The use of the excavated prime farmland soils from borrow sites for LPV construction provides a benefit to the greater New Orleans area and provides a reduction in risk of flooding undisturbed farmland within the HSDRRS. However, because the loss of these prime farmland soils is permanent and would result in a substantial reduction in the available productive farmland regionally, and because of the volume of prime farmland soils already removed from production in the region since 2005 due to construction and improvement of the LPV HSDRRS features, the West Bank and Vicinity HSDRRS features and other construction activities, the additional loss of prime farmland soils is anticipated to have a significant impact. No mitigation measures can be implemented that would reduce the level of impact.

Therefore, Alternatives 2, 3, and associated borrow areas would have major, significant impacts on soils.

7.2.3 CUMULATIVE IMPACTS

Other regional past, present, and future actions would also continue to change the land use patterns and would contribute to the cumulative loss of prime farmland soils in southeastern Louisiana. The CED Phase 1, Volume I (USACE, 2013) provides additional detail and is incorporated by reference and only briefly summarized here.

Beneficial cumulative impacts on soils would occur from coastal and wetlands restoration projects as healthier marsh and forested wetlands are created and protected and are to some degree better able to trap sediments, sustain vegetation, and build 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.

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

There would be adverse permanent, major cumulative impacts on soils from the construction of risk reduction efforts since Hurricane Katrina and removal of borrow materials associated with the proposed action alternatives, primarily due to the permanent loss of acres of prime farmland soils used for borrow. The magnitude of cumulative impacts on soils would be greater for the borrow sites than for construction of LPV levee lift components. Soil removed from borrow sites for LPV construction and future maintenance would occur primarily in rural areas and result in 177 acres for Alternative 2 or 362 acres for Alternative 3 that would no longer be suitable for pasture or farmland uses. (Alternative 3 quantities were not updated during feasibility level design.)

The LPV could also have a minor adverse cumulative impact on soils due to the potential for induced development in the study area as flooding risk of 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 rainwater and erosion of exposed soils. Increased development in the study area would remove soils from biological productivity, and permanently remove prime farmland soils from agricultural production.

Collectively, the cumulative impacts due to construction of risk reduction structures and levee raises in urban areas within LPV would have little adverse effect on previously disturbed soils. Areas within the HSDRRS that are designated prime farmland soils are beneficially impacted by the risk reduction system, as the land used as farmland, forestland, and wildlife habitat has a reduced risk of flooding.

Borrow material has been used by USACE for the construction of the HSDRRS and other projects in southeastern Louisiana. Over 17 million cubic yards of borrow material is estimated to have been obtained for the HSDRRS construction effort. 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. Due to the volume of prime farmland soils already removed for HSDRRS construction, the anticipated removal of prime farmland soils from borrow areas regionally for LPV construction would be a major impact and would be a significant loss of prime farmland soils.

Therefore, Alternatives 2, 3, and associated borrow would have major, significant cumulative impacts on soils.

7.2.4 ENVIRONMENTAL COMMITMENTS

To minimize impacts to soil resources, the following environmental commitments shall be implemented:

1) BMPs as described by Stormwater Pollution Prevention Plans (SWPPP) would be used at levee lift construction sites to reduce erosion.
2) Environmentally acceptable construction practices would be used to avoid excessive disturbance of soils present in the project area.
3) Silt fencing and hay bales would be installed around the perimeter of the borrow areas to control runoff.
4) Post-construction earthen levees would be re-vegetated to reduce erosion and scour.
5) All fill material used for levee lift construction would be free from contamination and certified by physical testing, chemical analysis, and/or manufacturer's certification.
6) To make optimal use of available borrow 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.
7) Excavation for semi-compacted fill would not be permitted in water, nor should 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.
8) Upon abandonment of a borrow area, site restoration would include placing the stockpiled overburden back into the pit and grading the slopes to the specified cross-section figures.
9) At borrow sites, all proper local, state, and federal permits would be required for potential impacts to water quality.

7.3 WATER QUALITY

7.3.1 REGULATORY FRAMEWORK

This water quality section addresses compliance for the following applicable environmental laws and regulations:

- Clean Water Act Section 401: Water quality certification pursuant to Section 401 of the Clean Water Act would be achieved prior to construction.
- Clean Water Act Section 402: Prior to construction, the National Pollutant Discharge Elimination System permit process would be completed and a General Stormwater Permit would be required. Contractors would need a site-specific Spill Prevention, Control and Countermeasure Plan in place prior to the start of construction.
- Clean Water Act Section 404: Specific impacts to water quality due to displacement of water bodies by fill materials, stockpiling, and hydro-modifications will be described in the 404(b)1 evaluation and included prior to final report approval.
- EO 11988, Floodplains
- Coastal Zone Management Act Compliance (see Appendix G for full compliance details)

Impacts to water resources would be considered significant if an alternative:

- Caused long-term or permanent violation of state water quality standards or otherwise substantially degraded water quality.
- Caused the study area to no longer meet state of Louisiana water quality attainment status.

7.3.2 IMPACTS OF CONSIDERED ALTERNATIVES

NO ACTION ALTERNATIVE – Without the proposed action, the USACE expects the water quality in and near the study area to continue in a fashion similar to current conditions. Natural and human-influenced activities affecting water quality would have both potentially beneficial and detrimental effects into the future. The existing levees and floodwalls would continue to be operated and maintained into the future. Some water bodies in and adjacent to the study area would likely continue to violate LDEQ pollution criteria for their designated uses due to natural and human-influenced causes. Those with known or suspected sources of impairment may show improvement through time as controls are put in place to address the impairment.

PROPOSED ACTION ALTERNATIVES – For water resources, Alternatives 2 and 3 have similar impacts unless called out otherwise.

***Direct Effects* –** Construction-related impacts would have direct effects to canals, drainage waterways, and open water due to increased sedimentation and nutrient loading of waterways from stormwater runoff during rain events notwithstanding use of BMPs during construction and prior to establishment of vegetated cover in newly raised levees. Direct, minor, short-term, construction-related impacts on water quality from the levee lift 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 incident solar radiation (USACE, 2013). Where the base of the earthen levee was expanded into open water of a bayou or lake, these actions would directly impact water quality through increased sedimentation during construction activities, but impacts on water quality are expected to cease once levee material stabilized and was armored. The foreshore protection in Lake Pontchartrain would impact approximately 75.1 acres of shoreline, which would have direct short-term less than significant impacts on water quality from increased turbidity.

***Indirect Effects* –** Minor, short-term, construction-related impacts on water quality from construction activities may include decreased DO levels in the waters immediately surrounding the construction site, decreased clarity due to construction runofff and sedimentation due to dredging activities, and increased water temperature due to increased suspended solids produced during construction that could absorb incident solar radiation. Temporary, minor less than significant water quality impacts could occur due to increased nutrient loading, miscellaneous debris, and accidental spills from construction equipment. After construction, conditions would be expected to stabilize and return to conditions similar to pre-construction.

Mississippi River – In the MRL locations requiring levee expansion to the flood side, filling of BLH-wet habitat would permanently eliminate the affected wetlands' ability to perform water quality functions, causing a major, permanent significant impact to water quality. These impacts would be offset by BLH –wet compensatory mitigation (See Appendix K, *Mitigation Plan).*

Therefore, impacts to water resources from proposed action alternatives would be less than significant.

GENERALIZED BORROW AREAS – Dewatering activities during borrow site excavation is expected to increase suspended sediment concentration in waterways and wetlands near discharge points. No permanent impacts on water quality from borrow site construction and use are expected. Borrow sites are expected to be constructed in upland environments, and the beds and banks of open water bodies created from borrow site construction are expected to quickly stabilize and not contribute to sedimentation and turbidity of nearby waterways during storm events. The new water bodies in abandoned borrow pits would remain isolated and would not contribute to any degradation of existing water bodies in the region. Disturbance of water quality would be temporary and confined to the borrow pit. **Therefore, impacts to water quality associated with borrow areas would be less than significant.**

7.3.3 CUMULATIVE IMPACTS

Past HSDRRS construction activities modified the surface hydrology, increased turbidity, decreased DO, increased suspended sediments, and potentially caused a slight increase in water temperature. Specific impacts of the HSDRRS are documented in the CED Phase I, Chapter 4, and are only summarized here (USACE, 2013). The HSDRRS construction activities did result in short-term moderate impacts to water quality for some of the sub-basins related to construction and maintenance activities. However, following the completion of construction activities and stabilization of material, there would be no further impacts on water quality.

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. As noted in Table 4-7, water quality in some water bodies in the region is impaired because of existing commercial and industrial uses and point source discharges of stormwater and wastewater.

The direct cumulative LPV impacts on water quality would be associated with the actual construction and maintenance activities. This would likely cause sedimentation and nutrient loading of waterways from stormwater runoff during rain events. These minor, short-term less than significant impacts would include localized changes in turbidity, water temperature, dissolved oxygen, hydrology, and water velocity.

In general, there would be less than significant cumulative impacts on water quality from the proposed action.

7.3.4 ENVIRONMENTAL COMMITMENTS

To minimize impacts to water quality, the following environmental commitments shall be implemented:

1) All appropriate and practicable steps would be 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 proposed construction activities.
2) Prior to construction a SWPPP would be prepared to address potential impacts to water quality from construction equipment, construction crews, and construction practices. The SWPPP would include required BMPs to reduce run-off, prevent accidental spills, and otherwise minimize the potential for impacts to water quality.
3) Construction BMPs (*e.g.*, sediment curtain) would be in place during construction.
4) Dust suppression methods such as watering of construction sites would be in place during construction.
5) Containment of fuel and construction-required chemicals would be in place during construction.
6) For foreshore protection construction, use of turbidity control measures is required.

7.4 WETLAND AND FOREST RESOURCES

7.4.1 REGULATORY FRAMEWORK

This section addresses compliance for the following applicable environmental laws and regulations:

- Section 906(d) of WRDA 1986
- Fish and Wildlife Coordination Act
- Clean Water Act Section 401
- Clean Water Act Section 402
- Clean Water Act Section 404
- EO 11990, Protection of Wetlands
- EO 11988, Floodplain Management

Impacts to wetlands and forest resources would be considered significant if substantial conversion or loss of wetlands would occur due to proposed actions.

7.4.2 IMPACTS OF CONSIDERED ALTERNATIVES

NO ACTION ALTERNATIVE – Wetland loss in coastal Louisiana is expected to continue due to subsidence and development of human infrastructure (USACE, 2013) (Boesch, et al., 1994). Future major hurricane events are expected to convert marsh into open water similar to the conversion that occurred from Hurricanes Rita and Katrina (Barras, Bernier, & Morton, 2008). The historic balance between wetland loss and formation along the deltaic plan would continue to be interrupted due to changes to the Mississippi River. The maintenance of the Mississippi River in its current course and subsequent changes to the deltaic cycle would continue as today, resulting in the majority of the sediment deposition and fresh water to be discharged off the continental shelf. The problem of saltwater intrusion into historically less saline marshes is expected to continue. Continued loss of cypress-tupelo swamps and BLH forests due to wind, storm surge damage, and saltwater intrusion would continue to impact the regional habitat and biological resources in the study area. CPRA 2017 Master Plan data indicate that large expanses of coastal marsh may be lost over the next 50 years, even with implementation of the Master Plan (Figure 7-3).

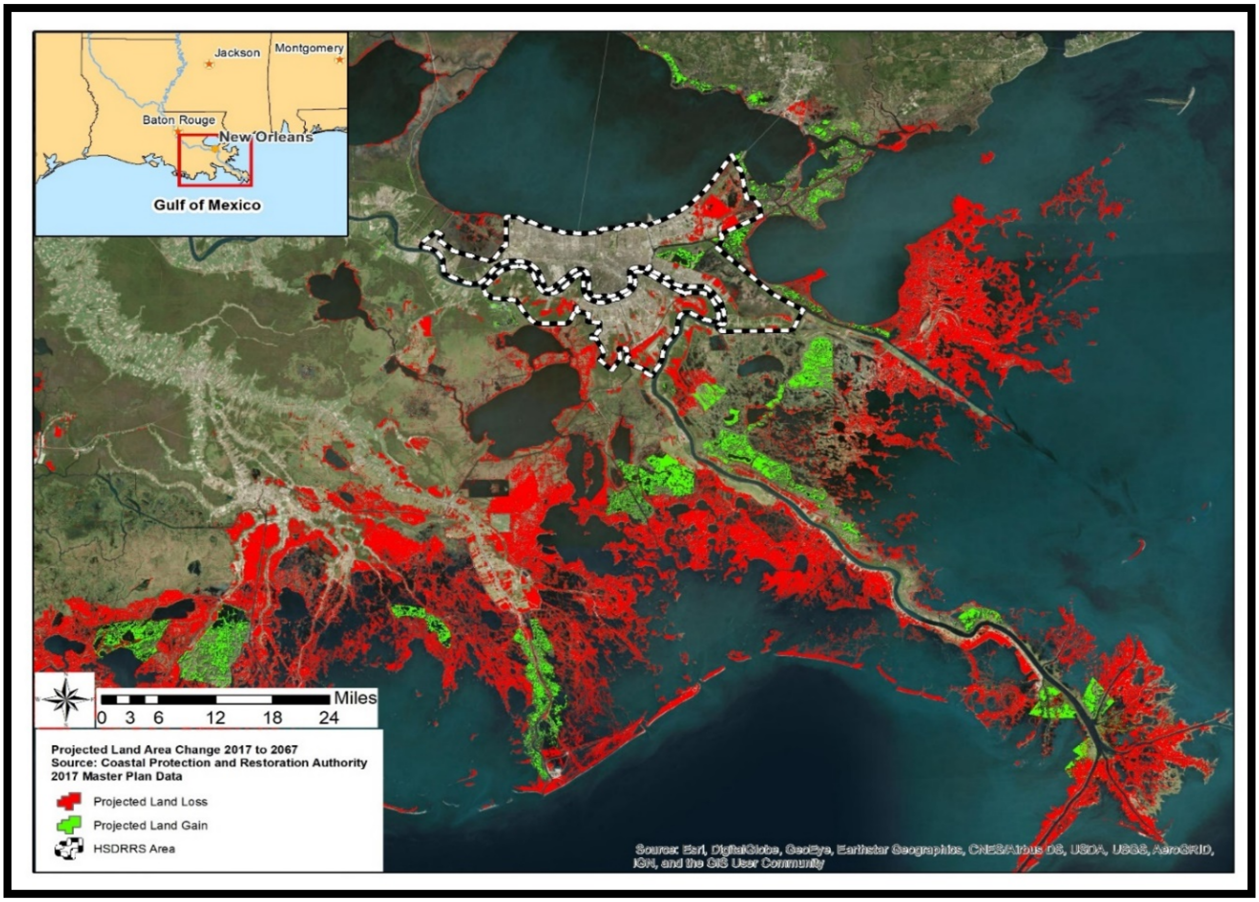


Figure 7-3. Projected land area change from 2017 to 2067 based on CPRA 2017 Master Plan data (medium scenario, with Master Plan implementation)

Without implementation of the proposed action, there would be no actions taken to lift the LPV levee reaches or raise existing floodwalls. However, maintenance activities would continue to occur. As no vegetated wetlands exist in the project footprints, no wetlands would be impacted by such continued maintenance.

PROPOSED ACTION ALTERNATIVES – For wetland and forest resources, Alternatives 2 and 3 have identical impacts unless called out otherwise.

Direct Effects – No permanent impacts to open water, marsh, or cypress-tupelo swamp habitats are anticipated with implementation of the Proposed Action Alternatives. However, potential wetland impacts would occur with lifts associated with Mississippi River levees due to the necessity to expand the levees to the flood side, thereby impacting BLH-wet habitat. These impacts would be avoided to the maximum extent practicable but would be unavoidable in some locations due to avoidance of infrastructure on the protected side of the levees. Initial design estimates indicate an additional 25 feet would be required on the flood side of the levees for construction. These flood side levee shifts would impact approximately 20.3 acres of bottomland hardwood-wet habitat with Alternative 2 and 28.4 acres with Alternative 3, requiring compensatory mitigation. (Alternative 3 quantities were not updated during feasibility level design.) See Appendix K for detailed mitigation information.

Existing rights of way would be used in almost all other cases. Minor increases in rights of way (0.7 acres total) would be required at 4 locations along the existing levee footprint on the Lake Pontchartrain shoreline, but the increases are in existing disturbed habitat and no wetland or forest habitat would be impacted.

Potential impacts to SAV in Lake Pontchartrain would be avoided. Pre-construction surveys would be required to delineate existing SAV to facilitate avoidance of impacts. SAV surveys and avoidance of impacts would be included in construction contract solicitation language.

Indirect Effects – Temporary increases in suspended sediment and turbidity in habitats adjacent to construction sites and staging areas could occur from stormwater runoff and from water-based construction activities, but these impacts are anticipated to be minor and short-term in nature.

GENERALIZED BORROW AREAS – Borrow areas would be selected so as to avoid any impacts to wetland or bottomland hardwood resources. The potential for indirect impacts on jurisdictional wetlands from borrow site excavation exists; however, measures implemented to protect jurisdictional wetlands from borrow site excavation during HSDRRS construction (upland buffers) were successful in preventing indirect impacts.

The proposed Action Alternatives are anticipated to have significant impacts on wetland and forest resources, requiring compensatory mitigation (see Appendix K). Approximately 12.1 AAHUs of BLH-Wet habitat would be required for Alternative 2 and 17.7 AAHUs for Alternative 3 to offset BLH-Wet impacts. (Alternative 3 quantities were not updated during feasibility level design.)

7.4.3 CUMULATIVE IMPACTS

Cumulative impacts to jurisdictional wetlands throughout the greater New Orleans area would continue with or without the proposed action. Impacts to wetlands, including mitigation projects from HSDRRS would continue. Past, ongoing, and future 404 permitted actions are expected to continue which would impact wetland resources. Historical and present wetland loss and gain in southeastern Louisiana has been caused by a multitude of natural and anthropogenic actions (Barras, Bernier, & Morton, 2008). Coastal wetland loss has occurred for thousands of years in Louisiana and has until the 20th century been balanced by various natural wetland building processes (LACOAST, 1997). Multiple factors have been associated with coastal land loss, including the inhibition of sediment movement into coastal systems due to levee systems along the Mississippi River; man-made canals and their associated hydrologic changes (i.e., saltwater intrusion); a decline of suspended sediments coming from the Mississippi River due to upriver dams and other projects; erosion caused by wave action and boating activity; geologic compaction and faulting; storm events, including hurricanes; and relative sea level rise (Boesch et al., 1994). Public and private wetland creation and restoration projects have contributed to wetland gain in southeastern Louisiana. Major programs and initiatives include the Coastal Wetlands Planning, Protection and Restoration Act program; the Beneficial Use of Dredged Material program; WRDA restoration projects (e.g., Caernarvon Freshwater Diversion); vegetation restoration projects (e.g., National Resources Conservation Service Plant Materials Center); Louisiana state restoration projects; the Louisiana Parish Coastal Wetland Restoration Program; FEMA restoration projects; public and private parties' initiatives, including those of nongovernmental organizations and corporations; and private mitigation banks. It is expected that the trend of wetland loss would continue, the rate of which would be slowed by the previously mentioned wetland creation and restoration initiatives.

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.

The proposed Action Alternatives are anticipated to have significant cumulative impacts on wetland and forest resources, requiring compensatory mitigation.

7.4.4 ENVIRONMENTAL COMMITMENTS

To minimize impacts to wetland and forest resources, the following environmental commitments shall be implemented:

1) Compensatory mitigation required to offset impacts to Bottomland Hardwood – Wet will be implemented (See Appendix K, *Mitigation Plan,* for details)
2) Avoidance methods and the use of buffer and "no-work" zones for the minimization of impacts on wetlands and non-jurisdictional BLH would be used.
3) Potential impacts to SAV in Lake Pontchartrain would be avoided. Pre-construction surveys would be required to delineate existing SAV to facilitate avoidance of impacts. SAV surveys and avoidance of impacts would be included in construction contract solicitation language.
4) No borrow excavation or work areas would be permitted in the area designated as wetlands. Wetlands would be protected through implementation of BMPs. These practices include installation of a silt fence around areas of excavation and maintaining a 100-foot buffer between the fence and wetlands areas in order to prevent surface runoff discharge into the wetlands.
5) A SWPPP and daily inspections by borrow personnel and other BMPs designed to protect wetlands as necessary would be used.
6) BMPs would be implemented to ensure adjacent wetlands and waters of the United States are not impacted by runoff during construction. Construction-related run-off into the wetlands would be managed through BMPs, which would minimize the potential indirect adverse impacts from considered action alternatives on wetlands. BMPs are effective, practical, structural or nonstructural methods which prevent or reduce movement of sediment, nutrients, pesticides, and other pollutants from the land to surface or ground water, or which otherwise protect water quality from potential adverse effects of construction activities. BMPs would be used to minimize construction related impacts along the entire study area.
7) Borrow areas would be selected to avoid impacts to wetlands and non-jurisdictional BLH.
8) All fill material used for levee lift construction would be free from contaminants.
9) All fill material would be placed by qualified contractors using the appropriate equipment to minimize impacts on wetland areas and equipment would be properly maintained.

7.5 UPLANDS

7.5.1 REGULATORY FRAMEWORK

This uplands resources section addresses compliance for the following applicable environmental laws and regulations:

- Fish and Wildlife Coordination Act
- Section 906(d) of WRDA 1986

Impacts to uplands would be considered significant if an alternative resulted in substantial loss and conversion of upland habitats.

7.5.2 IMPACTS OF CONSIDERED ALTERNATIVES

NO ACTION ALTERNATIVE – The habitat within all of the levee footprints is grass turf. The project areas of all reaches have been highly disturbed as a result of HSDRRS construction. The levee reaches were replanted with grass turf following completion of HSDRRS levee construction and are maintained by periodic mowing. Herbaceous woody vegetation is not allowed to take root within the levee footprint or the "vegetation-free zone" which extends 15 feet past the toe of each levee reach. It was assumed that the existing levee would be maintained to keep turf grass growing and woody species from establishing. The existing levee would be mowed routinely as necessary. In general, upland resources would remain similar to existing conditions; however, some uplands in the vicinity of the study area may become more saturated due to relative sea level rise and regional subsidence. There would be less than significant direct or indirect impacts to uplands within the project area if the levee lifts were not constructed.

ALTERNATIVES 2 AND 3 – Alternatives 2 and 3 would have similar impacts unless otherwise noted below.

***Direct Effects* –** Direct impacts would result from the clearing of approximately 1,760 acres of the existing turf grass and associated organic material for both proposed action alternatives. The waste material would be disposed of in compliance with all applicable federal, state and local laws. Following the completion of construction, the levee slopes would be re-vegetated and turf grasses maintained similar to pre-construction conditions.

***Indirect Effects* –** Indirect effects of construction (e.g., increased turbidity, noise, vibrations, fugitive dust, etc.) would have temporary effects to the upland habitats. Overall, the uplands would stabilize following construction, allowing sediment to settle and vegetation to stabilize the area.

Impacts to uplands within the proposed footprint of the levee lifts and floodwall raises are anticipated to be less than significant.

GENERALIZED BORROW AREAS – Excavation of borrow areas would affect upland habitat. In general, borrow areas would likely consist primarily of agricultural lands (*e.g.*, sugarcane fields, pasture), fallow agricultural lands, pine plantations, existing borrow sites, or formerly developed land. Any new upland borrow areas used for the proposed action would be cleared of existing vegetation, excavated, and would most likely convert to open water habitat, reducing forage and breeding habitat for upland wildlife. Alternative 2 would require approximately 177 acres of borrow area to supply fill for construction. Alternative 3 would require approximately

362 acres of borrow area to supply fill for construction. (Alternative 3 quantities were not updated during feasibility level design.) Borrow areas would be located in uplands. Borrow areas would meet the assumptions outlined in Section 7.1.4, including avoiding impacts to BLH-Dry habitat.

Therefore, borrow areas would have moderate, significant impacts to uplands.

7.5.3 CUMULATIVE IMPACTS

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 study area, in combination with the 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 the 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 provides forested resources is a long-term, moderate cumulative impact.**

7.5.4 ENVIRONMENTAL COMMITMENTS

To minimize impacts to upland resources, the following environmental commitments shall be implemented:

- USFWS recommendations for identification of borrow areas would be followed to the greatest extent practicable.
- Applicable mitigation measures, as described in Section 5.3.1.8 in the Comprehensive Environmental Document, Phase 1 (USACE, 2013) would be followed, including:
    - Tree protection measures
    - Pre-construction surveys for nesting birds
    - Limit removal of trees in forested wetlands to the fall or winter

7.6 FISHERIES

7.6.1 REGULATORY FRAMEWORK

This fisheries resources section addresses compliance for the following applicable environmental laws and regulations:

- Fish and Wildlife Coordination Act
- Coastal Zone Management Act
- Marine Mammal Protection Act
- Magnuson-Stevens Fishery Conservation and Management Act

Impacts to fisheries would be considered significant if an alternative resulted in substantial loss of desired aquatic habitat for native species or the direct loss of fishes within the study area as a result of implementing the proposed actions.

7.6.2 IMPACTS OF CONSIDERED ALTERNATIVES

NO ACTION ALTERNATIVE – RLSC would likely increase saltwater intrusion and exacerbate ongoing conversion of estuarine wetlands to shallow open water resulting in loss of existing estuarine fish habitats. RLSC could exacerbate ongoing conversion of existing aquatic organism distributions from an estuarine-dependent to more marine-dependent distribution. As habitat loss continues, there would likely be a corresponding reduction in overall species diversity and abundance as well as a loss of estuarine nursery, foraging, refugia, and other estuarine aquatic habitats.

Although fisheries productivity has remained high (Caffey & Schexnayder, 2002) as Louisiana has experienced tremendous marsh loss, this level of productivity may be unsustainable. As marsh loss occurs, a maximum marsh to water interface (i.e., edge) is reached (Browder, Bartley, & Davis, 1985). A decline in this interface would follow if marsh loss continues and the overall value of the area as fisheries habitat would decrease (Minello, Able, Weinstein, & Hays, 2003). Because fishery productivity is related to the extent of the marsh to water interface (Faller, 1979; Dow, Herke, Knudsen, Marotz, & Swenson, 1985; Zimmerman, Minello, & Zamora, 1984), it is reasonable to expect fishery productivity to decline as the amount of this interface decreases.

PROPOSED ACTION ALTERNATIVES – For Alternatives 2 and 3, impacts on fisheries are identical. In addition, similar impacts to fisheries productivity as described in the No Action Alternative would be anticipated.

Direct Effects – The placement of stone foreshore protection along the shoreline of Lake Pontchartrain to bring existing foreshore protection back up to the proper elevation for levee protection would permanently re-cover approximately 75.1 acres of lake bottom habitat. The removal of this habitat represents proportionately a very small area of similar aquatic habitat within the expanse of Lake Pontchartrain, which has an area of over 400,000 acres.

The dredging and material stockpiling to provide access to deliver and place the stone for foreshore protection could temporarily displace and possibly destroy the benthic organisms within a total area of approximately 212.5 acres of Lake Pontchartrain. All stockpiled material would be returned to its original location upon project completion. Increased turbidity from access dredging could affect fish and other organisms by clogging gills, reducing growth rates, and adversely affecting egg and larval development. However, most mobile species would avoid the areas temporarily impacted by dredging as well as shoreline areas that would be permanently lost due to filling. Stockpile areas would be brought to pre-construction lake bottom elevations upon project completion, which would minimize impacts to the lake bottom and re-establish fish habitat in the area. Impacts to less mobile benthic species from these activities likely would occur, but would be temporary, approximately 1.5 years to 2.5 years in duration, with effects lasting until the areas stabilize. Once the proposed action is complete, sediment would settle, benthos would repopulate, and fish and other mobile aquatic species would return.

Potential impacts to SAV in Lake Pontchartrain would be avoided. Pre-construction surveys would be required to delineate existing SAV to facilitate avoidance of impacts. SAV surveys and avoidance of impacts would be included in construction contract solicitation language.

Indirect Effects – Less than significant, indirect, minor, short-term, construction-related impacts on fisheries may include decreased DO levels in the waters immediately surrounding the construction site, increased turbidity due to construction runoff and sedimentation, and increased water body temperature due to increased suspended solids produced during construction that could absorb incident solar radiation. Temporary, minor water quality impacts could occur due to increased nutrient loading, miscellaneous debris, and accidental spills from construction equipment. Any of these localized changes in water quality could cause fish to temporarily avoid impacted areas and seek refuge in nearby suitable habitat. Water quality impacts in the project area would be temporary during project construction and would be minimized by the movement of the tides and the use of silt curtains and other best management practices. After construction, conditions would be expected to stabilize and return to conditions similar to pre-construction.

Overall, impacts on fisheries and fish habitat as result of the proposed action are anticipated to be less than significant.

GENERALIZED BORROW AREAS – Borrow areas are anticipated to be located in uplands so no direct or indirect impacts to fisheries habitat are anticipated. If borrow areas are identified near aquatic habitat, then potential impacts would be evaluated, as necessary, in a site-specific NEPA document. If borrow areas no longer in production are converted to open water habitat and fish are introduced, then abandoned borrow pits may provide fish habitat in the future.

7.6.3 CUMULATIVE IMPACTS

Direct cumulative adverse impacts on fisheries and fish habitat are associated with the actual construction activities, the associated dredge, fill, and material stockpiling activities, and water body displacement. These impacts would be primarily during the construction period. The total area within the study area potentially affected would be small and most areas would be affected only temporarily. The study area would be modified very slightly relative to the magnitude of historical changes within the study area.

Rain events during past and on-going risk reduction construction activities have caused sedimentation and contamination of waterways from storm water runoff (USACE, 2013). Alterations in water quality from sediment loading adversely impacted fisheries by lowering DO and increasing water temperatures. Additional adverse impacts on fish and other aquatic organisms from sediment suspension and siltation in water adjacent to risk reduction construction activities included clogged gills, reduced growth rates, and disruption of egg and larval development (USACE, 2013).

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. Past, present, and future human-induced changes to aquatic and wetland habitats in the vicinity of the study area would have adverse impacts to fisheries related to loss of habitat and overall productivity.

Storm damage reconstruction and transportation projects in the region are anticipated to result in less than significant 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. Hurricane and coastal storm risk reduction projects and 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.

Hurricane and coastal storm risk reduction projects and flood risk reduction projects, combined with other regional coastal and marsh restoration projects, would result in fish habitat with greater heterogeneity and interspersion and lower salinity levels. Hurricane and coastal storm risk reduction projects and flood risk reduction projects would also provide beneficial impacts on fish habitat through the reduction of storm surge inundation via increased hurricane and coastal storm damage reduction. Future regional projects also provide opportunities for dredged material from 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 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.

Therefore, less than significant cumulative impacts to fisheries and fish habitat are anticipated.

7.6.4 ENVIRONMENTAL COMMITMENTS

To minimize impacts to fisheries resources, the following environmental commitments shall be implemented:

1) Direct and indirect impacts associated with foreshore protection would be minimized by the use of BMPs to control sediment transport.
2) Potential impacts to SAV in Lake Pontchartrain would be avoided. Pre-construction surveys would be required to delineate existing SAV to facilitate avoidance of impacts. SAV surveys and avoidance of impacts would be included in construction contract solicitation language.
3) Continued coordination with natural resources agencies to ensure final design of features would enhance fish habitat to the fullest extent practicable.

7.7 ESSENTIAL FISH HABITAT

7.7.1 REGULATORY FRAMEWORK

- Magnuson-Stevens Fishery Conservation and Management Act

Mandatory Contents of EFH Assessment

Per 50 CFR 600.920(e)(3), all EFH assessments must include the following information:

- Description of the action
- Analysis of the potential adverse effects of the action on EFH and the managed species
- Federal agency's conclusions regarding the effects of the action on EFH
- Proposed mitigation, if applicable

Mandatory contents of the EFH assessment for the LPV GRR can be found at the following locations within this document:

1. **Description of the action.** A description of each of the proposed Alternatives, a description of each considered alternative is provided in Section 6.5, above.
2. **Analysis of the potential adverse effects of the action on EFH and the managed species.** An analysis of the direct, indirect, and cumulative impacts of the Alternatives on EFH and managed species can be found below in this section. A description of historic and existing conditions of EFH in the project area can be found in Section 4 above. An analysis of the direct, indirect, and cumulative impacts of the Alternatives on fisheries in general can be found in Section 7.6 above.
3. **Federal agency's conclusions regarding the effects of the action on EFH.** Despite some adverse impacts to EFH, the project is expected to result in only minor short-term adverse effects on EFH when compared to the No Action Alternative. Specific conclusions regarding the effects on EFH can be found within the analysis of direct, indirect, and cumulative impacts of each Alternative in Sections 7.7.2 and 7.7.3 below.
4. **Proposed mitigation, if applicable.** No mitigation is proposed. Environmental commitments to minimize impacts are listed in Section 7.7.4.

7.7.2 IMPACTS OF CONSIDERED ALTERNATIVES

NO ACTION ALTERNATIVE – RSLC (as described above in Section 2.2.2 and Section 5.2.1) will likely increase saltwater intrusion and exacerbate ongoing conversion of estuarine wetlands to shallow open water resulting in loss of existing EFH. RSLC could exacerbate ongoing conversion of existing aquatic organism distributions from an estuarine-dependent to more marine-dependent distribution. As habitat loss continues, there will likely be a corresponding reduction in overall species diversity and abundance as well as loss of estuarine nursery, foraging, refugia, and other estuarine aquatic habitats. The study team assumed that the degradation or loss of important EFH would continue and impact species in and near the vicinity of the study area.

Without implementation of the proposed action, there would be no actions taken to lift the LPV levees. However, maintenance activities would continue to occur. Two hundred and twelve acres of lake bottom would not be impacted for approximately 1.5 to 2.5 years by dredging, stockpiling, and re-placing foreshore protection.

PROPOSED ACTION ALTERNATIVES – Impacts of Alternative 2 and 3 are expected to be identical for EFH.

***Direct Effects* –** Dredging of access channels, adjacent stockpiling, and placement of stone foreshore protection along the shore of Lake Pontchartrain would disturb 212.5 acres of lake bottom and would permanently impact 75.1 acres of shallow lake bottom habitat. These localized construction activities could cause mobile aquatic species to temporarily avoid impacted areas and seek refuge in nearby suitable habitat. 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 and stockpiling activities through the loss of individuals. A temporary loss of invertebrates could also occur with construction activities, causing a temporary loss of forage habitat for finfish and shrimp. Temporary access channels and stockpile areas would be returned to previously existing grade upon completion of construction. This would allow for re-colonization by benthic organisms. Potential impacts to SAV in Lake Pontchartrain would be avoided. Pre-construction surveys would be required to delineate existing SAV to facilitate avoidance of impacts. SAV surveys and avoidance of impacts would be included in construction contract solicitation language. Overall, the temporary impacts and permanent removal of habitat associated with construction activities represent a proportionately very small area (approximately 287 acres) of similar aquatic habitat within the expanse of Lake Pontchartrain, which has an area of over 400,000 acres.

***Indirect Effects* –** Indirect, minor, short-term, construction-related impacts on EFH may include decreased DO levels in the waters immediately surrounding the construction site, increased turbidity due to construction runoff and sedimentation, and increased water body temperature due to increased suspended solids produced during construction that could absorb incident solar radiation. Temporary, minor water quality impacts could occur due to increased nutrient loading, miscellaneous debris, and accidental spills from construction equipment. Any of these localized changes in water quality could cause mobile aquatic species to temporarily avoid impacted areas and seek refuge in nearby suitable habitat. Water quality impacts in the project area would be temporary during project construction and would be minimized by the movement of the tides and the use of silt curtains and other BMPs. After construction, conditions would be expected to stabilize and return to conditions similar to pre-construction. No conversion of aquatic habitat to upland habitat is anticipated in designated EFH areas so no permanent loss of EFH is anticipated with construction of levee lifts or floodwall raises.

GENERALIZED BORROW AREAS – Impacts on EFH or managed species would not occur with use of existing borrow areas known to be used from within and outside the study area because they are not located in intertidal or estuarine areas. Borrow areas are anticipated to be located in uplands so no direct impacts to EFH are anticipated. Indirect impacts on EFH from future borrow area excavation could occur if borrow areas are located near aquatic habitat. If necessary, specific impacts on EFH would be identified in site-specific NEPA documents prepared after borrow areas have been identified.

Due to the localized nature of impacts related to the proposed action, it is anticipated that Alternatives 2, 3 and potential borrow areas would have less than significant impacts to EFH.

7.7.3 CUMULATIVE IMPACTS

The combination of past and ongoing regional work would contribute to cumulative loss of EFH in the vicinity of the study area. Regional projects would adversely impact EFH by causing direct habitat loss through the filling of waterways and marshes and dredging of waterways. Indirect cumulative effects 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 and 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 process 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 would offset some of these historic losses of EFH.

The incremental cumulative effect of the Proposed Actions were determined to be less than significant.

7.7.4 ENVIRONMENTAL COMMITMENTS

To minimize impacts to EFH, the following environmental commitments shall be implemented:

- BMPs to reduce sedimentation and erosion into adjacent water bodies during construction
- Potential impacts to SAV in Lake Pontchartrain would be avoided. Pre-construction surveys would be required to delineate existing SAV to facilitate avoidance of impacts. SAV surveys and avoidance of impacts would be included in construction contract solicitation language.
- Continued coordination with natural resources agencies to ensure final design of features enhance fish habitat to the fullest extent practicable

Per letter dated 7 Feb 2020 (See Appendix G, *Environmental Compliance*), NOAA's National Marine Fisheries Service (NMFS) reviewed the draft EIS and the TSP for LPV. With the inclusion of SAV avoidance measures and construction contract solicitation language, the NMFS does not object to the project as proposed and concludes that CEMVN's responsibilities to meet the requirements of 50 CFR 600.920(k) have been satisfied. NMFS did not provide any Conservation Recommendations.

7.8 WILDLIFE

7.8.1 REGULATORY FRAMEWORK

This wildlife resources section addresses compliance for the following applicable environmental laws and regulations:

- Fish and Wildlife Coordination Act
- Bald and Golden Eagle Protection Act of 1940, as amended
- Migratory Bird Treaty Act of 1918
- EO 13186, Responsibilities of Federal Agencies to Protect Migratory Birds

Impacts to wildlife would be considered significant if an alternative resulted in substantial loss of native wildlife habitat or the direct loss of wildlife within the study area as a result of implementing the proposed actions.

7.8.2 IMPACTS OF CONSIDERED ALTERNATIVES

NO ACTION ALTERNATIVE – Without implementation of the proposed action, there would be no actions taken to lift the LPV levees or raise floodwalls. However, maintenance activities associated with HSDRRS would continue to occur. Wildlife that currently utilize the levees would continue to do so with negligible temporary disturbance from maintenance activities.

RSLR, human encroachment and development, and other factors would result in the continued loss of habitat. RSLR would increase saltwater intrusion and exacerbate ongoing conversion of marsh habitat to shallow open water. Figure 7-4 depicts the anticipated wildlife habitat landscape of the study area and vicinity in 2067 based on CPRA 2017 Master Plan data. As habitat loss continues, migratory bird species would have less suitable stopover habitat forcing them to fly further distances to suitable habitat. Most mammalian, amphibian, and reptilian species would migrate to habitats that are more suitable. Wildlife would benefit from restoration activities implemented by other programs; however, these activities are not likely to be enough to keep up with the current trends in habitat loss and relative sea level rise (See Section 5.2.1 above).

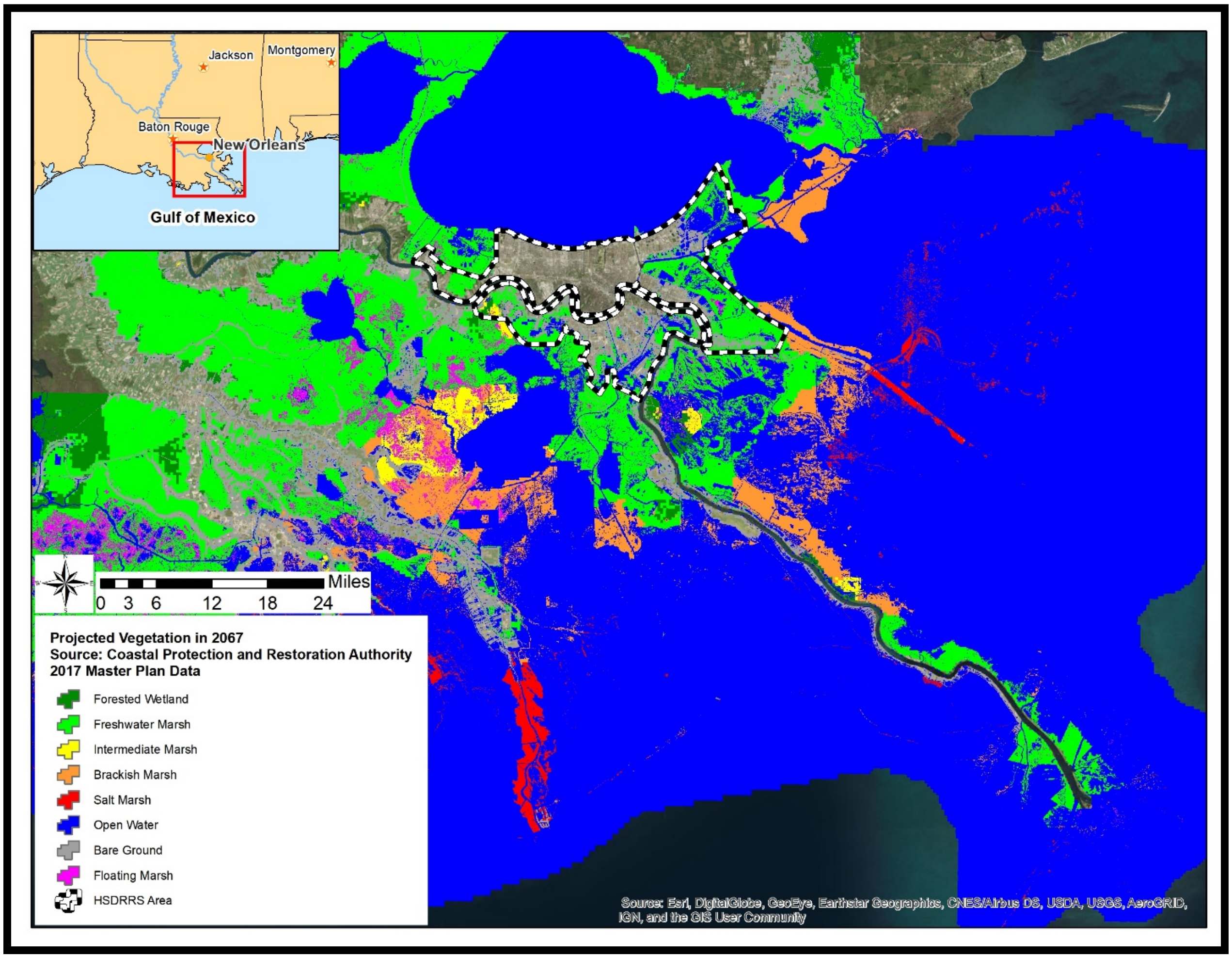


Figure 7-4. Projected habitats in year 2067 based on CPRA 2017 Master Plan data (medium scenario, with Master Plan implementation)

Under the No Action Alternative, no borrow areas would be utilized for the improvement of LPV levees. However, because known borrow sites are existing operating businesses, these borrow sites may continue to be used for activities by others. As the sites are excavated, wildlife would be temporarily displaced. Once the sites have been fully excavated, they may be converted to ponds and small lakes which may provide some wildlife habitat. Any excavated borrow pits that remain dry would be expected to be colonized by vegetation and woody plants. As vegetation density increases, the pit could attract a variety of wildlife including birds, reptiles, amphibians, and small mammals.

PROPOSED ACTION ALTERNATIVES – Impacts of Alternatives 2 and 3 are expected to be identical.

***Direct Effects* –** Wildlife in the vicinity of the study area (see Section 4.8 for common species in the study area impacted) may be temporarily stressed as a result of construction from increases in noise and traffic. Wildlife would be directly impacted by the loss of habitat in bottomland hardwoods areas adjacent to Mississippi River levees. Mobile wildlife species, such as rodents and birds, would be expected to leave the area during construction activities. Mortality rates for smaller, less mobile wildlife species such as amphibians and reptiles may increase during turf removal and grading activities on the levees. Following completion of construction, occasional direct and indirect impacts to less mobile species would continue to occur during routine maintenance. Most species of mobile organisms would likely relocate to nearby extensive wetlands and shoreline habitats. The habitat value of the maintained levees is limited, and large wildlife species, predominantly birds and small mammals that hunt and forage in the levee turf grass and adjacent vegetation, do not generally shelter or nest there. These species would be expected to move to nearby habitat for these activities during construction. Given the extent of similar or higher quality habitats in the vicinity of the levee lifts, wildlife movement would not result in impacts to the carrying capacity of nearby environments. Re-vegetating the area with turf grass would restore this temporarily lost terrestrial habitat, and wildlife species would return once construction activities are complete.

Protected species that may occur in the coastal parishes of this study area include colonial nesting water/wading birds including the formerly listed brown pelican (*Pelecanus occidentalis*) and various raptors including the formerly listed bald eagle (*Haliaeetus leucocephalus*) and the peregrine falcon (*Falco peregrines*).

The flood-side levee shift required along the MRL would result in a loss of BLH-Wet habitat, which is important to wildlife resources and is currently limited in coastal Louisiana. Alternative 2 would result in 20.3 acres converted and Alternative 3 would require 28.4 acres converted. (Alternative 3 quantities were not updated during feasibility level design.) These impacts to BLH-Wet would be offset through mitigation (See Appendix K, *Mitigation Plan*), but the loss of this habitat along the Mississippi River would still be significant to wildlife, including wetland game and non-game species.

***Indirect Effects* –** 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 study area, and wildlife would migrate to other adjacent habitats.

Alternatives 2 and 3 are anticipated to have moderate, significant impacts to wildlife resources due to the loss of BLH-wet habitat adjacent to Mississippi River levees.

GENERALIZED BORROW AREAS – As borrow sites are excavated, wildlife would be displaced. 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. The lands surrounding potential borrow areas likely contain a variety of mammals, birds, reptiles, and amphibians. Species likely inhabiting the area include nutria, muskrat, raccoon, white-tailed deer, rabbits, squirrels, and a variety of smaller mammals. If borrow areas hold water and water quality is adequate then herons, egrets, wood ducks, and migratory waterfowl may use these waters. Lands surrounding open waters and borrow pits may offer habitat to mammals, birds, reptiles, and amphibians; however, wildlife habitat within an active borrow area is limited. Any potential borrow site used for the proposed action would require environmental clearance and coordination with state and federal agencies. **Therefore, impacts to wildlife associated with borrow areas would be less than significant.**

7.8.3 CUMULATIVE IMPACTS

The work on the LPV reaches discussed in this EIS, combined with previous HSDRRS construction, ongoing development and work on the additional reaches in the vicinity, could impact similar wildlife species. Loss of wetlands and BLH habitat from 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, noise, and other disturbances. The displacement of wildlife from turf grass habitat would be temporary during the construction period, and the displaced individuals likely would return following project completion. Secondly, this habitat is similar to that which covers extensive areas in the New Orleans region, such as residential lawns and parks, and is not expected to exceed the carrying capacity of this adjacent habitat, so cumulative impacts to wildlife are expected to be minimal. Lastly, the reaches discussed in this EIS are not in close enough proximity to the majority of the other reasonably foreseeable levee lifts, so they are not likely to impact the same local populations of wildlife utilizing the levees in those other areas.

Thus, the potential cumulative impact on wildlife from the proposed action in conjunction with other construction projects in the region would be a moderate, significant impact due to the loss of BLH-wet habitat.

7.8.4 ENVIRONMENTAL COMMITMENTS

To minimize impacts to wildlife resources, the following environmental commitments shall be implemented:

1) Biological monitoring during construction activities
2) Use of dust suppression methods such as watering of construction sites
3) Pre-construction colonial nesting bird surveys conducted by USFWS and USACE and avoidance of active nests
4) Prevention of colonial nesting birds from establishing active nests within the project construction right-of-way to prevent nesting close to the noise and disturbance caused by the construction activities. If birds were allowed to establish nests in these areas, they could ultimately abandon eggs or hatchlings.
5) Recommendations to minimize potential project impacts to eagles and their nests are provided by LDWF in Appendix L and USFWS in their National Bald Eagle Management Guidelines and these recommendations would be followed during construction of the proposed actions. Pre-construction surveys, buffer areas, and construction seasons may be required.

6) USFWS recommends that a qualified biologist inspect the proposed work sites for the presence of undocumented nesting colonies during the nesting season (e.g. February through September depending on the species). If colonies exist, work should not be conducted within 1,000 feet of the colony during the nesting season.

7.9 THREATENED & ENDANGERED SPECIES

7.9.1 REGULATORY FRAMEWORK

This Threatened and Endangered Species section addresses compliance for the following applicable environmental laws and regulations:

- Endangered Species Act Section 7 (See Appendix G for full compliance details)

Significant Impacts to Threatened and Endangered Species are:

- A direct, adverse effect on a species protected under the ESA or an unmitigated loss of critical habitat that diminishes a regional population
- An unmitigated net loss of habitat value or sensitive habitat of special biological significance
- A substantial loss to the population of any protected species

7.9.2 IMPACTS OF CONSIDERED ALTERNATIVES

NO ACTION ALTERNATIVE – Degradation and loss of important fish and wildlife habitats would continue due to human development and natural forces. Many different fish and wildlife species use these habitats for shelter, nesting, feeding, roosting, cover, nursery, and other life history requirements. The loss and deterioration of transitional wetland habitats would continue to adversely impact all listed species in and near the vicinity of the study area. It is assumed the positive impacts of federal, state, local, and private restoration and recovery projects and programs would offset, to some degree, the adverse cumulative impacts on listed species.

It was assumed the degradation and loss of important essential fish and wildlife habitats would continue. Many different fish and wildlife species use these habitats for shelter, nesting, feeding, roosting, cover, nursery, and other life history requirements. The loss and deterioration of transitional wetland habitats would continue to adversely impact all listed species in and near the vicinity of the study area. It is assumed that the positive impacts of federal, state, local, and private restoration and recovery projects and programs would offset, to some degree, the adverse cumulative impacts on listed species.

PROPOSED ACTION ALTERNATIVES AND GENERAL BORROW AREAS – Alternatives 2 and 3 are expected to have identical impacts to Threatened and Endangered Species. Appendix G provides additional details on direct and indirect impacts to Threatened and Endangered Species. Table 7-5 summarizes the impacts for proposed action alternatives and generalized borrow areas.

1) *West Indian Manatee* – USACE determined that the potential for a manatee to be in the project area during construction was unlikely, and that the proposed action was not likely to adversely affect this species. USACE committed to implement BMPs to further reduce the potential effects. These measures include, but are not limited to, reducing vessel traffic speed, posting signs of the potential presence of manatees, and halting construction activities in the event a manatee is observed in the area.

2) *Gulf Sturgeon* - During construction, temporary, minor impacts to water quality would occur. Construction of foreshore protection would have a minor, permanent impact to approximately 24.3 acres of critical habitat along the Lake Pontchartrain shoreline that was previously impacted by foreshore protection placement. Construction of access channels and adjacent stockpiles would temporarily impact approximately 178.2 acres of critical habitat. Mitigation measures to minimize impacts to Gulf sturgeon would be necessary to minimize any potential impacts. Overall impacts to Gulf sturgeon and Gulf sturgeon critical habitat are expected to be insignificant due to their temporary nature and the relatively small footprint in comparison to the size of other available habitat. USACE determined that the proposed action is not likely to adversely affect this species.
3) *Pallid Sturgeon* – During construction, potential impacts could include increased turbidity, noise, and disruption of migration path. Mitigation measures to minimize impacts to pallid sturgeon would be necessary to minimize any potential impacts. These effects are expected to dissipate upon completion of construction. USACE determined that the proposed action was not likely to adversely affect this species.
4) *Sea Turtles* – Five species of sea turtles have the potential to be affected by water quality impacts or by direct injury of mortality. The study team determined that the proposed action was not likely to adversely affect these species but committed to implement BMPs to further reduce the potential effects. These measures include, but are not limited to, construction personnel instruction, siltation barrier requirements, reducing vessel traffic speed, and halting construction in the event a sea turtle is observed.

Overall, the Proposed Actions, including borrow areas, would be less than significant for Threatened and Endangered Species.

Table 7-5. Lake Pontchartrain and Vicinity Summary of Threatened and Endangered Species ESA Determination

Common Name	Alternative		Generalized Borrow Areas
	2	3	
West Indian Manatee	May affect, but is not likely to adversely affect	May affect, but is not likely to adversely affect	No effect
Gulf Sturgeon and Gulf Sturgeon Critical Habitat	May affect, but is not likely to adversely affect	May affect, but is not likely to adversely affect	No effect
Pallid Sturgeon	May affect, but is not likely to adversely affect	May affect, but is not likely to adversely affect	No effect
Sea Turtles	May affect, but is not likely to adversely affect	May affect, but is not likely to adversely affect	No effect

By letters dated 10 December 2019 and 23 April 2020, USFWS and NMFS, respectively, concurred with the not likely to adversely affect determinations.

7.9.3 CUMULATIVE IMPACTS

Past, ongoing, and future construction of hurricane and storm damage reduction project and flood risk reduction projects and the associated excavation of borrow areas contribute to cumulative impacts on water quality of protected species habitat in the study area.

Direct impacts on protected species habitat would occurred as a result of past filling of waterways and wetlands for right-of-way for the HSDRRS. The direct cumulative impacts on protected species habitat are associated with construction activities likely causing increased sedimentation of waterways from stormwater runoff during rain events. The direct impacts include changes in water temperature, salinity, turbidity, DO, hydrology, and water velocity. These water quality impacts would impact the protected species by degrading their aquatic habitat and potentially impacting their food sources, abilities to forage, and visibility for migration and escape from predators. Within much of the study area, no cumulative direct or indirect impacts on protected species would be expected to occur. Cumulative indirect, long-term impacts from the conversion of natural areas could increase marsh fragmentation, alter hydrology, and in turn affect habitat quality, degrading habitat for some protected species.

Other projects proposed in southeastern Louisiana could potentially lessen impacts from implementation of LPV, including other coastal and wetland restoration projects. Projects such as these would provide cumulative long-term beneficial impacts on protected species. Some of these projects in southeastern Louisiana would include restoration projects which create numerous acres of marsh through the beneficial placement of dredged sediments from the Mississippi River. Enhancement of habitat through wetlands and coastal restoration projects would provide long-term benefits to the area and would be beneficial to protected species.

The work on the LPV reaches discussed in this EIS, combined with work on the additional reaches in the vicinity, may affect but is not likely to adversely affect threatened and endangered species resulting in less than significant cumulative impacts.

7.9.4 ENVIRONMENTAL COMMITMENTS

To minimize impacts to threatened and endangered species, the following environmental commitments shall be implemented:

1) Use specific construction times to avoid threatened and endangered species
2) BMPs to reduce sedimentation and erosion into adjacent water bodies during construction
3) During construction, standard manatee protection measures as outlined in Appendix G would be implemented to minimize potential impacts to manatees.
4) During construction, standard Gulf sturgeon protection measures as outlined in Appendix G would be implemented to minimize potential impacts to Gulf sturgeon.
5) During construction, standard sea turtle protection measures as outlined in Appendix G would be implemented to minimize potential impacts to sea turtles.
6) Potential impacts to SAV in Lake Pontchartrain would be avoided. Pre-construction surveys would be required to delineate existing SAV to facilitate avoidance of impacts. SAV surveys and avoidance of impacts would be included in construction contract solicitation language.

7.10 INVASIVE SPECIES

7.10.1 REGULATORY FRAMEWORK

This invasive species section addresses compliance for the following applicable environmental laws and regulations:

- EO 13112, Invasive Species

- EO 13751, Safeguarding the Nation from the Impacts of Invasive Species

Impacts to invasive species would be considered significant if an alternative resulted in a substantial spread or introduction of invasive species into the study area as a result of the proposed action.

7.10.2 IMPACTS OF CONSIDERED ALTERNATIVES

NO ACTION ALTERNATIVE – Invasive species would likely continue to pose a threat in and near the study area. Landscape disturbances and deteriorations would be expected to continue into the future allowing for continued and expanded invasions by non-native species. Existing native vegetative communities would be expected to degrade and become vulnerable to infestation. Invasive species would replace native vegetation, forming monoculture stands of dense vegetation. Habitats may realize some benefit from establishment of invasive species in some areas. For example, the robust above and belowground production of cogongrass (*Imperata cylindrical*) may provide substrate stabilization and biomass contributions; or water hyacinth (*Eichhornia crassipes*) may provide potential water quality improvement through nutrient uptake and retention. However, it is expected that the overall adverse impacts of invasive species spread and abundance into the future outweigh the potential benefits. Expected adverse impacts may include reduced vegetative biodiversity, alteration of soil properties and ecosystem processes, and reduction in wildlife food and habitats. The existing invasive species found in the study area would likely continue and new invasive species not yet identified may become established in the future. Federal, state, and local laws, programs, and regulations aimed at invasive species management and control would be expected to continue.

PROPOSED ACTION ALTERNATIVES AND GENERALIZED BORROW AREAS – Alternatives 2 and 3 are expected to have identical impacts to invasive species. It is expected that the existing invasive species found in the study area would not be affected by the proposed actions. Invasive species are expected to persist with or without any of the proposed actions. The indirect adverse effect documented post HSDRRS construction was the potential for unchecked growth of Chinese tallow and other invasive plant species in borrow areas and this indirect effect may also occur with LPV construction.

The Proposed Action Alternatives and potential borrow areas would have less than significant impacts on invasive species.

7.10.3 CUMULATIVE IMPACTS

Past and ongoing construction projects have contributed to the introduction and spread of invasive species in the study area. The cumulative adverse impacts to the region include reduced biodiversity and altered ecosystem processes. Periodic eradication of invasive/nuisance plant species within the study area are expected to continue by private, non-federal, and federal entities. Ongoing mitigation enhancement projects and coastal and wetland restoration projects target eradicating of invasive and nuisance plants followed by plantings of native species. These efforts would lessen the adverse impacts locally; regionally, however, invasive species are expected to continue to have adverse impacts to the environment.

The proposed action, when considering the past, ongoing, and future actions would have negligible, less than significant cumulative impacts on invasive species.

7.10.4 ENVIRONMENTAL COMMITMENTS

To minimize impacts to invasive species, the following environmental commitments shall be implemented:

1) During construction, steps would be taken to prevent the introduction and spread of invasive species to stay in compliance with EO 13751 (*Safeguarding the Nation from the Impacts of Invasive Species*) and EO 13112 (*Invasive Species*).

7.11 CULTURAL & HISTORICAL RESOURCES

7.11.1 REGULATORY FRAMEWORK

This cultural and historic resources section addresses compliance for the following applicable environmental laws and regulations:

- National Historic Preservation Act, Section 106
- Cultural Resources Management Presidential Memorandum regarding Government to Government Relations (April 29, 1994)
- EO 13007, Indian Sacred Sites
- EO 11593, Protection and Enhancement of the Cultural Environment
- Native American Graves Protection and Repatriation Act 43 CFR 10
- Archaeological Resources Protection Act of 1989

Impacts to cultural resources would be considered significant if an alternative resulted in a substantial adverse effect to a historic property such that implementation of the alternative would result in the destruction of the property or the loss of the property's eligibility for listing in the National Register of Historic Places.

7.11.2 IMPACTS OF CONSIDERED ALTERNATIVES

NO ACTION ALTERNATIVE – Without implementation of the proposed action the existing levees and floodwalls would not be modified. Routine maintenance of the existing levee would have no effect on cultural resources. Without the increased level of risk reduction from the implementation of the proposed action, cultural and historic resources that may exist within the study area would be at higher risk for adverse impacts associated with hurricane storm surge, flood events, and land loss. Erosion damage from flood events could expose previously buried archaeological deposits and remove the data potential the sites may possess.

The CEMVN identified archaeological and historic built resources listed in the NRHP within the LPV study area that could be impacted if there is levee failure or if overtopping occurs as a result of the 1% AEP storm event. Resources identified were based on a review of the *Louisiana Cultural Resources Map and the Standing Structures and Districts Map* provided by the Louisiana State Historic Preservation Officer (SHPO). The review revealed a total of three (3) National Register Historic Districts (NRHDs) listed in the NRHP and an archaeological site that could be impacted if there is levee failure or if overtopping occurs as a result of the 1% AEP storm event. Two of the districts, Holy Cross NRHD and Jackson Barracks NRHD, are located in Orleans Parish, while the Chalmette National Historical Park and the Guichard Plantation site are located in St. Bernard Parish. All three districts are within the Chalmette Loop sub-basin.

Holy Cross NRHD, listed in 1986, is roughly bounded by the Mississippi River, Delery St., Burgundy St. and the Industrial Canal. The historic district is significant under Criterion C in the area of architecture at the state level. The district includes a total of 634 contributing buildings dating from the period of 1850 to 1936, and 223 non-contributing buildings. The shotgun house type makes up over half of the building stock within the Holy Cross NRHD. Architectural styles within the district include Greek Revival, Italianate, Eastlake, Craftsman, Neo-Classical, Colonial, and Mission. According to the H&H results of the 1% AEP storm event, the eastern portion of the historic district could be impacted if there is levee failure or if overtopping occurs.

Listed in the NRHP in 1976, Jackson Barracks is significant at the state and national level under Criterion A in the area of military history for the role the barracks played in state and national military affairs from its construction in 1834 to 1955, the year the property was transferred to the State of Louisiana. Jackson Barracks is also nationally significant under Criterion C in the area of architecture as a rare surviving example of an antebellum garrison property type with Greek Revival and Neo-Classical WPA-era style buildings. Further, Jackson Barracks is significant at the state and national level under Criterion D for its potential to yield important information related to the theme of military history and its association with the Trail of Tears. Hurricane Katrina caused significant flooding and wind damage to the barracks property. As a result, many of the original buildings underwent rehabilitation or were demolished due to extensive damage. According to the H&H results of the 1% AEP storm event, the northern portion between Dauphine St. and St. Claude Ave. could be impacted if there is levee failure or if overtopping occurs. This portion of Jackson Barracks is known as Area B in the NRHP nomination and contains no historic resources and thus is not included in the historic district.

The Chalmette National Historical Park (Chalmette Unit of Jean Lafitte National Historical Park Historic District) was listed in the NRHP in 1974. The Chalmette National Historical Park is nationally significant in the areas of archaeology, architecture, military, and social history. The district includes 16 historically significant built resources and sites, including the Chalmette National Cemetery which contains over 15,000 burials.

The Guichard Plantation archeological site consists of the archaeological and structural remains of an 1800s sugar plantation. According to the H&H results of the 1% AEP storm event, impacts from levee failure or topping could occur within established boundaries of the site.

PROPOSED ACTION ALTERNATIVES – Alternatives 2 and 3 are expected to have identical impacts to cultural and historic resources.

Direct Effects: Less than significant direct impacts on cultural and historical resources are expected from implementation of the proposed actions within the existing LPV footprint and no adverse effects to historic resources within the existing footprint are anticipated. The proposed levee shifts of the Mississippi River Levee outside of the existing right of way, yet-to-be identified borrow areas, and other project features outside of the existing footprint have the potential to impact known and unknown cultural resources. To comply with Section 106 of the NHPA for the work that is co-located with the Mississippi River levee, the USACE would utilize the programmatic agreement, if necessary, developed for the Mississippi River Levee Supplemental EIS pursuant to 36 CFR 800.14(b) in consultation with the SHPOs, Tribes, Advisory Council on Historic Preservation (ACHP), and other interested parties. USACE consulted with SHPO, Tribes, and the ACHP on the utilization of HSSDRS mitigation methods and the programmatic agreement to address potential impacts for the LPV co-located work. If any unrecorded cultural resources are determined to exist within the proposed project boundaries, then no work would proceed in the area containing these cultural resources until a USACE archaeologist has been notified and final coordination with the SHPO and THPO has been completed.

Indirect Effects: Implementing the proposed action would have beneficial indirect impacts to cultural and historical resources by providing an added level of storm damage 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 storm events. Erosion of ground deposits during storm events can result in severe damage and destruction of archaeological sites.

Alternatives 2 and 3 could include the introduction of new visual elements (levee lifts and floodwall modifications and replacements) to the study area's viewshed that have the potential to indirectly impact known and previously undocumented cultural resources that may be listed or eligible for listing in the NRHP. The introduction of new visual elements that are inconsistent with the historic or cultural character of these resources could indirectly diminish the integrity of the property's setting, feeling, or association and/or cause changes to the integrity of feeling or character associated with a historic resource or Traditional Cultural Property (TCP). USACE will continue to coordinate with stakeholders to ensure impacts to cultural resources are avoided to the greatest extent practicable.

All proposed actions for LPV are committed to minimizing any potential for cultural resources impacts by USACE through the Section 106 process. **Therefore, impacts of Proposed Actions would be less than significant for cultural and historic resources.**

GENERALIZED BORROW AREAS – With implementation of the proposed action, borrow material would be removed from the borrow locations identified in the future. Any undiscovered cultural resources could be impacted by borrow activities. All new borrow areas would require Section 106 compliance, including evaluation to determine the existence of known cultural resources eligible for the National Record of Historic Properties. If borrow areas have not been surveyed for cultural resources, Phase I or Phase II cultural investigations would be necessary. If needed, cultural resources surveys would be conducted within the borrow locations and any identified potentially significant cultural resources will be avoided or mitigated through the Section 106 process. Compliance with NHPA Section 106 would be achieved during the NEPA and environmental compliance process for the new borrow sites. **The potential impacts would be negligible and less than significant as all impacts on cultural resources would be avoided or minimized through the Section 106 process.**

7.11.3 CUMULATIVE IMPACTS

Projects controlled by, and projects that acquire their funds from, federal sources are subject to Section 106 guidelines and processes under the National Historic Preservation Act. Under these laws, the federal entity is required to consider the effects of their projects upon cultural resources. 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 hurricane and coastal storm risk reduction, 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 affect cultural resources.

While many cultural resources surveys have been conducted within the vicinity of the proposed action, 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 view-shed 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 and federally recognized Tribes have been notified. **As such, other federal current and future regional projects would potentially have minor, less than significant, direct and indirect cumulative adverse impacts on cultural resources.**

7.11.4 ENVIRONMENTAL COMMITMENTS

To minimize impacts to cultural and historic resources, the following environmental commitments shall be implemented:

1) General cultural resources mitigation measures as outlined in Section 5.2.1.12.1 of the CED, Phase 1 (USACE, 2013) would be followed.
2) USACE developed a Programmatic Agreement pursuant to 36 CFR 800.14(b) in consultation with the SHPOs, Tribes, ACHP, and other interested parties for the portion of Recommended Plan that is co-located with the Mississippi River Levee. The stipulations of the Programmatic Agreement would be followed during project implementation of the co-located work.
3) USACE will continue to coordinate with Chalmette National Historical Park personnel to ensure impacts are avoided and minimized.
4) If new borrow sites are selected, USACE would be required to fully investigate the proposed borrow areas for the presence of cultural resources and consult with the SHPO and Tribes pursuant to Section 106 of the NHPA and complete additional NEPA documentation.

7.12 AESTHETICS

7.12.1 REGULATORY FRAMEWORK

This aesthetic resources section addresses compliance for the following applicable environmental laws and regulations:

- National Environmental Policy Act, 42 USC Section 4321, *et seq.*
- 1988 Visual Resources Assessment Procedure
- Wild and Scenic Rivers Act
- Scenic Byways
- Louisiana Scenic Rivers Act

Impacts to aesthetics (visual) would be considered significant if an alternative substantially degraded any existing institutionally, technically or publicly significant visual resource.

7.12.2 IMPACTS OF CONSIDERED ALTERNATIVES

NO ACTION ALTERNATIVE –

Under the No Action Alternative, the proposed action would not be constructed. The visual environment attributed to cultural landscapes and historic structures existing within the study area would be at risk for adverse impacts associated with storm events and land loss.

Physical and ecological changes, including vegetative succession occurring in the study area, determine the future of the study area’s visual landscape in the absence of new projects. Additionally, recreation and land use trends contribute to determine the landscape’s visual future. Future forecasts for the ecological, recreation, and land use resources can be found elsewhere in this document.

Existing borrow sites are actively used by private individuals, non-federal, and federal entities seeking borrow and are visually unappealing. Once abandoned, those sites may convert to lake or ponds. No change to aesthetic or visual resources values from the No Action Alternative would be expected.

PROPOSED ACTION ALTERNATIVES – Alternatives 2 and 3 are expected to have identical impacts.

***Direct Effects* –** The visual attributes of the study area would be temporarily impacted by construction activities at the project sites and by transport activities needed to move equipment and materials to and from the sites. Temporary impacts on visual resources would occur during actual implementation of the proposed actions when the area would contain construction equipment and staging areas. The levees and floodwalls would be similar in design and scale to the existing conditions, except slightly higher in elevation, and therefore permanent impacts would be less than significant. However, it is noted that with slightly higher elevations, the views may be impacted, but the impact was deemed less than significant. Turf grass would be re-established on the levees after construction, and the appearance of the levees would remain similar to the existing conditions.

***Indirect Effects* –** Maintaining the earthen levees and floodwalls would provide a continued benefit to aesthetic quality due to a reduction in properties damaged by both storm surge and flood events. The visual environmental surrounding would also indirectly affect the surrounding recreational and cultural and historic resources which are further discussed in Sections 7.11 and 7.13 of this document.

Therefore, the proposed action impacts on aesthetics would be less than significant.

GENERALIZED BORROW AREAS – The majority of the existing borrow areas are remote and inaccessible to the public. New borrow sites would be expected to further reduce the study area's aesthetic quality through the introduction of more disturbed borrow sites. Currently, the number and location of potential new borrow sites are unknown. If necessary, site-specific impacts will be discussed in site-specific NEPA documentation once specific sites have been identified.

7.12.3 CUMULATIVE IMPACTS

Short-term adverse cumulative impacts on visual resources has 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 would be minor, as most of the proposed actions remain similar to what previously existed, only at a higher elevation. Additionally, the cumulative impact of the reduction of threat to property posed from flooding would be beneficial to the regional aesthetic resources.

The use of borrow sites for proposed actions would have a cumulative minor impact on visual resources, because most borrow sites would be located on private land with limited to no public access, and where borrow sites are not backfilled, open water habitats would remain and in many cases are also aesthetically pleasing.

Cumulative long-term impacts on visual resources are still evident from Hurricanes Katrina and Rita in some parts of the study area and include degraded, damaged, or destroyed homes, facilities, and recreational parks in some of the areas. 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. Hurricane and coastal storm risk reduction projects, flood risk reduction projects, and coastal restoration projects would beneficially impact aesthetic resources and the overall visual view sheds within the study area, as the risk of coastal 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 study area by upgrading aging or failing infrastructure, which often contributes to a blighted visual quality within the area.

The proposed action and use of borrow sites would contribute to the permanent cumulative impacts on visual resources, but regionally, the cumulative impacts on aesthetics would be negligible and less than significant.

7.12.4 ENVIRONMENTAL COMMITMENTS

To minimize impacts to aesthetic resources, the following environmental commitments shall be implemented:

- Soil borrow sites for levee building material needed to construct the proposed levees are not specifically identified in this study; therefore, if the visual impacts caused by borrow areas differ from the generalized impacts documented here, further evaluation will be conducted during additional NEPA, as necessary.
- Architectural design concepts for floodwalls and other hard structure hurricane and coastal storm damage risk reduction features are not identified in this study; therefore, the visual impacts caused by hard structure hurricane and coastal storm damage risk reduction features will be evaluated during PED.
- If new borrow sites are selected, 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.

7.13 RECREATIONAL RESOURCES

7.13.1 REGULATORY FRAMEWORK

This recreational resources section addresses compliance for the following applicable environmental laws and regulations:

- CEQ 40 CFR 1508.27(b)(3) (NEPA evaluation of intensity of impacts)
- Wild and Scenic Rivers Act
- Louisiana Scenic Rivers Act

Impacts to recreation would be considered significant if an alternative resulted in a substantial effect to the long-term provision of, or access to, recreational uses in the area.

7.13.2 IMPACTS OF CONSIDERED ALTERNATIVES

NO ACTION ALTERNATIVE – Under the No Action Alternative, the LPV and MRL levee lifts and floodwall raises would not occur. Recreational resources within the LPV study area will continue to have reduced risk from storm surge inundation by the HSDRRS, but less so for the 1% AEP event in the without project condition. Routine maintenance would continue causing negligible interference with recreational activities in the vicinity of the LPV project area. Borrow operations would continue at the existing various sites in the vicinity of the study area.

The study area lies in a region of active subsidence and sea level rise (see Section 5.2.1). As levees subside, they provide a lower level of overtopping flood risk reduction. Land-based recreational resources, including camps, park structures, and recreation facilities would be susceptible to a higher risk of inundation in the future without-project condition. Water-based recreational resources, such as fishing and hunting, would also be affected from deposits of salt laden waters into interior estuaries thereby affecting fishing opportunities, especially in the short-term. Over time, water-based recreational resource opportunities would return to baseline conditions.

PROPOSED ACTION ALTERNATIVES –- Alternatives 2 and 3 are expected to have identical impacts. Under the proposed action, the levee lifts and floodwall raises would be confined to the existing levee right-of-way except along the MRL where flood-side shifts to levee alignments are anticipated. No impacts to Wild and Scenic Rivers anticipated.

Direct Effects – No direct impacts to state or locally-owned recreational facilities are expected because they are far enough from the work areas to avoid impacts. Walking, jogging, biking, dog-walking, and recreating on levee reaches could be prohibited temporarily during construction and access for bank fishing might be limited. No impacts to Louisiana Scenic Rivers are anticipated.

Indirect Effects –There could be minimal, indirect construction-related impacts to recreational resources in the study area, including temporary congestion of traffic corridors. Temporary closures of Lake Pontchartrain lakefront green space would be expected. The MRL levee construction near the Industrial Canal will impact use of the green space on the protected side. The area, adjacent to an historic residential neighborhood, is very popular for dog walking and river site-seeing and active recreational use, including jogging. Use of the area may not be available for the duration of construction activities. Finally, visitors to the Chalmette Battlefield in St. Bernard Parish may be indirectly impacted by construction activities along the MRL. Impacts to visitors of the Battlefield may include noise and temporary road impacts from construction vehicles and equipment. The conditions would return to normal after the construction activity is completed.

Adverse impacts on recreational resources from levee lifts and floodwall raises 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 the proposed actions.

Therefore, impacts from the Proposed Action Alternatives to recreational resources would be less than significant.

GENERALIZED BORROW AREAS – With implementation of the proposed action, borrow material would be removed from the borrow locations to be identified in the future. Existing borrow areas are actively used by private individuals, non-federal, and federal entities seeking borrow and are heavily impacted. Upon depletion of a given borrow area, depending how the end site is left, the habitat may be suitable to support some recreation activities (e.g., wildlife viewing and fishing). These benefits are expected to be minimal and sites would remain private, restricting their recreational value to the public. Therefore, there would be no direct, indirect, or cumulative impacts to recreational resources in the region related to existing borrow areas. If new borrow sites are required, then these new areas would need to be investigated and evaluated under NEPA.

7.13.3 CUMULATIVE IMPACTS

Present and future actions by USACE, 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. The CED, Phase I (USACE, 2013) discusses the cumulative impacts of present and future regional storm damage reconstruction, redevelopment, coastal, and wetland restoration, and transportation actions on recreational resources and is incorporated by reference here.

Temporary cumulative adverse impacts on recreational resources have occurred in the study area; temporary impacts primarily associated with access closures are expected to occur for the life of the project. Access and navigation to land- and marine-based recreational opportunities and resources have been affected by past and ongoing actions. Noise and water quality issues from past and ongoing flood risk reduction construction activities cumulatively reduce fishing and hunting opportunities within the study area. In addition, the displacement of wildlife due to construction impacts would limit outdoor nature activities such as bird watching, hiking, and photography.

Cumulative impacts from construction might be noticeable to individuals who use the levees for walking or access to bank fishing, but park, field, and trail users would only be affected if a major event generating a lot of traffic were held at the same time that construction traffic is on the roads.

The proposed action in association with past and ongoing flood risk reduction projects provides cumulative benefits for recreational resources in the study area by reducing flood and storm damage risk to recreation facilities, museums, sporting arenas, recreational paths, park infrastructure, and green space.

Cumulatively, the proposed action construction and future borrow site excavation would have negligible permanent impacts on recreational resources. 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 study area. **Regionally, the permanent cumulative impacts on recreational resources would be negligible and less than significant.**

7.13.4 ENVIRONMENTAL COMMITMENTS

To minimize impacts to recreational resources, the following environmental commitments shall be implemented:

- Continued coordination with LDWF, Scenic Rivers Program regarding minimization of impacts to affected Louisiana Scenic Rivers, if any.
- Continued coordination with NPS
- The CEMVN would ensure that impacts and encroachments onto public lands are avoided.
- USFWS recommends USACE should avoid impacts to public lands, if feasible. If not feasible, USACE 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.
- As noted in IER #3, lighted marine buoys would be placed in Lake Pontchartrain to delineate the hazard of the stockpiled dredged sediment for the project work.

7.14 AIR QUALITY

7.14.1 REGULATORY FRAMEWORK

This air quality resources section addresses compliance for the following applicable environmental laws and regulations:

- Clean Air Act
- General Conformity Rule (see Appendix G for full compliance details)

Impacts to air quality would be considered significant if an alternative resulted in emissions that exceeded the General Conformity de minimis thresholds associated with the Clean Air Act.

7.14.2 IMPACTS OF CONSIDERED ALTERNATIVES

NO ACTION ALTERNATIVE – Under the No Action Alternative, there would be no potential for direct, indirect, or cumulative effects to air quality because construction of the proposed action would not occur, and the attainment area status for the study area is not anticipated to change from current conditions. St. Bernard Parish is expected to continue to be in non-attainment for sulfur dioxide.

Air quality would continue to be subject to institutional recognition and regulation into the future. However, air quality in the study area would likely decline for the following reasons: continued population growth, further commercialization and industrialization, increased numbers of motor vehicles, and increased emissions from various engines. These impacts would be coupled with the continued loss of coastal wetland vegetation that would no longer be available to remove gaseous pollutants. The study team assumes respiratory ailments, such as asthma, would increase in the human population due to the reduced air quality.

Existing borrow areas are actively used by private individuals, non-federal, and federal entities seeking borrow. On-going air quality impacts form activities at the borrow sites would include temporary diesel and gasoline emissions from the operation of construction equipment and the creation of particulate emissions generated by activities that disturb and suspend soils. However, the attainment area status of the parishes is not anticipated to change from the current conditions.

PROPOSED ACTION ALTERNATIVES – Alternatives 2 and 3 are expected to have identical impacts.

Direct Effects – Probable direct impacts to air quality would include temporary diesel and gasoline emissions from the operation of construction equipment and temporary creation of particulate emissions during project construction. Construction workers would temporarily increase the combustible emissions during their commute to and from work. The emissions from supply trucks and workers commuting to work would temporarily impact air quality in the vicinity of the project area. Operation of construction equipment and support vehicles would also generate Volatile Organic Compounds (VOCs), Particulate Matter $(PM)_{10}$, $PM_{2.5}$, Nitrogen Oxides (NO_x), Carbon Monoxide (CO), Ozone (O_3) and Sulfur Oxides (SO_X) emissions from diesel engine combustion. During the construction of the proposed action, proper and routine maintenance of all vehicles and other construction equipment would be implemented to ensure that emissions are within the design standards of all construction equipment. St. Charles, Jefferson and Orleans Parishes are in attainment of all NAAQS. St. Bernard Parish is in attainment for all NAAQS except sulfur dioxide (SO_2). Due to the short duration of the construction project, any increases or impacts on ambient air quality would be expected to be short-term and minor and would not be expected to cause or contribute to a violation of federal or state ambient air quality standards. Releases of sulfur dioxide in St. Bernard Parish would not exceed the *de minimus* threshold. Long term, there is no anticipated effect to air quality. Regional air quality standards would not be violated. The proposed project would be in conformance with NAAQS.

***Indirect Effects* –** The indirect effects to air quality of implementing the proposed action would be related to the emissions from transportation of personnel and equipment to and from the job site on a daily basis until the completion of construction.

CONFORMITY DETERMINATION –

The General Conformity Rule (40 CFR Part 93) ensures that the actions taken by federal agencies in nonattainment and maintenance areas do not interfere with a state's plans to meet national standards for air quality. A conformity determination evaluates whether a federal action meets the requirements of the general conformity rule and must be performed when a federal action generates air pollutants that would exceed conformity threshold ("de minimis") levels in a region designated as a non-attainment or maintenance area for one or more NAAQS. If emissions would not exceed de minimus levels, a conformity determination is not required. The study team performed a conformity evaluation for the proposed action for sulfur dioxide emissions in St. Bernard Parish and determined that emissions would not exceed *de minimis* thresholds. See Appendix G for details on the conformity analysis.

GENERALIZED BORROW AREAS – For generalized borrow locations, impacts resulting from implementation of the proposed action would be expected to be similar to the FWOP conditions. There would be short-term impacts to air quality that would result from the operation equipment to excavate, move and transport borrow. Air emissions would be controlled by implementation of BMPs. Air quality impacts would be limited to those produced by heavy equipment and suspended dust particles generated by bulldozing, dumping, and grading. Operation of construction equipment and support vehicles would generate VOCs, PM_{10}, $PM_{2.5}$, NO_x, CO, O_3, and SO_x emissions from diesel engine combustion. The construction equipment should have the same emissions as local traffic in the areas. Duration of the impacts to air quality would depend upon the daily frequency of trucks, weather, and the amount of borrow available. Additional evaluation of potential air quality impacts associated with borrow site excavation, including potential emissions of SO_2 from borrow excavation in St. Bernard Parish, would be documented in future NEPA.

Air emissions from the proposed action would be temporary and would have less than significant impacts to air quality in the region and are not expected to cause or contribute to a violation of federal or state ambient air quality standards.

7.14.3 CUMULATIVE IMPACTS

Cumulative effects to air quality may be noticeable if construction activities and borrow operations are conducted simultaneously. The limited temporal and quantitative contribution of emissions from the proposed action to cumulative air emissions from other area sources such as vehicles and other potential levee lifts in the vicinity of the study area would not be expected to alter the existing attainment status of these parishes.

A number of construction projects are occurring or are planned for the study area that would produce air emissions, including hurricane storm damage risk reduction projects, flood risk reduction projects, Sections 404/10/408 permitted actions, several hotels and high-rise housing projects, and riverfront development[7]. Present and future regional actions, along with the proposed action, would increase the ambient air pollution levels in the New Orleans Metropolitan Area, and local citizens may experience an increased exposure to air pollution. Other storm and flood risk reduction construction projects could potentially increase and extend the time that local residents are exposed to an elevated air pollution level. 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 and less than significant.**

7.14.4 ENVIRONMENTAL COMMITMENTS

To minimize impacts to air quality, the following environmental commitments shall be implemented:

1) Dust suppression methods would be implemented to minimize fugitive dust emissions.
2) Standard construction BMPs would be developed in coordination with LDEQ and be used during construction of the proposed action, 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.
3) Construction equipment and haul trucks would have catalytic converters and mufflers to reduce exhaust emissions.
4) Conformity analyses would be conducted for borrow areas located in non-attainment areas.

7.15 NOISE

7.15.1 REGULATORY FRAMEWORK

This noise section addresses compliance for the following applicable environmental laws and regulations:

- Noise Control Act of 1972, as amended by Quiet Communities Act of 1978
- NEPA
- Local Noise Ordinances

Impacts to noise would be considered significant if an alternative resulted in:

- Substantial permanent increase in ambient noise levels for adjacent sensitive receptors
- Exposure of persons to or generation of noise and vibration levels in excess of standards established by local/regional noise ordinances or applicable standards of other agencies

[7] Available online at: https://nola.curbed.com/maps/new-orleans-riverfront-development-construction-mapped. Accessed 19 November 2019.

7.15.2 IMPACTS OF CONSIDERED ALTERNATIVES

NO ACTION ALTERNATIVE – Noise impacts would be similar to those under existing conditions because there would be no direct or indirect impacts from construction equipment. Future maintenance activities could result in a slight increase in noise levels from equipment and activities associated with maintenance activities but any increase in noise levels is anticipated to be temporary.

Existing borrow sites would be actively used by private individuals, non-federal, and federal entities seeking borrow. Noise levels would be expected to be similar to existing conditions of continued operation of borrow areas. These noise impacts related to borrow operation would continue until the borrow area is depleted.

Local and temporary noise typically associated with human activities and habitations such as car and truck traffic, operation of commercial and recreational boats, water vessels, airboats, and other recreational vehicles; operation of machinery and motors; and human residential-related noise (air conditioners, lawn mowers, etc.) would likely continue to affect humans and animals in the study area in the future. Noise levels may increase slightly with increasing population and industrialization in the study area. Changes in local noise ordinances may also increase or decrease future noise levels.

PROPOSED ACTION ALTERNATIVES – Alternatives 2 and 3 are expected to have identical impacts.

Direct and Indirect Effects – Noise along the existing right-of-way would increase due to the temporary operation of equipment and vehicles used in the construction of the levee lifts and floodwall raises. While noise impacts may cause a temporary inconvenience to residents and facilities in the immediate area, noise levels associated with construction activities would be temporary and monitored to ensure acceptable standards are maintained. No permanent noise impacts as a result of LPV construction is anticipated, and all noise emissions are expected to be short-term, lasting only as long as construction activities. No long-term indirect effects on noise are anticipated with implementation of proposed actions.

Noise levels associated with construction activities have the potential to temporarily impact wildlife that may be present in the area, but would not be significantly different from noise associated with other human activities that occur on a daily basis. After completion of the proposed action, noise levels would be expected to return to pre-action levels. Future maintenance activities could result in a slight increase in noise levels from equipment and activities associated, but any increase in noise levels associated with maintenance activities is anticipated to be lower and of shorter duration.

Table 7-6 describes noise emission levels for construction equipment that would be expected to be used during the proposed construction activities. As can be seen from this table, the anticipated noise levels at 50 feet range from 76 dBA to 83 dBA based on data from the federal Highway Administration. All construction is anticipated during daytime hours. After completion of the proposed action, noise levels would be expected to return to pre-action levels. Future maintenance activities could result in a slight temporary increase in noise levels from maintenance equipment such as mowers, but would be the same as the currently existing conditions.

Table 7-6. Sound Levels (dBA) of Construction Equipment and Modeled Attenuation at Various Distances

Noise Source	Distance from Source				
	50 feet	100 feet	200 feet	500 feet	1,000 feet
Dump Truck	76 dBA	70 dBA	64 dBA	56 dBA	50 dBA
Compactor/ Roller	83 dBA	77 dBA	71 dBA	63 dBA	57 dBA
Excavator	81 dBA	75 dBA	69 dBA	61 dBA	55 dBA
dBA at 50 feet is a measured noise emissions. The other distances are modeled estimates. Source: USDOT, 2006					

Table 7-7 summarizes the sensitive noise receptors located in the LPV sub-basins that would be exposed to noise emissions associated with the proposed LPV action. These noise receptors are located along the proposed levee raises and were previously identified by USACE (2013). In addition, the Chalmette National Historical Park (Chalmette Unit of Jean Lafitte National Historical Park Historic District) is located adjacent to the proposed section of levee lifts and floodwall modifications and replacements outside the HSDRRS along the Mississippi River in St. Bernard Parish. Noise emissions would be expected throughout the construction period for each project feature. Construction periods may range from 1 to 2 years. Construction would only occur during times allowed by applicable noise ordinances (see Section 4.15.) While the noise emissions would create major impact to sensitive receptors during construction activities, they would be temporary and limited to active construction windows and sporadic (over 50 years), making long-term impacts from noise emissions negligible and less than significant.

Table 7-7. Number of Sensitive Noise Receptors Impacted from Proposed Action (USACE, 2013)

Sub-Basin	Number of Sensitive Noise Receptors				
	Single-Family Homes	Apartment Buildings	Churches	Schools	Hospitals
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 & Orleans East Bank	98	4	1	0	0
New Orleans East	1,206	23	2	2	0
Chalmette Loop	13	0	0	0	0
TOTAL	**2,413**	**118**	**8**	**10**	**3**

GENERALIZED BORROW AREAS – Temporary noise would occur during construction and hauling activities associated with equipment such as bulldozers, excavators, and dump trucks. It is assumed that excavation and hauling would be limited to daylight hours (10 – 14 hours per day) seven days a week. However, this may change due to construction schedules, weather conditions, and project borrow needs. Nearby residential areas may be impacted by elevated noise levels due to excavation and hauling. Actual noise impacts would depend on locations of borrow sites relative to sensitive receptors, construction schedules, which are dependent on weather conditions and specific borrow area characteristics, which are not known at this time. Those factors would be addressed in future, borrow-site-specific NEPA.

Therefore, the noise impacts of the proposed action alternatives would be less than significant.

7.15.3 CUMULATIVE IMPACTS

Cumulative noise impacts associated with LPV construction activities would be periodically major due to the number of sensitive noise receptors adjacent to proposed action; however, these impacts would be short-term and would end when construction is completed. No permanent cumulative impacts would occur from LPV construction.

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 study 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 study area; should pile driving operations occur, those impacts could be major. If LPV construction projects coincide with other construction projects, then the short-term adverse cumulative impacts would occur on sensitive noise receptors in the region.

Overall, noise associated with LPV construction and other regional projects would be limited to specific locations of construction activities and would be temporary in nature. **Regional, long-term cumulative noise impacts would be negligible and less than significant.**

7.15.4 ENVIRONMENTAL COMMITMENTS

To minimize impacts from noise, the following environmental commitments shall be implemented:

1) Adherence to the local noise ordinances.
2) Construction equipment would be routinely checked to ensure that the equipment is operating properly.

7.16 TRANSPORTATION

7.16.1 REGULATORY FRAMEWORK

This transportation section addresses compliance for the following applicable environmental laws and regulations:

- Federal Aid Highway Act

Impacts to traffic would be considered significant if an alternative resulted in an increase in traffic which is substantial in relation to the existing traffic load and capacity of the local road network.

7.16.2 IMPACTS OF CONSIDERED ALTERNATIVES

NO ACTION ALTERNATIVE – Under the No Action Alternative, the levee lifts and floodwall raises would not occur. The routine maintenance of public roads around the project area would continue. It is assumed that major transportation and evacuation corridors within the vicinity of the study area would likely become more vulnerable to storm damage in the future without action resulting in significant adverse impacts. Some transportation and evacuation routes may also become more vulnerable due to future loss of coastal marshes, which act as natural buffers to storm surge resulting from tropical storms and hurricanes.

Under the No Action Alternative, known borrow area sites are likely to continue to be used by private individuals, non-federal, and federal entities seeking borrow. The use of these borrow areas is anticipated to continue until they have exhausted the borrow supply, and the current impact of borrow pit use on area roads would continue until the pit is exhausted.

PROPOSED ACTION ALTERNATIVES – The impacts on transportation between Alternatives 2 and 3 are expected to be identical unless otherwise noted.

***Direct Effects* –** Use of the area's roads would increase during construction due to the presence of construction related vehicles and activities. It is assumed the same transportation corridors would be used for construction of LPV as previously used during HSDRRS construction. The CED, Phase I describes the estimated transportation impacts and is incorporated by reference (USACE, 2013) and only briefly summarized here. Construction equipment such as bulldozers and graders would need to be delivered to the construction sites. Haul trucks would be entering and exiting the areas on a daily basis during the period of construction. The truck hauling would temporarily impede vehicle traffic and result in minimal reduction of the level of service on some local road segments. Any increase in traffic would be moderate and temporary. After construction is complete, transportation would return to pre-construction levels.

Assuming a 14 cubic yard dump truck, Alternative 2 would require approximately 329,000 truck trips to haul approximately 4.6 million cubic yards of in-place borrow material to the project sites. For Alternative 3, approximately 664,000 truck trips to haul approximately 9.3 million cubic yards of in-place borrow material to the project sites. (Alternative 3 quantities were not updated during feasibility level design.) The number of miles and the transportation route for each truck trip would depend upon the borrow pit selected for each reach. The increase in truck traffic would have a short-term temporary impact on the direct travel routes to/from the borrow sites and would result in localized congestion at the construction site.

In terms of evacuation routes, it is expected the existing routes would remain passable in the future until the arrival of tropical storm force winds, at which point, driving would be unsafe regardless of whether the roads are passable.

***Indirect Effects* –** With implementation of the proposed action, indirect effects on transportation would include increased use of existing transportation corridors within the study area.

Overall, the impact on transportation from implementing the proposed action would be a moderate, significant impact.

GENERALIZED BORROW AREAS – With implementation of the proposed action, haul trucks would be entering and exiting the areas on a daily basis during the period of construction. The truck hauling would temporarily impede vehicle traffic and result in a minimal reduction of the level of service on some local road segments. Impacts on roads that are used near borrow areas would occur. Adverse short-term, congestion-related impacts and degradation of the roads would likely be moderate to major during construction period.

7.16.3 CUMULATIVE IMPACTS

The HSDRRS construction and associated excavation of borrow areas contributed directly and indirectly to cumulative impacts on the transportation system throughout the study area. Cumulative moderate adverse impacts such as damage and degradation of infrastructure and roadway wear-and-tear due to increased truck traffic occurred in the study area. Likewise, lower hurricane and coastal storm risk to a portion of the greater New Orleans area upon completion of LPV 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 LPV-related transportation.

The transportation analysis conducted by USACE **Invalid source specified.** to address the overall cumulative impacts of construction and future operation and maintenance of the HSDRRS describes and characterizes the environmental impacts of transporting materials necessary to construct the HSDRRS for New Orleans, Louisiana. The 2009 report was updated in 2016 using final transportation information. The analysis addressed the effects of using the public highways and waterways to supply earthen borrow, structural steel (*e.g.*, sheet pile, pipe pile, H-pipe), ready-mix concrete, concrete pile, aggregate, and rock to over 150 different construction projects for the LPV and WBV projects. The database of projects used to analyze quantities, trips, and timing of trips contains 150 projects, which were analyzed in 19 previous IERs. Table 4-17 shows the quantities of the material used for the 150 projects. According to the transportation analysis, an estimated 1.5 million truck trips are estimated to have been needed to deliver the quantity of material presented in the table below to construct HSDRRS. In addition, 814 barge trips delivered some of the material, mainly rock. This past action, along with proposed action and other known construction activities, could contribute to cumulative impacts on transportation on major roads such as Interstate 10. However, this cumulative impact would be short term and is not considered significant given the existing high traffic volumes present on these major roads.

Table 4-8. HSDRRS Material Quantities

Material	Quantity	Units
Earthen Fill	17,319,700	Cubic yards
Concrete	1,559,500	Cubic yards
Aggregate	2,979,300	Tons
Sheet Pile	11,479,800	Square feet
H-Pile	10,368,800	Linear feet
Pipe Pile	845,500	Linear feet
Concrete Pile	1,592,200	Linear feet
Rock	3,043,500	tons

Short-term cumulative adverse impacts on transportation caused by increased construction traffic, congestion from transporting materials (primarily borrow material) to project construction locations, and temporary road closures resulting from the implementation of the proposed action. Damage to pavement from increased truck traffic may occur. Short-term cumulative impacts on residents from construction and traffic noise occurred during HSDRRS improvements and ongoing redevelopment construction activities and transportation improvement projects. Similar impacts are expected with the proposed actions.

If one or more of the levee lift projects in the vicinity uses the same borrow pit at the same time as the LPV reaches, local roads in the immediate vicinity of the borrow pit would see a cumulative impact of a further reduction in level of service or traffic congestion. This cumulative impact would be temporary and would return to pre-project conditions once the hauling of material for the levee lifts is complete.

Present and future actions by 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. The CED, Phase I describes other present and future regional actions and is incorporated by reference (USACE, 2013), and only summarized here. The combination of LPV construction, excavation of borrow areas, and other regional projects (*e.g.*, transportation, storm damage reconstruction, coastal and wetland restoration, and flood risk reduction projects) would contribute directly and indirectly to cumulative impacts on transportation in the study 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 LPV study area. Likewise, lower flood and coastal storm damage risk in the greater New Orleans area upon completion of the LPV 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. Construction of the LPV would also provide beneficial impacts on transportation resources in the region, as it reduces flood and coastal storm damage risk and future storm damage to these resources. The LPV 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.

The cumulative impact on transportation would be a moderate, significant impact for implementation of the proposed action.

7.16.4 ENVIRONMENTAL COMMITMENTS

To minimize impacts to transportation resources, the following environmental commitments shall be implemented:

1) Use of flagmen, signage, cones, barricades, temporarily re-routing roads during construction, and installation of temporary turn lanes near construction areas
2) Appropriate measures to ensure safety and facilitate the movement of traffic would be implemented at all approved borrow areas
3) Use of dust suppression methods such as watering of construction sites
4) Traffic coordination meetings with local and state transportation departments would be held to discuss traffic situations, conditions, and traffic management strategies.

7.17 HUMAN ENVIRONMENT

7.17.1 REGULATORY FRAMEWORK

This section addresses compliance for the following applicable environmental laws and regulations:

- NEPA

Impacts to the human environment would be considered significant if:

- Socioeconomic impacts resulted in a substantial shift in population trends or adversely affected regional spending and earning patterns

7.17.2 IMPACTS OF CONSIDERED ALTERNATIVES

NO ACTION ALTERNATIVE – The No Action Alternative would not raise the levees to provide hurricane and storm damage risk reduction for a 1% AEP storm. The human environment would continue to be protected by the HSDRRS, but would be exposed to an increasing risk of inundation without implementation of project features. There would be no direct impact on the human environment under this alternative since construction of levee lifts would not occur.

PROPOSED ACTION ALTERNATIVES – Alternatives 2 and 3 are expected to have identical impacts.

***Direct Effects* –** There are no direct impacts to socioeconomic resources from the LPV and MRL projects. No permanent adverse direct impacts on population and housing, business and industry, employment and income, community and regional growth, or community cohesion is expected to occur as a result of Alternatives 2 and 3. All of the LPV construction activities would take place in existing ROWs and within areas already environmentally assessed for NEPA (USACE, 2013) and would not directly impact the human environment. MRL improvements would take place on the flood-side of the system, sparing impacts to the human environment.

***Indirect Effects* –** The socioeconomic indirect impacts from LPV and MRL projects would be primarily beneficial and include hurricane and coastal storm risk reduction resulting from increasing the heights of the levees/floodwalls for the 1% AEP or 0.5% AEP storm events. Indirect impacts include temporary, minor inconveniences from construction activities to those living near the HSDRRS or Mississippi River levees, such as increases in traffic and noise and inability to recreate in areas affected by construction.

In the short-term, construction activities related to proposed action directly provide jobs, benefit businesses through the purchases of materials and supplies, and provide sales tax revenue to local governments. In the long-term, providing a level of risk reduction to communities in southeast Louisiana would improve the confidence of residents and the business community in the long-term viability and resilience of the Greater New Orleans area and could generate further interest in redevelopment of storm-damaged neighborhoods.

Therefore, implementation of the proposed actions would have less than significant impacts to socioeconomics, and therefore the overall human environment, as related to the implementation of levee lifts and floodwall raises.

GENERALIZED BORROW AREAS – Impacts on socioeconomics may occur as a result of the additional borrow, but until borrow sites are selected, the total impacts cannot be estimated.

7.17.3 CUMULATIVE IMPACTS

The impacts of past, proposed action, and actions of others associated with raising levees, floodwalls, floodgates, and new construction collectively would continue to have a cumulative beneficial impact on the socioeconomics of southeast Louisiana because these projects are tied directly to regional recovery projects, enhance flood risk reduction, or contribute to wetland and coastal restoration. The CED, Phase I discusses the cumulative socioeconomic and environmental justice impacts of present and future regional actions within the study area and is incorporated by reference (USACE, 2013), and only briefly described here.

The cumulative long-term benefits of the long-term confidence in risk reduction brings are not truly quantifiable, but providing greater safety for everyone with investment interests in southeast Louisiana is a beneficial cumulative economic benefit to Louisiana and the U.S.

Cumulatively, 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. Although there would be adverse cumulative impacts on socioeconomic resources within the study area, most of these impacts would be short-term and occur only during ongoing construction activities of the LPV and other regional projects.

Many federal agencies 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 wetland restoration, and other flood and coastal storm risk reduction projects. These tens of billions of dollars of investments all have an economic multiplier benefit which, when combined with the proposed action, would result 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 LPV and other risk reduction projects regionally would cumulatively improve economic conditions in the long-term through reduced insurance costs and greater investment (USACE, 2013). **Thus, the long-term regional cumulative impacts on socioeconomic resources would be predominately beneficial and are considered by the majority in the region and the nation as essential**.

7.17.4 ENVIRONMENTAL COMMITMENTS

Although there is no requirement through regulations to minimize socioeconomic impacts from construction of LPV, adverse impacts on socioeconomic resources are minimized primarily by designing the footprint of risk reduction work within existing ROWs, thereby reducing the need to acquire additional property or to “take” property.

To minimize impacts to socioeconomic and environmental justice, the following environmental commitments shall be implemented:

1) Minimize impact on the overall footprint
2) Temporary construction easements would be returned to pre-construction conditions and consistent with the 1% AEP level of risk reduction.

3) All project features would 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.
4) Use best management practices to reduce or minimize construction impacts to the human environment.

7.18 ENVIORNMENTAL JUSTICE

7.18.1 REGULATORY FRAMEWORK

This section addresses compliance for the following applicable environmental laws and regulations:

- EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations
- EO 13166, Improving Access to Services with Persons with Limited English Proficiency

Impacts to the human environment would be considered significant if:

- Environmental Justice impacts resulted in a disproportionately high and adverse impact to a minority or low-income population.

7.18.2 IMPACTS OF CONSIDERED ALTERNATIVES

NO ACTION ALTERNATIVE – The No Action Alternative would not raise the levees to provide hurricane and storm damage risk reduction for a 1% AEP storm. There would be no direct impact on minority and/or low-income population groups or the human environment under this alternative since construction of levee lifts would not occur. However, since this alternative fails to provide full overtopping flood risk reduction for a 1% AEP storm at year 2073, the actual and perceived risks to minority and/or low-income population groups under this alternative would be higher than under the with-project alternatives.

Minority and low-income residents would remain vulnerable to storm events and over time, may consider relocation. However, low-income populations may find it difficult to move to areas with lower flood risk because of the financial strain associated with moving. In those cases, residents would remain and continue to be impacted by storm events.

PROPOSED ACTION ALTERNATIVES – Alternatives 2 and 3 are expected to have identical impacts. The HSDRRS CED Phase I study identifies EJ communities and EJ resource impacts from construction of the HSDDRS for WBV and those findings are incorporated into this analysis. The link, https://www.mvn.usace.army.mil/Missions/Environmental/NEPA-Compliance-Documents/HSDRRS-Projects/ provides the IERs, the CED report and the EJ analysis for the five parish HSDRRS study area.

Direct Effects – There are no direct impacts to EJ resources from the LPV and MRL projects. All of the LPV construction activities would take place in existing ROWs and within areas already environmentally assessed for NEPA (USACE, 2013) and would not directly impact the human environment. MRL improvements would take place on the flood-side of the system, sparing impacts to the EJ resources. Additionally, no permanent disproportionate impacts are expected to occur on any minority or low-income community from LPV and MRL construction.

Indirect Effects – Indirect adverse impacts to EJ communities that are adjacent to the LPV levee and MRL projects may include short-term construction impacts, such as noise during daylight hours, dust, temporary road closures and increases in truck traffic. High, adverse short-term or permanent adverse impacts are not expected to occur as a result of the federal action. Best management practices would be utilized during construction activities that should reduce and minimize noise levels and dust and transportation routes for material delivery would be identified, before construction activities commence, to limit impacts to EJ communities. Short-term adverse impacts will be felt by communities adjacent to the levee lifts, but also to those in the general metropolitan area as trucks will be using roads to deliver levee material from borrow source sites. Residents in the study area, regardless of race or income level, could be impacted by short-term construction activities. Hurricane and storm damage risk reduction benefits will be conferred to all residents within the HSDDRS.

No disproportionate, high adverse impacts on low-income or minority communities is expected from the proposed action because all residents and businesses are provided an equal level of risk reduction and any adverse construction impacts are spread throughout the study area impacting EJ and non EJ communities alike. Additionally, there are no long-term high and adverse impacts from construction of Alternatives 2 and 3 and all residents regardless of income or race and including EJ and non EJ communities would receive flood risk benefits from the projects.

Therefore, implementation of the proposed actions would have less than significant impacts to environmental justice as related to the implementation of levee lifts and floodwall raises.

GENERALIZED BORROW AREAS – Impacts implicating environmental justice concerns may occur as a result of the additional borrow, but until borrow sites are selected, the total impacts cannot be estimated.

7.18.3 CUMULATIVE IMPACTS

Cumulative impacts under the No Action Alternative include the potential for a steady decline in minority and/or low-income population groups and other groups as residents move to areas with lower storm risks as well as continued financial and emotional strain placed on these groups as they prepare for and recover from flood events.

The CED, Phase I discusses the cumulative environmental justice impacts of present and future regional actions within the study area and is incorporated by reference (USACE, 2013), and only briefly described here. Cumulatively, large construction projects have the potential to disproportionately impact low-income and minority communities. However, although there would be adverse cumulative impacts on the EJ resources within the study area, most of these impacts would be short-term and occur only during ongoing construction activities of the LPV and other regional projects. **Thus, the long-term regional cumulative impacts on EJ resources would be less than significant.**

7.18.4 ENVIRONMENTAL COMMITMENTS

Adverse impacts on environmental justice resources were minimized primarily by designing the footprint of risk reduction work within existing ROWs, thereby reducing the need to acquire additional property or to “take” property.

To minimize impacts with potential environmental justice concerns, the following environmental commitments shall be implemented:

1) Minimize the overall footprint to the extent practicable.
2) Temporary construction easements would be returned to pre-construction conditions and consistent with the 1% AEP level of risk reduction.
3) All project features would 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.
4) Use best management practices to reduce or minimize construction impacts to the EJ communities.
   If Limited English Proficiency (LEP) communities are present, then efforts to ensure meaningful access to project information, notifications, and other aspects of the proposed project would occur now and into the future.

7.19 HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE (HTRW)

7.19.1 REGULATORY FRAMEWORK

Under ER 1165-2-132, the type and extent of all HTRW contamination within the vicinity of the proposed actions are assessed during feasibility stage to inform the choice among alternative plans. USACE policy is to avoid the use of project funds for HTRW removal and remediation activities.

This HTRW section addresses compliance for the following applicable environmental laws and regulations:

- Resource Conservation and Recovery Act
- Comprehensive Environmental Response, Compensation, and Liability Act
- Solid Waste Disposal Act

Impacts associated with HTRW would be considered significant if an alternative resulted in:

- The creation of a public health hazard involving the use, production, dispersal, or disposal of a hazardous material posing a health risk to human, animal, or plant populations
- The creation of a hazard to the public or environment through reasonably foreseeable upset or accident conditions involving the release of a hazardous material

7.19.2 IMPACTS OF CONSIDERED ALTERNATIVES

NO ACTION ALTERNATIVE – The previous Phase I ESA investigations did identify existing or potential RECs near the project area, but it is unlikely that HTRW would alter the operation and maintenance of the flood risk reduction features, adversely affect the project area, personnel working on the project, or the public at large. The probability of encountering RECs during future levee and floodwall operations and maintenance would remain low. The NFS would be responsible for testing and investigations to determine the existence and extent of any hazardous substances regulated under CERCLA and to develop and implement any response plan required by the regulating agency, at no cost to the Government.

Indirect and cumulative impacts resulting from the No Action Alternative would potentially increase the risks of flooding in residential and commercial areas and may result in the mixing of surface waters with sewage, contamination of drinking water supplies, and mobilization of HTRW. As floodwaters recede, the constituents could enter surface waters and cause temporary reductions in water quality. Soil and sediment contamination may also occur within the project area due to the floodwaters.

PROPOSED ACTION ALTERNATIVES – The impacts on HTRW between Alternatives 2 and 3 are expected to be identical unless otherwise noted.

The proposed action occurs within existing ROWs and any RECs previously identified in the Phase I ESAs for HSDRRS construction would be reflected in the project documents. As noted in Section 4, any previously-identified RECs would have been remediated or avoided prior to HSDRRS construction and would be unlikely to affect future LPV work, personnel working on the project, or the public. The probability of encountering RECs during future levee and floodwall improvements would remain low. An abridged Phase 1 ESA did not identify any existing RECs. If this project is approved and funded, a full Phase 1 ESA would be conducted prior to construction. Should HTRW concerns or RECs be identified at any time during future project improvements, USACE would undertake the appropriate evaluation and would follow applicable laws, regulations, and procedures, including those contained in the Project Partnership Agreement and its provisions regarding NFS HTRW remediation.

If the Record of Decision is signed and funding allocated, then a full Phase I ESA will be conducted on the project features prior to construction. Additionally, new Phase I ESAs would be required within a 6 month period prior to the start of construction to ensure that no additional RECs are present. The probability of encountering HTRW in the study area would be low and RECs would be avoided or remediated; **therefore, no direct or indirect impacts would be expected.**

GENERALIZED BORROW AREAS – Should new borrow site excavation be needed, 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 and floodwall 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.

7.19.3 CUMULATIVE IMPACTS

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. These present and future regional actions are discussed in the CED, Phase I and are incorporated by reference (USACE, 2013). 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. The cumulative effects of these projects on HTRW problems would be temporary and minor. Coastal and wetland restoration, as well as flood and storm risk reduction projects, could potentially cause contaminated sediment suspension, which would result in adverse effect and indirect HTRW impacts during construction. However, a reduced risk of flooding and storm damage afforded by the proposed action would offer long-term beneficial HTRW impacts by lessening risk of storm surge devastation in the region.

The cumulative effects of all types of regional projects on HTRW would be temporary and minor and primarily during construction activities. Compliance with 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 LPV study area.**

7.19.4 ENVIRONMENTAL COMMITMENTS

To minimize impacts to HTRW, the following environmental commitments shall be implemented:

1) A full Phase I ESA will be completed for each of the future levee lifts.
2) Containment of fuel and construction-required chemicals
3) For borrow areas, the contractor would 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 the Response Conservation and Recovery Act and other applicable laws and regulations.
4) Solid waste receptacles would be maintained at all staging areas. Non-hazardous solid waste (trash and waste construction materials) would be collected and deposited in on-site receptacles.

7.20 PROBABLE UNAVOIDABLE ADVERSE IMPACTS (ON ALL RESOURCES)

During construction of the proposed action, there would be temporary unavoidable adverse impacts on the existing flora and fauna, soil, and traffic in those locations where construction would occur adjacent to an existing roadway or would be along the transportation corridor between borrow areas and construction sites. Some of these impacts may occur, on a lesser scale, during maintenance of the proposed the action. Temporary, unavoidable adverse impacts including increased turbidity and noise would result from construction activities. These impacts would return to normal when construction is completed. Longer-term, non-temporary adverse impacts related to operation and maintenance of the proposed action includes loss of prime farmland within the borrow areas and loss of soil and habitat from borrow areas. However, benefits from an improved hurricane and coastal storm damage risk reduction system for the New Orleans Metropolitan Area would outweigh these unavoidable adverse impacts.

Where unavoidable construction impacts (including borrow areas) to the environment occur, mitigation would occur to replace loss of wetland habitats (*i.e.,* BLH-wet, fresh and intermediate marsh, and brackish marsh). At this time, Alternative 2 would require 12.1 AAHUs of BLH-Wet mitigation to offset impacts while Alternative 3 would require 17.7 AAHUs (Alternative 3 quantities were not updated during feasibility level design). If unavoidable impacts to non-wetland habitat occur (such as dry bottomland hardwood forest), in accordance with WRDA 1986, Section 906 (as amended), compensatory mitigation would also be required.

7.21 RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

This section discusses the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity. This section discusses whether construction and operation of the proposed project could cause short-term uses of the environment that would affect, either positively or negatively, the long-term productivity of the environment. “Short-term” generally refers to more immediate periods of time during which the proposed action would be constructed, whereas, “long-term” refers to an indefinite period beyond this timeframe.

Short-term uses of the environment associated with the proposed actions are generally the same as the environmental impacts described in the previous sections (Section 7.2-7.18) of this EIS. These impacts include both temporary and permanent “use” of the physical environment as a result of developing the proposed action and energy and resource use during project construction and maintenance. In considering the effect of these uses on long-term productivity, four main types of long-term productivity are considered: soil productivity, hydrological productivity, biological productivity, and economic productivity.

7.21.1 SOIL PRODUCTIVITY

While maintenance of long-term soil productivity is mainly a concern in areas that are in agricultural use, this concern also can arise anywhere that soils provide an economic or ecological benefit. Construction of the proposed action would affect soil productivity by borrow excavation, clearing, and grading. At borrow areas, long-term negative effects on soil productivity would be expected since these soils would be taken out of use. However, long-term positive effects on soil productivity for soils within the protected levee system are expected due to reduced risk of storm surge and flooding.

7.21.2 HYDROLOGICAL PRODUCTIVITY

Wetlands, groundwater resources, and floodplains contribute to long-term hydrological productivity by providing filtration, habitat for sensitive species, and essential recharge for agricultural and municipal use. Wetlands would lose productivity in those areas requiring mitigation, but productivity would be replaced through compensatory mitigation. Water bodies and floodplain would lose some productivity in the short-term from increased sedimentation from erosion during construction and increased amounts of potential pollutants that could enter construction sites from construction equipment and soil-disturbing activities.

7.21.3 BIOLOGICAL PRODUCTIVITY

Plant communities, fish, and wildlife contribute to biological productivity; their long-term productivity provides an ecological and recreational benefit in sensitive or remote areas. Proposed construction would affect biological resources through land clearing, grading, and borrow area excavation.

During construction, clearing and grubbing along existing levees would occur. After construction, levee vegetation would be restored. Excavation of borrow areas would permanently remove vegetation. After the borrow area is depleted, natural cover and/or vegetation restoration could take place. Borrow area excavation would also impact wildlife. Substantial habitat could be permanently lost, altered, and fragmented. The noise and increased human activity related to construction could decrease some wildlife species' breeding success and in some cases cause direct mortality. At the same time, habitat alteration can encourage the increase of species that can best adapt to the altered habitats. Over the long-term, species that are highly adaptable or avoid areas during short-term construction activities are expected to return once construction is complete.

7.21.4 ECONOMIC PRODUCTIVITY

Agriculture, urban and suburban development, and industrial uses can contribute to economic productivity. Risk reduction measure construction and maintenance could affect the economic productivity of some resources by limiting their long-term revenue potential but could contribute to long-term revenue potential in sectors that benefit from an improved hurricane and coastal storm damage risk reduction system. Proposed construction would affect economic productivity through borrow area excavation, construction of levee lifts, and raising of flood walls. At borrow areas, there would be long-term negative effects on land used for agriculture since these areas may be taken out of agricultural production. The proposed project is expected to create a long-term increase in economic productivity by providing a more reliable hurricane and coastal storm damage risk reduction system for a portion of the greater New Orleans area. Increased reliability could create a long-term economic benefit to existing businesses that rely on reduced flooding for production. An improved hurricane and coastal storm damage risk reduction could also attract new industrial and commercial business to the study area, which would provide a long-term increase in economic productivity through increased revenue and jobs.

7.22 IRREVERSIBLE OR IRRETRIEVABLE COMMITMENT OF RESOURCES

This section discusses likely irreversible and irretrievable commitments of resources for the project. The impact of the proposed actions on resources that would be forever lost or altered also is discussed. No mitigation specific to the irreversible and irretrievable commitment of resources discussed below has been identified to date for the proposed actions.

Irreversible commitments are those that cannot be reversed, except perhaps in the extreme long run (Shipley, 2010). Simply stated, once the resource is removed it can never be replaced. For the action alternatives considered, there are no irreversible commitments to natural resources. This study is in the planning stage. Money has been expended to complete this planning document and pre-project data collection and modeling. No construction dollars, which are considered irreversible, have been expended for the study. Fossil fuels consumed during construction of proposed actions would be irreversibly expended since their use cannot be reversed or resources replenished. Lastly, human power and funding used to construct the proposed action would result in irreversible fiscal resource commitments. When time and money are dedicated to the project and used, these expenditures cannot be restored or dedicated to another project.

Irretrievable commitments are those that are lost for a period of time (Shipley, 2010). The proposed action alternatives require a vast commitment of construction materials, fuel, energy, land, funding, and labor. Construction materials used to build the proposed action, such as aggregate, steel, and petroleum would be irretrievably committed to the project. These materials cannot be retrieved until they are removed, recycled, and used elsewhere. In addition, water used directly in concrete mixtures or through dust abatement would effectively be an irreversible expenditure. Although concrete can be retrieved through recycling and reuse, the water used to make it is irreversibly locked in solid form. Water quality in adjacent water bodies may be degraded by the proposed actions. This degradation would constitute an irretrievable commitment of water resources because water quality improvements could conceivably be retrieved if future restoration strategies would be implemented.

7.23 COMPLIANCE WITH ENVIRONMENTAL STATUTES

There are many federal and state laws pertaining to the enhancement, management, and protection of the environment. Federal projects must comply with environmental laws, regulations, policies, rules, and guidance.

Public review of the draft report occurred from 13 Dec 2019 to 7 February 2020. Public meetings occurred in January 2020. Comments received during the public review period are documented in Appendix L, *Coordination.* Appendix G provides additional environmental compliance documentation. Environmental compliance will be achieved prior to potential approval of a Record of Decision.

Table 7-8 provides a list of the relevant laws and regulations, including the agency tasked with the jurisdiction for each and the respective permit, license and compliance, or other review.

Table 7-8. Relevant Laws and Regulations

Relevant Laws & Regulations	Agency	Permit, License, Compliance, or Review/Status	Action Requiring Permit, Approval, or Review
Sound/Noise			
Noise Control Act of 1972 (42 USC 4901 *et seq.*) as amended by Quiet Communities Act of 1978 (PL 95-609)	USEPA	Compliance with surface carrier noise emissions	Construction and operations
Air			
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
Water			
Clean Water Act of 1977 (33 USC 1341 *et seq.*) 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 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
Clean Water Act of 1977 (33 USC 1344) 40 CFR 230	USACE	Section 404(b)1 Evaluation -	Discharge of dredge or fill

Relevant Laws & Regulations	**Agency**	**Permit, License, Compliance, or Review/Status**	**Action Requiring Permit, Approval, or Review**
		Compliance	material to a watercourse
Coastal Zone Management Act of 1972 (16 USC 1456(c)) Section 307	Administered by LDNR	Consistency Determination - Compliance	Consistency with the Louisiana Coastal Management Program
EO 11988 (Floodplain Management), as amended by EO 12608	Water Resources Council, FEMA, and CEQ	Compliance	Construction in or modification of floodplain
EO 11990 (Protection of Wetlands), as amended by EO 12608	USACE and USFWS	Compliance	Construction in or modification of wetlands
Soils			
Resource Conservation and Recovery Act of 1976 (42 USC 6901(k)), as amended by Hazardous and Solid Waste Amendments of 1984 (PL 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
Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 USC 9601), as amended by Emergency Planning and Community Right-To-Know-Act of 1986 (42 USC 1101 *et seq.*)	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 *et seq.*) 7 CFR 657-658	NRCS	NRCS Determination via form AD-1006	Prime and unique farmlands
Soil Conservation Act (16 USC 590(a) *et seq.*)	NRCS	Compliance	Soil conservation of federal lands
Natural Resources			
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	Protection of threatened and endangered species and their critical habitats

Relevant Laws & Regulations	**Agency**	**Permit, License, Compliance, or Review/Status**	**Action Requiring Permit, Approval, or Review**
Wild and Scenic Rivers of 1968 (P.L. 90-542; 16 USC 1271 et seq.)	Bureau of Land Management, National Park Service, USFWS, and US Forest Service	Compliance	Preserve certain rivers with outstanding natural, cultural and recreational values in a free-flowing condition for the enjoyment of present and future generations.
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 Protection 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 Coordination Act (16 USC 2901)	USFWS, NMFS	Compliance	Conserve and promote conservation of 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
Magnuson-Stevens Fishery Conservation and Management Act (P.L. 104-297)	NMFS	Compliance	Conserve and enhance Essential Fish Habitat.

Relevant Laws & Regulations	Agency	Permit, License, Compliance, or Review/Status	Action Requiring Permit, Approval, or Review
Health and Safety			
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
Cultural/Archaeological			
NHPA (16 USC 470 *et seq.*) 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 Protections Act of 1989 (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	Investigations and excavation on federal lands
Socioeconomics			
EO 14045 (Protection of Children from Environmental Health Risks and Safety Risks)	USEPA	Compliance	Identify and assess environmental health risks and safety risk 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

Relevant Laws & Regulations	Agency	Permit, License, Compliance, or Review/Status	Action Requiring Permit, Approval, or Review
EO 13166 (Improving Access to Services for Persons with Limited English Proficiency)	Department of Justice	Compliance	If Limited English Proficiency communities are present, ensure meaningful access to project information, notifications, etc.

7.23.1 FISH AND WILDLIFE COORDINATION ACT

The following fish and wildlife conservation recommendations were provided by the U.S. Fish and Wildlife Service as part of their final Fish and Wildlife Coordination Act Report (Appendix G, *Environmental Compliance*).

We do not oppose the Corps' plan to implement alternative 2 for the LPV HSDRRS provided that the following fish and wildlife conservation recommendations are incorporated into future project planning and implementation efforts:

> *1. Impacts to Essential Fish Habitat (EFH) shall be avoided and minimized to the greatest extent possible. Because impacts to designated EFH habitat may need to be mitigated the Corps shall coordinate with the NMFS regarding this need.*
>
> *2. To the greatest extent possible, situate final flood protection features so that impacts to wetlands and non-wet bottomland hardwoods are avoided or minimized.*
>
> *3. Avoid adverse impacts of bald eagle nesting locations and wading bird colonies through careful design of project features and timing of construction. Forest clearing associated with project features shall be conducted during the fall or winter to minimize impacts to nesting migratory birds, when practicable.*
>
> *4. The Service recommends that the USACE contact the Service for additional consultation if: 1) the scope or location of the proposed project is changed significantly, 2) new information reveals that the action may affect listed species or designated critical habitat; 3) the action is modified in a manner that causes effects to listed species or designated critical habitat; or 4) a new species is listed or critical habitat designated. Additional consultation as a result of any of the above conditions or for changes not covered in this consultation should occur before changes are made and or finalized.*
>
> *5. Further detailed planning of project features (e.g., Design Documentation Report, Engineering Documentation Report, Plans and Specifications, Water Control Plans, or other similar documents) shall be coordinated with the Service, NMFS, LDWF, 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.*
>
> *6. The Corps shall 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. In addition all mitigation proposed to occur on public lands should be coordinated with the respective land managing agency. Points of contacts for the agencies potentially impacted by project features are: National Park Service (NPS), contact*

Superintendent Chuck Hunt, (504) 589-3882 extension 137 (Charles_Hunt@nps.gov) or Chief of Resource Management Guy Hughes (504) 589-3882 extension 128, (Guy_Hughes@nps.gov) and for Bayou Sauvage NWR, the following people should be coordinated with; Shelly Stiaes, (Shelly_Stiaes@fws.gov) Refuge Manager, Barret Fortier (Barret_Fortier@fws.gov) Southeast Refuges Complex Biologist and Neil Lalonde (Neil_Lalonde@fws.gov) Southeast Refuge Complex Supervisor. The telephone number for the Southeast Refuge Complex is (985)882-2000.

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

8. The Corps shall maintain full responsibility for all mitigation projects until the projects are found to be fully compliant with success and performance requirements.

9. The Corps shall fully compensate for any unavoidable losses of wetland habitat or non-wet bottomland hardwoods caused by project features.

10. Borrow sites shall be designed to avoid and minimize impacts to fish and wildlife habitat; in the event new borrow sites are identified, guidelines for borrow site selection found in Appendix B should be followed.

11. Identified impacts shall have a fully defined mitigation plan that is included in the integrated National Environmental Policy Act document. The mitigation plan should be developed, including locations and AAHUs vetted through the natural resource agencies. Only existing mitigation banks and existing credits released by Corps Regulatory Branch may be considered.

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

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

14. The Corps shall finalize mitigation plans and proceed to mitigation construction so that it will be concurrent with project construction. If construction is not concurrent with mitigation implementation then revising the impact and mitigation period-of-analysis to reflect additional temporal losses will be required.

USACE Responses to USFWS Conservation Recommendations

1. Concur. USACE has coordinated with NMFS on EFH (see Appendix G – Environmental Compliance).

2. Concur. Impacts to wetlands and non-wet bottomland hardwood habitat have been and will continue to be avoided and minimized to the greatest extent possible.

3. Concur. USACE will avoid adverse impacts to bald eagle nesting locations and wading bird colonies through careful design of project features and timing of construction. Forest clearing

will be conducted during the fall or winter to minimize impacts to nesting migratory birds, when practicable.

4. Concur. USACE will continue to coordinate with the Service and will contact the Service for additional consultation as the need arises.

5. Concur. USACE will continue to coordinate with the Service and other resource agency partners and will provide all applicable documents for review.

6. Concur. USACE will avoid impacts to public lands to the extent practicable and will continue to coordinate with land managers.

7. Concur. If applicable, a General Plan for mitigation will be developed by the Corps, the Service, and the managing natural resource agency.

8. Concur. USACE will maintain full responsibility for all mitigation projects until the projects are found to be fully compliant with success and performance requirements.

9. Concur. Compensatory mitigation is proposed for unavoidable impacts to bottomland hardwood-wet habitat (see Appendix K – Mitigation Plan).

10. Concur. Borrow sites will be designed to avoid and minimize impacts to fish and wildlife resources to the maximum extent practicable. Guidelines for borrow site selection will be followed to the maximum extent practicable.

11. Concur. A Mitigation Plan has been developed and is included as Appendix K. The purchase of mitigation bank credits is the recommended mitigation method as detailed in Appendix K.

12. The purchase of mitigation bank credits is the recommended mitigation method, which would not require any operation or maintenance on the part of USACE or the project sponsor. If USACE-constructed mitigation were required, all operations and maintenance obligations would be met by the NFS on behalf of the public interest.

13. Concur. Any proposed changes to mitigation features will be coordinated with all appropriate resource agency partners.

14. Concur. Mitigation will occur prior to or concurrent with project construction.

8 EVALUATE & COMPARE ALTERNATIVE PLANS

This section evaluates and compares the final array of alternatives. While the authorizing language does not allow for the 0.5% AEP plan (Alternative 3) to be recommended for implementation by this study, it was found to be an economically viable plan and is presented for comparison to the 1% AEP plan as part of a reasonable array of alternatives for evaluation.

Evaluation and comparison of alternatives is based on preliminary modeling, design, cost estimates, and evaluation of effects. The results of those preliminary analyses are presented in this chapter. Once an alternative has been selected for recommendation, additional detailed analyses are conducted for the recommended plan, which results in refinements to the plan's features, outputs and effects. This more detailed analysis is described in Section 8.8, following identification of the recommended plan, and the revised details of the recommended plan are presented in Chapter 9.

Four accounts have been established to facilitate evaluation and display the effects of alternative plans:

a) (a) The **NED** account displays changes in the economic value of the national output of goods and services.
b) The **EQ** account displays non-monetary effects on significant natural and cultural resources.
c) The **RED** account registers changes in the distribution of regional economic activity that result from each alternative plan. Evaluations of regional effects are to be carried out using nationally consistent projections of income, employment, output, and population.
d) The **OSE** account registers plan effects from perspectives that are relevant to the planning process but are not reflected in the other three accounts.

Evaluation and comparison of alternatives is based on the four Principles and Guidelines criteria: completeness, acceptability, efficiency, and effectiveness. Resilience, redundancy, robustness, and sustainability contribute to completeness, efficiency, and effectiveness of plans and are accounted for in the evaluation of alternatives. In some cases, the evaluation may be qualitative.

The alternatives are evaluated based on the following decision criteria:

- **Economic costs and benefits –** quantitative estimates of the costs of each alternative and the NED benefits, resulting in display of Benefit-to-Cost Ratios (BCRs) and net economic benefits.
- **Environmental effects –** quantitative estimates of mitigation requirements and costs.
- **Life safety risk reduction –** quantitative estimates of 1) reduction in the annual probability of failure due to overtopping, and 2) reduction in the average annual life loss due to overtopping .
- **Contributions to addressing USACE Tolerable Risk Guidelines 1 and 4 –** qualitative or semi-quantitative assessment of the degree to which each TRG is achieved by each alternative (met, partially met, or not met).

This evaluation and comparison step was based on a conceptual level of design and associated cost estimates. A summary of the evaluation and comparison of the final array of alternatives is presented in Section 8.6.

8.1 ALTERNATIVES DESIGN

For purposes of developing the initial cost estimate and evaluating potential environmental impacts, the study team made the following levee and floodwall design assumptions:

- HSDRRS design criteria were applied to both alternatives for determining the design elevations of levees and floodwalls. This includes excluding still-water (also known as “surge”) overtopping and limiting the expected wave overtopping rate to 0.1cfs/ft at 90% confidence and 0.01 to 0.03 cfs/ft at 50% confidence at each design segment. Additionally, the design elevations will be checked for resiliency by comparing top of levee/structure elevations to the 0.2% AEP still-water elevations.
- Floodwall design used the draft guidance for Engineering Manual 1110-2-2502.
- Due to the size and scope of the study area, levee design was based on representative reaches.
- Multiple levee lifts would be constructed over time to incrementally address the combined effects of levee settlement, rising sea levels, and regional subsidence. These lifts would be “straddle lifts” wherever possible. The use of straddle levee lifts reduces the need for additional real estate acquisition and potential environmental impacts. Figure 8-1 illustrates the concept of levee lifts performed over time. A detailed listing of analysis and levee lifts are presented in Appendix B and Appendix A, respectively.
- Some levee reaches have concrete paved transitions from levee to floodwall. It is assumed that with each lift, the slope paving would need to be removed, lifted and replaced to match the required design elevation.
- It is assumed that all previously placed armoring for each reach would need to be removed before each lift and then replaced after construction of each lift. All MRL levees have concrete slope paving on the flood side slope. It is assumed that the slope paving will need to be removed and replaced with any expansion of the levee footprint.
- New co-located levee reaches are assumed to include armoring.
- Floodwalls falling below target design elevations were assumed to be modified if the deficiency was less than 2 feet and replaced if the deficiency was greater than two feet.
- For the initial design, the study assumed no changes to interior ponding or pumping capacity. The inclusion of additional interior ponding or pumping features would be reconsidered during the refined design of the recommended plan. However, due to the authorizing language, addition of these features would be limited to cases where project features were found to cause induced flooding.
- The initial design does not include modifications to the Lake Borge Surge Barrier.
- Assume no additional utility relocations are required. All potential relocations would likely have been performed during construction of HSDDRS (2006-2011) when the system was completely rebuilt after Hurricane Katrina. During this time, land owners would have signed acts of subordination to the project in order to receive reimbursement and are responsible for any future relocation costs. As such, it is reasonable to assume that no (or only limited) utility relocations are required, and this is a low-risk assumption based on likely impact to overall cost.
- No increased resiliency or robustness actions were considered at this time. The current project levees all have landside armoring and some have foreshore protection. Floodwalls have landside splash pads. All of these features contribute to a relatively resilient and robust system. The inclusion of additional features to further increase

resiliency and robustness would be reconsidered during the refined design of the recommended plan.

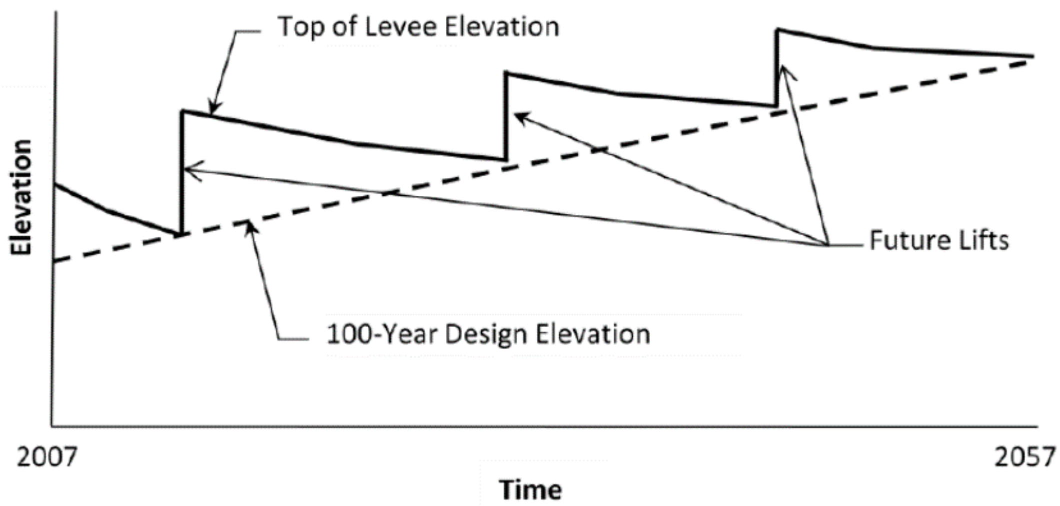


Figure 8-1. Conceptual Levee Lifts

8.2 ECONOMIC COSTS AND BENEFITS OF ALTERNATIVES

The HEC-FDA Version 1.4 USACE-certified model was used to calculate expected annual damages and benefits over the period of analysis. The economic and engineering inputs necessary for the model to calculate damages include structure inventory, content-to-structure value ratios, vehicles, first-floor elevations, depth-damage relationships, ground elevations, and stage-probability relationships. More information about these economic and engineering inputs are described in Appendix J, *Economics*.

8.2.1 FIRST COSTS OF ALTERNATIVES

Table 8-1 identifies the first costs of the final alternatives array by account and includes contingencies. Contingencies were determined by performing an abbreviated cost risk assessment for each action alternative, which considered uncertainties related to each input to the cost estimate.

Table 8-1. First Costs of Final Array of Alternatives (October 2019 Price Level)*

Account	LPV No Action	LPV ALTERNATIVE 2	LPV ALTERNATIVE 3
01 Lands and Damages	$0	$9,200,000	$9,700,000
06 Fish and Wildlife Facilities	$0	$3,700,000	$4,100,000
11 Levees and Floodwalls	$0	$2,154,500,000	$2,362,100,000
30 Planning, Engineering and Design	$0	$259,000,000	$283,900,000
31 Construction Management	$0	$172,700,000	$189,300,000
Total	$0	$2,599,000,000	$2,849,000,000

*All numbers have been individually rounded and, therefore, may not appear to add correctly to the total.

8.2.2 ECONOMIC BENEFITS

As discussed in Section 3.4 (Existing Economic Damages), the estimate of economic benefits assumes that there is no system failure (non-performance) prior to overtopping. Additionally, the benefits do not include any potential increases to the structure inventory (see Section 5.4 – Future Economic Damages). Table 8-2 displays the economic costs and benefits of the final array of alternatives.

Table 8-2. Costs and Benefits of Final Array of Alternatives (October 2019 Price Level)

	LPV No Action	LPV ALTERNATIVE 2	LPV ALTERNATIVE 3
Costs			
Total Project First Cost	$0	$2,599,000,000	$2,849,000,000
Average Annual Investment Cost	$0	$57,000,000	$63,000,000
Annual O&M Costs*	$0	$24,000,000	$27,000,000
Total Average Annualized Costs	$0	$82,000,000	$89,000,000
Economic Benefits - NED			
Without Project Damages	$233,000,000	$233,000,000	$233,000,000
With Project (Residual) Damages	$233,000,000	$30,000,000	$26,000,000
Damages Reduced (Benefits)	$0	$203,000,000	$207,000,000
Net Benefits	$0	$122,000,000	$118,000,000
Benefit-to-Cost Ratio (BCR)	N/A	2.5	2.3

*OMRR&R estimates at this stage of the study were incorrectly calculated but did not impact the comparison and selection of the recommended plan. See Section 9.3 for the correct estimate of OMRR&R costs for the recommended plan.

8.3 LIFE RISK REDUCTION OF THE ALTERNATIVES

Table 8-3 summarizes the levee performance (APF) and consequences (AALL) for both the No Action Plan and both designs that were evaluated.

Table 8-3. Levee Performance and Consequences

Alternative	APF	AALL
No Action	1E-04 to 1E-03	3E-02
With Project Alternative 2 (1% AEP design at 1.8 ft. RSLR)	3E-07 to 3E-06	3E-04
With Project Alternative 3 (0.5% AEP design at 1.8 ft. RSLR)	1E-07 to 1E-06	1E-04

The results of the risk assessment at this stage of the study show that both alternatives reduce the risk due to overtopping below the societal tolerable risk line associated with TRG-1 and TRG-1 is considered fully addressed for overtopping by each alternative, with Alternative 3 providing a greater level of risk reduction. In consideration of TRG-4, the study team considered whether additional actions were warranted to further reduce life safety risk. Although there are already robust emergency action plans in place, given the large urban population, there may be opportunities for improvements to evacuation plans and better communication of those plans to further reduce risk.

The likelihood of critical infrastructure inundation due to overtopping is also reduced for both alternatives. Table 8-4 compares the effects of each plan regarding critical infrastructure. Critical infrastructure data was obtained from the Homeland Security Infrastructure Program (HSIP) Gold 2015 database, which is a data inventory assembled by the National Geospatial-Intelligence Agency in partnership with the Department of Homeland Security.

Table 8-4. Comparison of Critical Infrastructure at Risk

	Without Project	Alt 2 1% AEP	Alt 3 0.5% AEP
Category	**Number**	**Number**	**Number**
Agriculture	0	0	0
Chemicals	51	8	8
Communications	7	0	0
Education	60	3	3
Emergency Services	15	2	2
Energy	65	6	6
Law Enforcement	2	0	0
Manufacturing	35	9	9
National Symbols	0	0	0
Public Venues	89	27	24
Transportation-Air	2	0	0
Transportation-Ground	498	64	61
Transportation-Water	48	45	43
Water Supply	1	0	0
Total	**873**	**164**	**156**

8.4 ALTERNATIVES SENSITIVITY TO RELATIVE SEA LEVEL RISE SCENARIOS

As discussed in Section 5.2.1, three relative sea level rise scenarios were estimated for the study's period of analysis (2023 to 2073) and the study team chose to design and evaluate the alternatives using the intermediate RSLR scenario. USACE policy also requires that the evaluation consider each alternative's performance over a 100-year adaptation horizon (in this case, through 2123) for all three scenarios, identify any critical thresholds, and identify any adaptability differences between the alternatives.

8.4.1 RSLR DIFFERENCES IN LOADING AND ALTERNATIVES' PERFORMANCE OVER TIME

An evaluation was performed to estimate the performance of each project alternative up to and after year 2073, which is the end of the study's period of evaluation. Additionally, Corps policy demands a performance evaluation of major infrastructure related to sea level change for a time period of 100 years, which would be the year 2123. The performance of the project through time depends on the RSLC projection (low, intermediate, or high), the level of risk reduction of each alternative, and an understanding of how the exterior stage-frequency changes through time for the various RSLC amounts.

Using the same methodology described in Section 5.2.1, the three RSLC scenarios were extended out to the 100-year performance horizon and the results are displayed in Table 8-5. Figure 8-2 displays the same information in graphical form, with the black lines tracking the intermediate RSLC estimate in 2073 (1.8 feet) horizontally to the low and high scenarios. The plot shows how the project performance of a system designed and built to intermediate RSLC conditions (1.8 feet in 2073) would begin to decrease near 2053 for a high RSLC scenario or be extended to 2091 for the low RSLC projection.

Table 8-5. USACE Relative Sea Level Rise (feet) from 2023 to 2123. Average of 7 gages

	Low	Int	High
2023	0.0	0.0	0.0
2028	0.1	0.2	0.3
2033	0.3	0.3	0.5
2038	0.4	0.5	0.8
2043	0.5	0.6	1.1
2048	0.6	0.8	1.4
2053	0.8	1.0	1.8
2058	0.9	1.2	2.2
2063	1.0	1.4	2.6
2068	1.2	1.6	3.0
2073	1.3	1.8	3.4
2078	1.4	2.0	3.8
2083	1.5	2.2	4.3
2088	1.7	2.4	4.7
2093	1.8	2.6	5.2
2098	1.9	2.8	5.7
2103	2.1	3.1	6.3
2108	2.2	3.3	6.9
2113	2.3	3.5	7.4
2118	2.4	3.8	8.0
2123	2.6	4.0	8.6

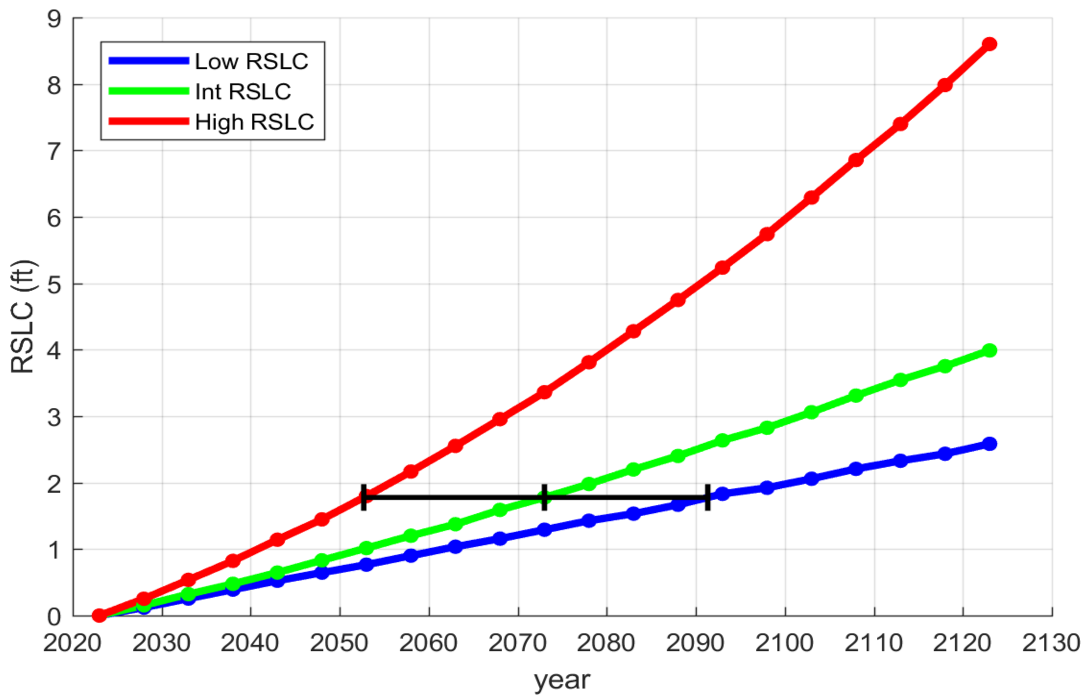


Figure 8-2. Low, intermediate and high relative sea level rise projections from 2023 to 2123

The effects of RSLR vary around both the LPV and WBV systems. For illustrative purposes, the RSLR elevations for a range of AEP events at the Lake Borgne Surge Barrier (in the LPV system) is shown in Figure 8-3. In this figure, vertical lines are drawn from the 1% and 0.5% events to intersect the RSLR curves, showing the RSLR stillwater elevations for those events. Horizontal lines show how the intermediate scenario compares to the low and high scenarios for each event.

As demonstrated in Figure 8-3, at the Lake Borgne Surge Barrier, both plans' intermediate RSLR surge elevations (18 ft and 19.5 feet) are approximately 6 inches higher than the low RSLR elevation and approximately 1.5 feet below the high RSLR elevation, at the end of the study's period of analysis (2073).

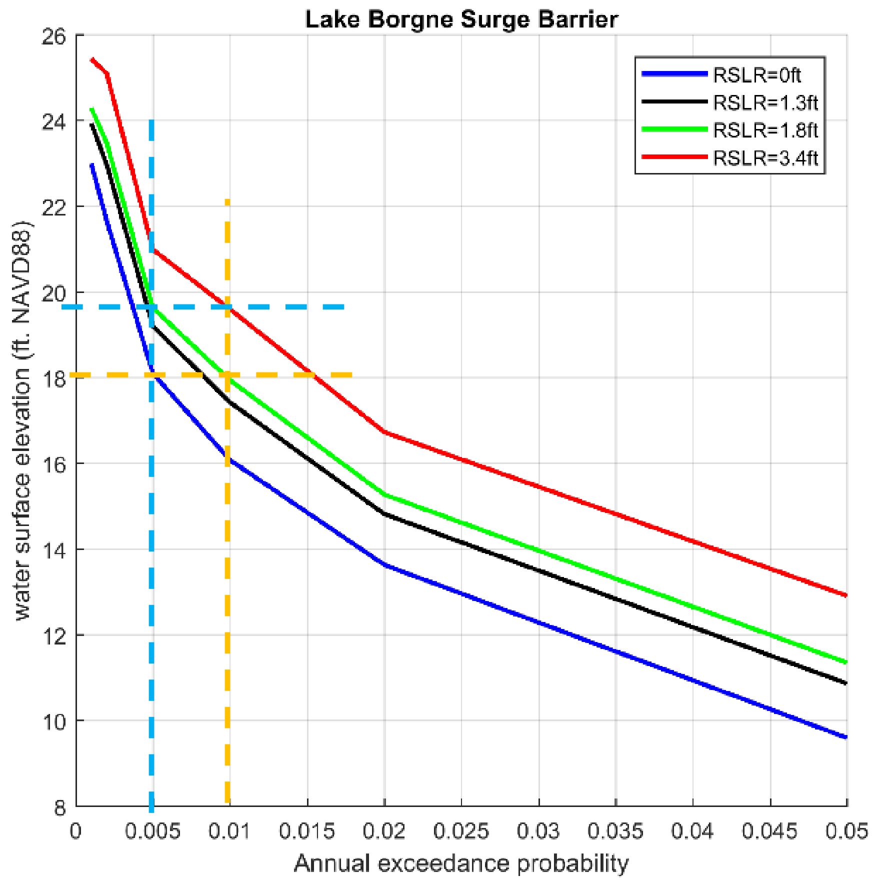


Figure 8-3. Projected Still Water Elevations at the Lake Borgne Surge Barrier for a Range of Events (RSLR Projected Values for 2073)

Because the two alternatives are very similar, the study team could identify no critical thresholds (physical characteristics of the area or the structures at risk) that would materially differentiate between the two plans with regard to their performance under different RSLR scenarios. As discussed in Section 8.4.1, the timing and duration of performance at the intended design level could vary between the plans. And the plans' abilities to provide sufficient risk reduction for system certification (and thereby reduced flood insurance premiums) will vary under different RSLR scenarios.

For the most part, both plans can be adapted to higher RSLR conditions in the future by raising the levees and modifying the floodwalls. Both of these actions are relatively straightforward up to certain thresholds. The study team identified the following general thresholds, beyond which alterations become much more complicated and costly:

1) Levee raises can be accomplished on existing right of way until the corresponding increases to the levee base exceed the available right of way.
2) Floodwalls can be extended vertically, within limits, or replaced.

3) Overtopping of the Lake Borgne Surge Barrier can be adequately stored in the IHNC up to a point and then those structures would need to be raised or replaced.

Levee adaptation is relatively straightforward and theoretically has no limit – simply add a layer of soil on top of the exiting levee. However, as the top of the levee increases in elevation, the base of the levee expands and, depending on the location, stability berms may need to be added. The expansion of the base and berms can be accommodated on existing levee right-of-way up to a point, which varies around the system. When that point is reached, additional land will need to be acquired. However, the analysis of the two final plans indicate that the additional land required due to increased levee height may not be significant (the 1% plan requires approximately 27 acres of acquisition for the levee footprint while the 2-3 feet higher 0.5% plan requires just 28 acres of acquisition). If there are structures located in the levee's design footprint, they may need to be purchased and removed or a floodwall may need to be constructed instead. Possible adaptation actions to accommodate levee raises include pre-purchasing additional right of way adjacent to the levees.

A high RSLR scenario extended out to the 100-year horizon would also present additional challenges beyond height concerns. 8.6 feet of RSLR would result in perimeter levees that are constantly loaded, possibly requiring additional measures to address seepage and stability, in addition to overtopping. Some of these additional features may extend beyond the available right of way or may have increased impacts on the environment, cultural resources, or existing structures.

Floodwall adaptation is more limited than levee adaptation. The ability of a floodwall to be extended vertically depends on its foundation type and the original design parameters. If a floodwall can't be extended vertically (or reaches its limit), it must be replaced. Possible adaptation actions to allow for more vertical extension include designing the foundations for each plans' new floodwalls to handle additional wall height or design them to be below the upper limits of the design criteria. Particular challenges may include modifications to the IHNC Lock and replacing the floodwall in the French Quarter and along the Lake Pontchartrain lakefront due to space constraints.

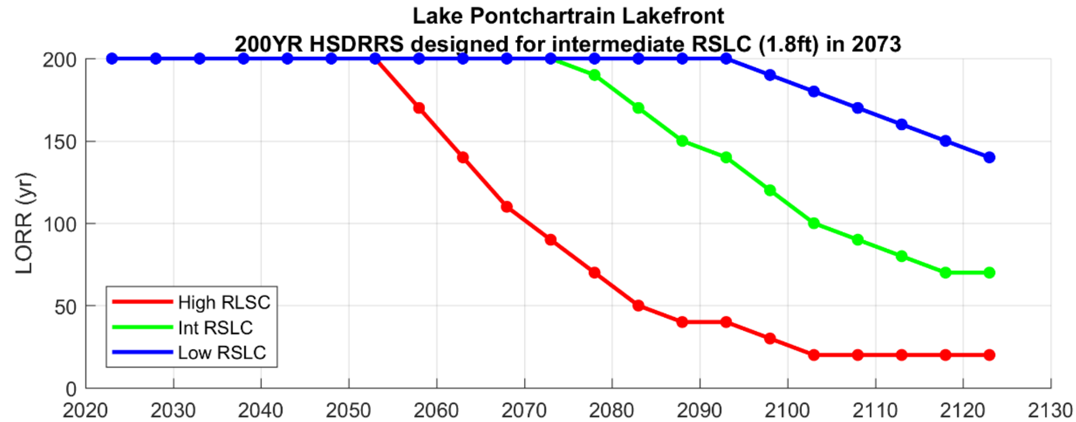
Additional overtopping of the Lake Borgne Surge Barrier into the IHNC can be accommodated for all RSLR scenarios within the study's period of analysis. The high RSLR scenario beyond the 50-year horizon would require some form of adaptation. The surge barrier is unlikely to be replaced but can be modified to accommodate higher surge by adding some plates. Additional pumping capacity could be added in the IHNC, or additional storage could be sought in the central wetlands.

8.4.2 PERFORMANCE FOLLOWING CONSTRUCTION IF THERE ARE NO ADDITIONAL LIFTS

To consider how these alternatives would perform in different RSLR scenarios, it is helpful to consider what would happen if there were no additional levee lifts or floodwall replacements following completion of construction. This is an unrealistic scenario because the local sponsor will be required to maintain the authorized level of risk reduction, but it does help to demonstrate how varying the RSLR assumption can affect the expected performance of the project.

Figure 8-4 displays the estimated level of risk reduction through time for the 0.5% AEP and 1% AEP alternatives at a portion of HSDRRS near the LPV Lakefront. Notice that the intermediate

RSLR (the assumed scenario for the alternatives) is in green, low RSLR is in blue and high RSLR is in red.



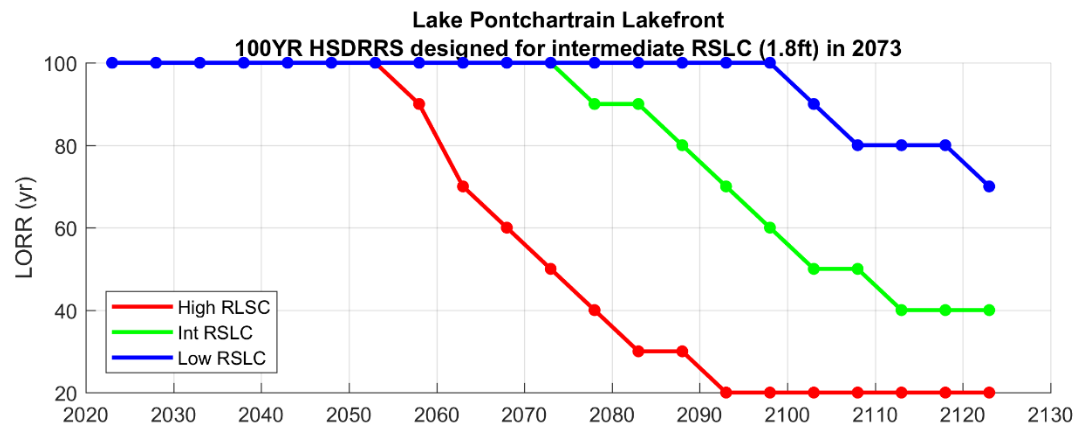


Figure 8-4. Level of risk reduction for the 200YR and 100YR alternatives for 3 RSLC projections at a location along the LPV Lakefront

The following conclusions about project performance under different RSLC scenarios can be drawn from these graphs.

1) For both alternatives, the project begins to lose performance near 2053 for the high RSLC projection.
2) For both alternatives, the project begins to lose performance in 2073 for intermediate RSLC projections (this is as designed).
3) If the 0.5% AEP alternative were to realize a low RSLC scenario, it would perform adequately to 2093.
4) If the 1% AEP alternative were to realize a low RSLC scenario, it would perform adequately until 2098.

8.5 COMPLETENESS, EFFECTIVENESS, EFFICIENCY & ACCEPTABILITY

Completeness, effectiveness, efficiency, and acceptability are four basic criteria used in the evaluation and screening of alternative plans. Alternatives considered in any planning study should meet minimum subjective standards of these criteria to qualify for further consideration and comparison with other plans.

Completeness is the extent to which a given alternative plan provides and accounts for all necessary investments or other actions to ensure the realization of the planning objectives, including actions by other federal and non-federal entities. Part of the evaluation of completeness will include the contribution of the plan towards the resilience in the engineered infrastructure, as well as in the community, economy, and environment.

Resilience is generally defined as the ability to avoid, minimize, withstand, and recover from the effects of adversity, whether natural or anthropogenic, under all circumstances of use. Completeness also considers sustainability, which is an evaluation of whether the plans include the features and resources to meet the study objectives in the study area beyond the period of analysis and the impact of the proposed project.

Effectiveness is the extent to which an alternative plan alleviates the specified problems and achieves the specified opportunities. Effectiveness will also consider the resiliency of the plan, the contribution of redundant features to overall plan effectiveness, and the robustness of the plan.

Redundancy is the duplication of critical components of a system with the intention of increasing reliability of the system, usually in the case of a backup or fail-safe. Robustness is the ability of a system to continue to operate as intended across a wide range of foreseeable operational conditions with minimal damage, alteration, or loss of functionality and to fail in a predictable way outside of that range.

Efficiency is the extent to which an alternative plan is a cost effective means of alleviating the specified problems and realizing the specified opportunities, consistent with protecting the nation's environment. Efficiency will also consider redundancy and robustness in the alternatives and should describe any potential trade-offs with economic efficiency.

Acceptability is the workability and viability of an alternative plan with respect to acceptance by state and local entities, tribes, and the public and compatibility with existing laws, regulations, and public policies.

Table 8-6 compares the final array of alternatives against these criteria.

Table 8-6. Evaluation of Alternatives using Principles and Guidelines Criteria

Alternative	Complete	Effective	Efficient	Acceptable
No Action Alternative	No	No	No	No
Alternative 2	Yes	Yes	Yes	Yes
Alternative 3	Yes	Yes	Yes	Yes

Completeness – Both of the action alternatives are complete in that they include all of the necessary investments to achieve the objectives. They all include appropriate levee resilience and are all sustainable if properly operated, maintained, repaired, rehabbed, and replaced when necessary. The No Action plan is not complete because it does not address any of the objectives.

Effectiveness – *At this stage of the study,* both of the action alternatives have been evaluated to be effective in achieving the economic and life safety risk reduction objectives. None of the action plans contain redundant features. The No Action Plan is not effective because it does not achieve any of the objectives.

Efficiency – Both of the action alternatives reduce the life safety risk due to overtopping by different amounts for different levels of investment. Increased investment does result in additional decrease in life safety risk but Alternative 2 is more cost-effective from an economic standpoint and has similar life safety risk reduction achievements. The No Action plan is not efficient because it does not achieve any of the objectives.

Acceptability – Both of the action alternatives have been designed to be acceptable in terms of laws, regulations, and public policies. They are likely to have varying levels of public acceptance (from the general public, the sponsor, affected communities, and governmental entities), which will be discussed further following the public review period. The No Action plan is unlikely to be acceptable to the public.

8.6 COMPARISON SUMMARY

The results of the evaluation of the final array are presented in Table 8-7. The costs are presented at fiscal year (FY) 19 price levels and the economic calculations utilize the FY 20 discount rate of 2.75%.

Table 8-7 only displays the evaluation information that was critical to differentiating between the monetary and non-monetary costs and benefits of each plan. Additional information on the differences between the plans with regard to Other Social Effects (OSE) and Environmental Quality (EQ) can be found in Section 7. Following identification of the recommended plan, Section 9 presents additional and updated details on the costs and benefits of the recommended plan.

Table 8-7. Evaluation of Final Array (October 2019 Price Level)

Key Factor	LPV No Action (Intermediate RSLR)	LPV ALTERNATIVE 2 System Levee Lifts to the Projected 1% AEP Event at 2073 (Intermediate RSLR)	LPV ALTERNATIVE 3 System Levee Lifts to the Projected 0.5% AEP Event at 2073 (Intermediate RSLR)
Costs			
Total Project First Cost	$0	$2,599,000,000	$2,849,000,000
Annual O&M Costs[3]	$0	$24,000,000	$27,000,000
Average Annual Costs	$0	$82,000,000	$89,000,000
Economic Benefits - NED			
Average Annual Damages Reduced (Benefits)	$0	$203,000,000	$207,000,000
Average Annual Net Benefits	$0	$122,000,000	$118,000,000
Benefit-to-Cost Ratio (BCR)	N/A	2.5	2.3
Life Safety Risk - OSE			

Key Factor	LPV No Action (Intermediate RSLR)	LPV ALTERNATIVE 2 System Levee Lifts to the Projected 1% AEP Event at 2073 (Intermediate RSLR)	LPV ALTERNATIVE 3 System Levee Lifts to the Projected 0.5% AEP Event at 2073 (Intermediate RSLR)
Tolerability	Life safety risk will be above tolerable levels.	The plan is anticipated to reduce life safety risk due to overtopping below TRG1	The plan is anticipated to reduce life safety risk due to overtopping below TRG1
Environmental Impacts – EQ[1]			
Mitigation BLH-Wet AAHUs	N/A	12.1	17.7
Mitigation Costs	N/A	$3,713,000	$4,125,000
Real Estate[2]			
Temporary Road Access and Work Area (acres)	N/A	16	16
Perpetual Levee (acres)	N/A	27	27
Borrow (acres)	N/A	321	362
Residual Risk			
Life Safety	Life safety risk will remain above tolerable levels.	Residual risks are high due to the extensive population protected by the levee system, even with good evacuation procedures.	Residual risks are high due to the extensive population protected by the levee system, even with good evacuation procedures.
Economic Damages	$233,000,000	$30,000,000	$26,000,000
Critical Infrastructure (#) at Risk	873	164	156

1 Environmental impacts in this table reflect the information available prior to selection of the recommended plan. After selection, the recommended plan was further refined and the revised numbers can be found in Chapter 7 and Section 8.8.1. Alternative 3 quantities were not updated during feasibility level design

2 Requirements for ROW will continue to be evaluated to determine whether temporary or permanent easements are most advantageous to the Government.

3 OMRR&R estimates at this stage of the study were incorrectly calculated but did not impact the comparison and selection of the recommended plan. See Section 9.3 for the correct estimate of OMRR&R costs for the recommended plan.

8.7 RECOMMENDED PLAN / NATIONAL ECONOMIC DEVELOPMENT PLAN

The primary decision criteria for identifying the NED Plan includes reasonably maximizing net benefits while remaining consistent with the federal objective of protecting the nation's environment. Contributions to NED are increases in the net value of the national output of goods and services, expressed in monetary units.

Based on the evaluation and comparison analysis summarized above, Alternative 2 is identified as the NED Plan and the Recommended Plan. Based on these preliminary numbers, the recommended plan had a total project first cost of approximately $2.6 billion and a BCR of 2.5. Additional refinements to the plan (summarized in Section 8.8) resulted in changes to the estimated benefits and the revised numbers are described in Section 9.

In order to implement the Recommended Plan, Public Law 113-121, Section 3017, REHABILITATION OF EXISTING LEVEES requires modification to extend or eliminate the authorization termination date of 2024.

8.8 REFINEMENTS TO THE RECOMMENDED PLAN

Following identification of the recommended plan, the study team made further refinements to the recommended plan, including incorporation of additional detail into the modeling and the design of features, consideration of additional measures, and an update to the period of analysis. This section discusses each of these areas of refinement.

8.8.1 ANALYSIS AND DESIGN REFINEMENTS

The study team updated the hydraulic modeling with additional information about foreshore ground conditions and other existing features located exterior to the system, such as existing wave berms. These modifications resulted in reduced surge and wave heights, thereby reducing the required design elevations. Reduced design heights resulted in reduced quantities for levee lifts and reduced need for floodwall replacement. Cubic yards of borrow required were reduced by 45%. Floodwall replacements were reduced from 18.5 miles to 3.2 miles, which includes a 2-mile floodwall along a co-located levee as described below. This reduction reflects that the initial design estimated that most of the floodwalls were deficient by less than 3 feet. The refined design lowered the design height between 1 and 3 feet in most cases and up to 5 feet in one area. Therefore, most of the floodwalls no longer needed to be replaced. In areas where floodwalls were still determined to be deficient in height, the refined structural analysis determined that modification could only be considered if the deficiency were less than 6 inches (rather than the two feet originally assumed). A decision was made at that time to conservatively assume any floodwall height deficiency would require full replacement.

Refinements to the hydraulic modeling also affected the calculations of existing, future without project and future with project economic damages, as well as estimates of life safety risk. Reduced damage estimates due to lower surge and wave heights were offset by price level increases and discount rate reductions, resulting in little to no change to with-project benefits estimates. Combined with the overall construction cost reductions, the benefit-to-cost ratio increased. There was no significant change to life risk estimates.

Additionally, survey data was gathered in the area of new co-located levees along the Mississippi River, which demonstrated that one reach lacked sufficient space to incorporate a levee lift and, instead, a 2-mile floodwall would need to be constructed. This resulted in increased costs in these reaches but also reduced the estimated environmental impacts. The acreage of Bottomland Hardwood-Wet habitat impacted decreased from 27 to 20 acres.

Finally, the study team considered if additional actions would be needed to address future increased overtopping of the Lake Borgne Surge Barrier due to RSLR. The team concluded that the additional flow into the IHNC corridor could be accommodated without additional modifications to the surge barrier or the IHNC levees or floodwalls. See Appendix C (Hydrology and Hydraulics) for additional information on this analysis.

8.8.2 UPDATE TO THE PERIOD OF ANALYSIS

Per USACE policy, the period of analysis begins when project benefits begin to be accrued. For this project, that would be the year of completion of the first construction contract. As discussed in Section 1.4, the current construction authority terminates in June 2024. With the current schedule to complete the study in 2021 and the need for additional authorization, the study team estimated that the earliest the first construction contract could be completed would be 2028. This shift of three years does not have any impact on identification of the recommended plan but does have a small impact on the economic analysis and those updated calculations are presented in Appendix J.

Adjusting the period of analysis is unlikely to substantively change the projected RSLR calculations and projected design heights – most likely no more than a few tenths of a foot. Design elevations are rounded up to the to the nearest 0.5 feet, allowing some flexibility to accommodate any change and design elevations are also likely to continue to change in the future as updated ADCIRC modeling and more detailed design efforts are completed during PED. Therefore, the study did not adjust any engineering modeling, design calculations or cost estimates to reflect this change in the period of analysis. Additionally, the estimating timing of levee lifts and floodwall construction presented in the appendices was not revised to reflect the delay in construction authorization. However, the economic analysis did shift the construction schedules to reflect the revised period of analysis.

Appendix J provides the updated economic analysis. The updated benefits are presented in Section 9.3 and the updated residual economic risk is presented in Section 9.8.3.

8.8.3 CONSIDERATION OF ADDITIONAL MEASURES

During this time of design refinement, the team also reconsidered several measures that were previously found during measure screening to be insufficiently effective on their own but could possibly be added to the recommended plan to increase its effectiveness or efficiency. These considerations included adding non-structural features (such as improved risk communication, additional risk reduction for critical infrastructure, etc.), features to increase robustness or resilience (additional armoring, etc.) and increased interior drainage measures (storage and pumping). The team reached the conclusion that no additional measures should be added to the recommended plan. The following paragraphs discuss the rationale for this conclusion.

Additional Non-Structural Features

Risk communication is an essential aspect associated with all flood and coastal storm risk management studies. In general, risk communication in the New Orleans area is already at a high level (see discussion in Section 3.2). Each Parish, as well as the State of Louisiana, has an emergency action plan for a hurricane event. As such, the recommended plan does not include additional non-structural features such as flood warning systems or evacuation plans. However, USACE has the responsibility to continue to assess levee systems and communicate findings (including associated benefits and risks) in order to ensure the project is delivering the intended federal benefits. Based on the results of future levee screening assessments, USACE will continue to coordinate a risk communication strategy with the sponsor, FEMA, and other entities as appropriate.

Additional Risk Reduction for Critical Infrastructure

USACE guidance requires that special consideration is given to critical infrastructure within a study area. Critical infrastructure includes emergency services such as hospitals, fire stations, schools, refineries, and other high value facilities. Figure 8-5 shows the location of some of the critical infrastructure that is located throughout the interior of the LPV system.

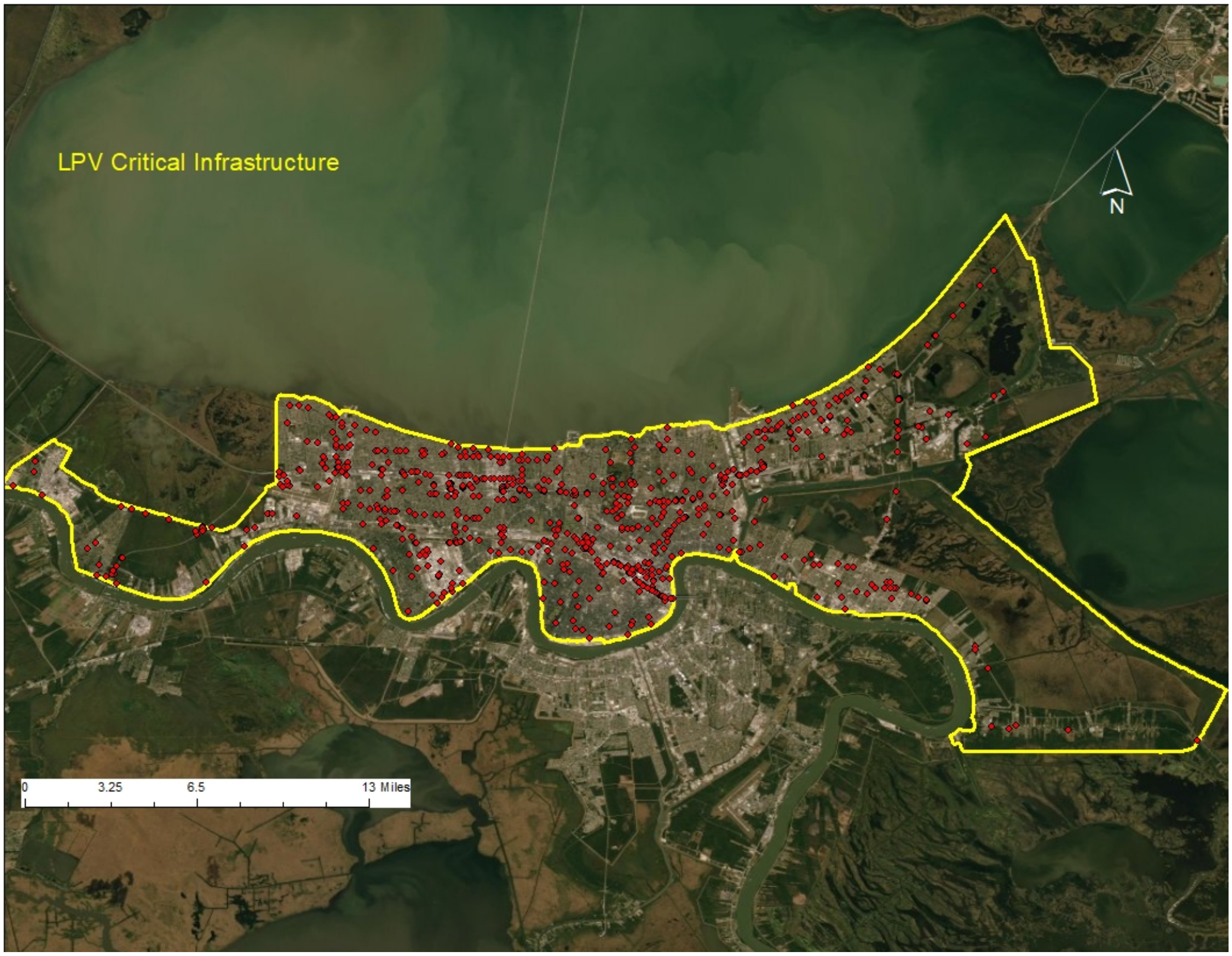


Figure 8-5. Location of Critical Infrastructure (red dots)

As displayed in Table 8-8, the recommended plan greatly reduces the number of critical infrastructure structures at risk of inundation due to overtopping. The study team evaluated possible measures to further reduce the remaining flood risk for critical infrastructure once the project is constructed. As an example, one potential solution might be compartmentalization by either building a small ring levee or floodwall around certain areas containing critical infrastructure.

A targeted evaluation of critical infrastructure included assessing residual damages to three categories of critical infrastructure: emergency services (e.g., hospitals, fire stations, national shelters, state and local emergency operations centers, American Red Cross facilities, etc.), chemical manufacturing plants, and bridges. Under the future with-project condition, inundation is minimal or non-existent at these key locations (see Table 8-8). This assessment indicates that residual risk of flood damages to critical infrastructure is low. As such, targeted risk reduction measures are not currently recommended.

Table 8-8. Select Critical Infrastructure Impacted by Residual Flooding (LPV)

Critical Infrastructure Category	Structures Inundated	Inundation >1 foot
Emergency Services		
American Red Cross Facilities	0	0
Helipads	0	0
Communication Centers	0	0
Emergency Medical Services	0	0
FEMA Recovery Offices	0	0
Fire Stations	2	0
State Emergency Operations Centers	0	0
Receiving Hospitals	0	0
National Shelter Systems	0	0
Service Providers	0	0
Chemical Manufacturing Plants	3	0

Increased Resiliency and Robustness

Additional features such as wave berms and armoring were evaluated to determine their effectiveness at improving the resiliency or robustness of the recommended plan. However, all perimeter levees are already armored with either high performance turf reinforcement mats, concrete aprons, rip-rap, or articulated concrete blocks. In addition, upon further evaluation of potential wave berm locations, there were only limited technically feasible locations to place wave berms in the project area. Therefore, it was determined that there are limited opportunities to provide significant improvements in overall project performance with the addition of these types of features.

Interior Drainage Facilities

The interior drainage infrastructure in the study area includes local pump stations and drainage canals, the federal flood risk reduction Southeast Louisiana Urban Flood Control Project ("SELA"), and the post-Hurricane Katrina authorized storm-proofing of interior pump stations to ensure the operability of the stations during hurricanes, storms, and high water events. As previously discussed, the authorizing language limits considering of additional interior drainage features to those that may be required if the perimeter features were to have an adverse impact on interior drainage. The study found no adverse impacts and, therefore, additional interior drainage facilities are not required.

9 RECOMMENDED PLAN

This section discusses the details of the Recommended Plan, as updated during design refinement. All information reflects the project requirements at the end of the 50-year period of analysis and assume an intermediate scenario for relative sea level rise.

9.1 DESCRIPTION

Alternative 2 is the Recommended Plan which includes system levee lifts to the projected 1% AEP event at 2073, assuming an intermediate RSLR condition. Construction of the Recommended Plan would generally occur in the same footprint as the existing LPV project and existing MRL levees. Project features consist of 50 miles of levee lifts along the existing levee alignment, with construction timing to occur before the combined effects of consolidation, settlement, subsidence and sea level rise reduce the levee elevations in each levee reach below the required design elevation. In some reaches, levee lifts may need to occur more than once during the period of analysis. Additionally, the Recommended Plan includes 3.2 miles of floodwall replacements or new floodwall along the existing alignment to be constructed prior to the combined effects causing the design requirements to be exceeded for each structure. Approximately 9 miles of MRL levees will be added as co-located features with the LPV project.

Mitigation is anticipated to be required to address potential impacts to habitat along the Mississippi River in the co-located reach. Project implementation is estimated to require acquisition of approximately 7 acres for temporary road access, 9 acres for temporary work areas, 27 acres for perpetual levee easements, and 177 acres for borrow. These estimates may be revised during the design phase when additional modeling is completed and may also be revised if a different RSLR condition is realized in the future.

The Recommended Plan includes targeted areas of foreshore protection along Lake Pontchartrain in areas where foreshore protection already exists. Water-based construction would be required for construction of the foreshore protection along the shore of Lake Pontchartrain. This will require some dredging with a bucket dredge and temporary material stockpiling to provide access to deliver and place the stone for foreshore protection, and bring it back up to the required elevation for levee protection. In order to allow construction equipment to access the shoreline, construction access channels would be dredged and dredged material would be temporarily stockpiled adjacent to the channels. Construction access channels and stockpile areas would be brought back to original elevations subsequent to completion of construction activities. In addition, rock foreshore protection would be placed on top of existing foreshore protection in Lake Pontchartrain to bring the stone back up to the required elevation for proper levee protection.

Figure 9-1 depicts the location of features included in the Recommended Plan. Areas of the existing LPV project that are not highlighted in Figure 9-1 were determined to not require modification.

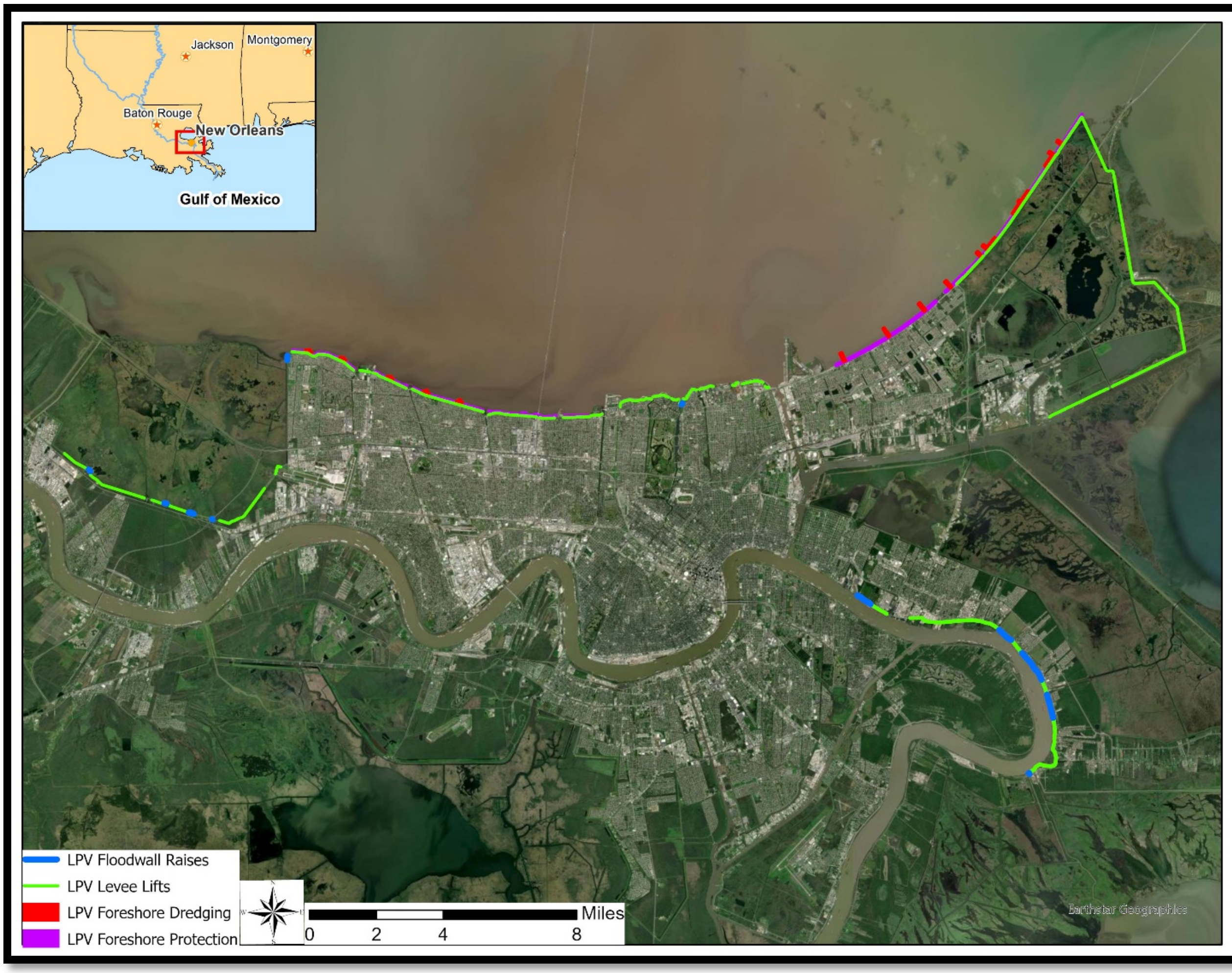


Figure 9-1. Location of Features Included in the Recommended Plan

The new design elevation will require areas of LPV levee co-location with the MRL along the Mississippi River. The current and estimated new crossover points can be seen in Figure 9-2. The existing east bank crossover point (which is not currently within the LPV system) is in red at River Mile 77.3 and the east bank Recommended Plan crossover point is in yellow at River Mile 90.5.

Figure 9-2. Existing (red) and With-Project (yellow) Crossover Points on the MRL

9.2 COSTS

Based on October 2020 price levels, the total first cost of the Recommended Plan is estimated to be $1.1 billion. Additional information about how these costs were estimated can be found in the civil, structural, real estate, mitigation and cost appendices. Appendix I (Cost Engineering) includes contingency estimates by Civil Works Breakdown Structure as well as the fully funded cost estimate including inflation through the midpoint of construction.

Table 9-1. Total Project First Cost Summary by Feature (Oct 2020 price level)

Feature Code	Feature Name	First Cost
06	Fish and Wildlife Facilities	$3,000,000
11	Levees and Floodwalls	$889,200,000
01	Lands and Damages	$8,600,000
30	Planning, Engineering and Design	$124,900,000
31	Construction Management	$80,300,000
	Total	$1,106,000,000

9.3 BENEFITS

This report section summarizes the impacts (both positive and negative) of the recommended plan. Some of the information is summarized from detailed information provided in Chapter 7 (Environmental Consequences) and the reference to the relevant sections are provided.

9.3.1 NATIONAL ECONOMIC DEVELOPMENT (NED) BENEFITS

The Recommended Plan reduces annual economic damages by $194 million and has annual net benefits of $167 million. Table 9-2 summarizes the updated economic information for the recommended plan.

Table 9-2. NED Summary for the Recommended Plan (October 2020 Price Level; FY 2021 Discount Rate)

Total Project First Cost	$1,106,000,000
Interest During Construction	$4,200,000
Total Investment Cost	$1,109,800,000
Average Annual Investment Costs	$26,100,000
Average Annual OMRR&R Costs	$479,000
Total Average Annual Costs	$26,600,000
Without Project Expected Annual Damages	$246,500,000
Expected Annual Damages Reduced (Benefits)	$193,600,000
Net Benefits	$167,000,000
Benefit-to-Cost Ratio	7.3

9.3.2 REGIONAL ECONOMIC DEVELOPMENT (RED) BENEFITS

The Recommended Plan generates benefits to the regional economy through construction activities. These activities can impact the levels of income, output and employment throughout the region. These impacts are not included in the NED analysis and may be used by decision makers as part of their investment decision process. The study estimates that 96% of the construction expenditures will be captured within the local area, with the remainder accruing to the state or nation. These local direct expenditures are estimated to support approximately 292 average annual, full-time equivalent jobs, nearly $1.1 billion in labor income, approximately $1.3 billion in gross regional product, and approximately $2.1 billion in economic output in the local impact area . Additional information about the effects at the state and national level, as well as income and value information, can be found in Appendix J (Economics).

9.3.3 OTHER SOCIAL EFFECTS (OSE)

9.3.3.1 LIFE RISK REDUCTION

Given the study's limited time and budget, and considering the authorizing language to "address consolidation, settlement, subsidence, sea level rise, and new datum to restore Federally authorized hurricane and storm damage reduction projects", the study's SQRA focused on risks related to overtopping of the levee system and did not evaluate prior-to-overtopping risks. This decision was supported by examination of the available Screening Level Risk Assessments, which identified overtopping of levees as the major risk driver. However, this scope decision means that the risk estimates presented in this report do not reflect the full project related flood risks, but rather just those risks related to overtopping of the system by stillwater and waves. If future risk assessments find that prior-to-overtopping failure modes drive the risk for the system, then it is possible that the project benefits identified by this study will not be fully realized.

The Recommended Plan reduces the future life safety risk associated with overtopping to a level below the societal life safety tolerable risk guideline associated with TRG-1. It reduces the risk of damages to 70 critical infrastructure structures.

The recommended plan is cost-effective, socially acceptable, and environmentally acceptable. The system already includes features that reduce the likelihood of failure (splash pads, armoring) and those are also included in the recommended plan. While additional actions could be taken locally to further reduce risk through continual improvements to communication and evacuation plans, current plans are very robust.

The recommended plan has met the guidelines of TRG-1 and TRG-4 for overtopping risk. The limited scope of the study and of the supporting risk assessment prevents an evaluation of TRG-1 and TRG-4 for total levee system risk. Incremental (with-project) life safety risk estimates are discussed in Section 9.8.2.

9.3.3.2 URBAN, RURAL, AND COMMUNITY IMPACTS

The recommended plan reduces the risk of flooding impacts due to overtopping to major transportation and evacuation corridors within the LPV system. Although the use of area roads would increase during construction, thereby impacting traffic and causing localized delays, road use would return to normal following construction (Section 7.16.2).

The plan would have some benefit to agricultural land within the system by reducing the storm surge flooding and related introduction of brackish water (Section 7.2.3). Borrow acquired from outside the system would impact up to 177 acres of prime farmland across seven parishes, which is a significant regional impact (Section 7.2.2).

The recommended plan does not displace any residents or businesses. In the long-term, the recommended plan's level of risk reduction should improve the confidence of residents and businesses and generate additional interest in redevelopment of storm-damaged neighborhoods (Section 7.17.2). The plan is expected to create a long-term increase in economic productivity by providing a more reliable hurricane and coastal storm damage risk reduction system for a portion of the greater New Orleans area. Increased reliability would prevent disruption to the local economy and prevent loss of wages for community residents. Increased reliability could create a long-term economic benefit to existing businesses that rely on reduced flooding for production. An improved hurricane and coastal storm damage risk reduction could also attract new industrial and commercial business to the study area, which would provide a long-term increase in economic productivity through increased revenue and jobs (Section 7.21.4).The plan lowers the actual and perceived risk to minority and/or low-income population groups within the system, who might otherwise consider relocation, thereby increasing the potential for continued community cohesion (Section 7.18.2). It would also allow vulnerable populations within the study area to better recover from a hurricane event. The improved level of overtopping risk reduction with the recommended plan would contribute to a sense of safety, cultural security, and identity and promote social connectedness of affected communities.

The recommended plan also reduces the risk of flooding due to overtopping to three National Register Historic Districts and an archaeological site (Section 7.11.2) as well as reduces the risk that valued leisure and recreational activities would be disrupted by flooding (Section 7.13.2).

9.3.3.3 HEALTH AND SAFETY

The recommended plan reduces the risk of vector-borne diseases, contaminated drinking water and direct harmful contact with contaminated surface water that may occur if flood water inundation related to overtopping mixes with sewer and hazardous industrial substances (Section 7.19.2). The recommended plan would likely contribute to residents feeling safer in their community and living space.

9.3.4 ENVIRONMENTAL QUALITY (EQ) EFFECTS

At borrow areas, long-term negative effects on soil productivity would be expected since these soils would be taken out of use. However, long-term positive effects on soil productivity for soils within the protected levee system are expected due to reduced risk of storm surge and flooding (Section 7.21.1). Borrow area excavation would also impact wildlife. Substantial habitat could be permanently lost, altered, and fragmented (Section 7.21.3).

The plan impacts 20 acres of bottomland hardwoods in the co-located reaches along the Mississippi River. Impacts would be mitigated through purchase of mitigation bank credits. It also impacts 75 acres of lake bottom habitat in Lake Pontchartrain.

The recommended plan is not anticipated to have disproportionate adverse effects on minority and/or low-income populations in the study area (Section 7.18.2).

Cumulative effects determinations on all resources can be found in Section 7.1.3.

9.4 REAL ESTATE REQUIREMENTS

Most of the Recommended Plan will be constructed on land already acquired for the LPV project. The exception is the area along the MRL between the existing crossover point and the new crossover point, as well as a small area along the Lake Pontchartrain lakefront to the west of the Seabrook floodgate. Additional acquisition and rights of way will be required in this area. Project implementation requirements for lands, easements, rights-of-way, relocations, and disposal (LERRD) include approximately 7 acres for temporary road access, approximately 9 acres for temporary work areas, approximately 27 acres for perpetual levee easements, and approximately 177 acres for borrow.

9.5 CULTURAL RESOURCES REQUIREMENTS

The proposed levee shifts of the Mississippi River Levee outside of the existing right of way, unidentified borrow areas, and other project features have the potential to impact known and unknown cultural resources. To comply with Section 106 of the NHPA, for the features that are co-located with the Mississippi River Levee, the USACE has developed a programmatic agreement (PA) pursuant to 36 CFR 800.14(b) in consultation with the SHPOs, Tribes, ACHP, and other interested parties. The PA for the Mississippi River Levees (MRL) Supplemental Environmental Impact Statement (SEIS) establishes an alternative process for USACE to reach

Section 106 compliance for undertakings co-located with the MRL. The PA lists ‘Programmatic Allowances’ agreed upon by USACE, SHPOs, Tribes, and ACHP. The allowances are types of work that USACE will be able to conduct without consulting with SHPOs and Tribes, including levee and berm maintenance, floodwall replacement, levee enlargement, and others. The PA also creates a process for streamlined project reviews that allows USACE to expedite reviews of undertakings in areas that were previously surveyed and to mitigate impacts to identified cultural resources by implementing treatment measures from a list of agreed upon measures.

For the MRL areas of the LPV project, USACE will utilize the allowances and streamlined reviews as established in the MRL SEIS PA. For the LPV features that are not co-located with the MRL, the District determined that no adverse effect to historic properties would occur. Letters were emailed to the Louisiana SHPO and Federally-recognized Tribes on March 9, 2021 with a determination of No Adverse Effect to Historic Properties for most LPV features and describing the implementation of the MRL SEIS PA for the co-located LPV/MRL portions of the project. As such, the LPV project achieved full compliance with Section 106 of the NHPA on April 8, 2021.

9.6 MITIGATION REQUIREMENTS

Most of the Recommended Plan will be constructed on land already impacted by the LPV project. One exception is the area along the MRL between the existing crossover point and the new crossover point. The proposed mitigation plan assumes the 12.1 AAHUs of flood side bottomland hardwood-wet impacts (approximately 20 acres) would be mitigated through the purchase of mitigation bank credits. Additionally, borrow sites for the levee raises have not been identified. USACE will endeavor to identify sites that would not require compensatory mitigation; however, a need for compensatory mitigation associated with borrow excavation remains a possibility. The proposed mitigation plan is detailed in Appendix K. If mitigation would be required for future, proposed borrow sites, mitigation plans would be included in future NEPA documents evaluating those sites.

9.7 RISK & UNCERTAINTY

At the planning level, there is always uncertainty about the extent to which the Recommended Plan will meet the planning objectives. Even when project performance uncertainty is negligible, there are some retained risks. In addition, there can be new or transferred risks associated with the tentatively selected plan. It is important to evaluate, communicate, and manage these risks. This section addresses analytical risks associated with the study which are important to understand when considering the recommendation. These include remaining study risks (uncertainty related to the study’s conclusions), implementation risks (uncertainty related to design and construction activities), and outcome risks (uncertainty related to the ability to achieve the plan’s estimated benefits).

9.7.1 REMAINING STUDY RISKS

Over the course of the study, the study team made many assumptions and, with each assumption, there was a risk that the assumption could be wrong. If the study team assessed that an incorrect assumption could result in a poor study decision, it sought to either confirm the reasonableness of the assumption or took actions (usually additional analyses) to reduce the risk of a poor decision. Through this activity, most study assumptions were eventually confirmed as reasonable and/or the remaining risk was assessed to be low. This section summarizes the study risks that remain and are relevant to the recommendations of this study.

Limited ADCIRC model updates– As discussed in Section 3.2, the existing ADvanced CIRCulation (ADCIRC) and Simulating Waves Nearshore (SWAN) simulations were processed with the ERDC JPM-OS statistical code to produce exterior surge and wave statistics for design elevations. It was assumed that the datasets from the ADCIRC model sufficiently forecast exterior surge conditions to compute feasibility level design elevations. Additionally, the overtopping calculations and resulting inundation estimates are 50%, or, average value deterministic estimates. The risk associated with this assumption is that the estimated design heights may be incorrect.

- Management: To reduce the uncertainty associated with the existing ADCIRC model results, the 2017 CPRA storm surge and wave modeling (2017 Coastal Master Plan: Storm Surge) water levels, wave heights, and wave periods results were used in the overtopping calculations.
- Outcome: This reduced the study risk to a tolerable level but some risk remains that design heights could change during PED when the ADCIRC model is fully updated.

Economic analysis assumes levees do not breach prior to overtopping – Damages associated with a levee breach (due to non-performance or design exceedance) are not included in the economic analysis, possibly resulting in conservative (underestimated) damage estimates. The risk associated with this assumption is that the economic damages and benefits are not accurate. Additionally, if future risk assessments find that prior-to-overtopping failure modes drive the risk for the system, then it is possible that the project benefits identified by this study will not be fully realized.

- Management: The study team considered if fragility curves could be developed from the SQRA effort and incorporated into the economic modeling. The team determined that it would be a large effort and had a low likelihood to change the recommendation. The lack of fragility curves is anticipated to result in underestimated damages in all study conditions (existing, future without project, and future with project).
- Outcome: This is a tolerable risk that is not likely to affect the recommendation.

9.7.2 IMPLEMENTATION RISKS

Availability of specific borrow areas during the construction window – Real Estate acquisition estimates and NEPA compliance actions assume the sponsor will procure the necessary real estate in a timely manner on lands that avoid environmental impacts over the lengthy construction period. Impacts of borrow areas for the proposed actions were evaluated based on the list of assumptions outlined in Table 7-2. Because there are multiple projects in the area, the area is highly urbanized, and borrow sites are relatively shallow there is risk that protracted real estate acquisition and NEPA compliance actions could delay project implementation if not proactively managed.

- Management: In order to reduce the risk, additional coordination with USFWS and the local sponsor will be pursued during PED to ensure areas identified for borrow avoid impacts to wetlands and minimize impacts to sensitive areas. The recommendations provided from USFWS would be followed as much as practicable when identifying future borrow sites (See Appendix L, *Coordination*). Prior to construction, additional NEPA documentation and associated public review would be conducted, as necessary, to address impacts associated with borrow areas including compliance with all environmental laws and regulations.

Future availability of mitigation bank credits – Real Estate and NEPA compliance analyses assume there will be credits available from mitigation banks in the future, thereby precluding the need to construct mitigation sites. This is the most cost-effective alternative to mitigate the impacts of the project. Although the total number of credits needed is relatively small, there are currently insufficient mitigation bank credits available to cover the needs of the project. However, USACE anticipates that additional banks and credits will become available before the credits are required by the project. The risk associated with this assumption is that, if bank credits are not available, additional time and effort will be needed to acquire land and construct mitigation sites.

- Management: The New Orleans District currently tracks and will continue to track mitigation needs for all projects in its geographical area and monitor availability of credits. The project will identify credit needs incrementally as construction contracts are designed and implemented. If credits will not be available when needed, the project can develop mitigation sites at an additional cost.

Stability of existing floodwalls not recommended for replacement – Project costs assume little to no need to modify or replace existing floodwalls that are of sufficient height to meet the wave overtopping criteria under the future loading conditions. Due to study time constraints, stability of the existing floodwalls that will not be replaced by the project was not checked during the study under the modeled future stillwater loading. The risk associated with this assumption is that some floodwalls may not have a sufficient factor of safety when evaluated for future stillwater loading and will therefore need to be modified or replaced, thereby increasing project costs.

- Management: The cost risk register has an increased contingency applied to the floodwall feature. Updated ADCIRC modeling developed during PED will be used to evaluate stability. The PDT will calculate the factors of safety associated with the longer design life and develop new fragility curves to determine the appropriate risk and make informed decisions during PED.

9.7.3 OUTCOME RISKS

River Discharge Assumption – As discussed in Section 5.2.2, a Mississippi River discharge of 400,000 cubic feet per second was assumed in the ADCIRC modeling. This assumption is a key element in the estimate of surge elevations in the Mississippi River, which then drives the design elevations for levees and floodwalls located along the river. This was an assumption contained in the original ADCIRC modeling (circa 2002) as a reasonable estimate of average river flows during hurricane season and was not revised during the study. The risk associated with this decision is that the estimated design heights may be incorrect.

- Management: The study team considered if this was a reasonable assumption by looking at additional data on river flows through 2019. When the latest data was added and statistics processed, there appeared to be up to a 10% increase in mean discharge during hurricane season, which could affect storm surge estimates by up to 1 foot. However, due to the number of other anticipated changes to the ADCIRC model which could also affect design heights, the study team chose not to revise this single input to the model.

- Outcome: This risk was not anticipated to affect the study recommendation but some risk remains that design heights could change during PED. The ADCIRC model is currently being updated through an effort outside of this study and is anticipated to be available for use during the design phase to determine final design heights. Part of that update includes reconsideration of the river discharge assumption.

Intermediate Sea Level Rise Scenario – Alternatives development and evaluation utilized an intermediate RSLR scenario to estimate potential damages in the future, the necessary design heights (and thereby costs) of alternatives, and the reduction in damages (benefits) in the future if the alternatives were implemented. Due to the lengthy projection timeline, there is a relatively high risk that any estimate of RSLR at the end of the period of analysis will not be accurate. The potential consequences associated with this risk include increased costs associated with higher required design elevations (including construction quantities, real estate needs, and environmental impacts and associated mitigation).

- Management: All three relative sea level rate scenarios were calculated and evaluated. It was determined that the low and intermediate relative sea level rise scenarios were similar at 1.3 ft. and 1.8 ft. respectively and therefore the risk of under or over estimating benefits based on scenario selection between these two scenarios was low. However, the variance of 1.5 feet between the intermediate (1.8ft) and high (3.4 ft.) sea level rise scenarios is likely to affect benefits. Additional discussion on the sensitivity of the Recommended Plan to the low and high sea level rise scenarios is discussed with alternatives' comparison in Section 8.4.1. Construction of project features will occur over several decades and the timing of each contract will be dependent on the monitored progress of the combined effects of subsidence, settlement and sea level change. If RSLR is occurring faster or slower than anticipated, adjustments can be made to design elevations, as needed (see Section 8.4.2 for discussion of critical thresholds and adaptability of features). If a higher RSLR is realized and significant additional related project costs will be incurred, the project may need additional authorization.

9.8 RESIDUAL RISK

Implementation of flood risk reduction measures does not remove all risks due to flooding. There is always a residual risk of economic damages or life safety consequences associated with any project. Residual flood risk is defined as the risk of flooding in an area that remains at any point in time after accounting for the flood risk reduction contributed by the levee system. This risk stems from the possibility of the project design being exceeded, the possibility that the project will not perform as intended, or the possibility that the project changes the flood risk in nearby areas (this last one is termed "risk transfer" or "induced flooding").

This section discusses the residual risks estimated to occur if the project performs as designed, which includes estimates of likelihood of failure (breach) due to overtopping of the system. In this discussion, breach is not the result of an underlying system problem or unforeseen circumstance, but rather the result of design exceedance. The section presents estimated residual inundation within the system when the design is exceeded by a larger, less-frequent event but does not breach. It also includes consideration of possible induced flooding outside of the system. Estimates of economic and life risk are included.

This section does not evaluate flood risk in the possibility of project non-performance due to unforeseen circumstances. The public does need to be aware that unforeseen circumstances can cause non-performance (for example, a levee breach) and result in sudden localized high velocity flows and rapid increases in flood depth on the interior of the system.

9.8.1 RESIDUAL INUNDATION

As stated in Section 5.1. the study assumes that the MRL portions of the system will continue to be maintained at their currently required design heights and will function as intended. Additionally, as discussed in Section 3.4, the study's economic damage assessment assumes that the levees do not fail under any storm conditions. Other system components that are not recommended for action by this study (for example the Lake Borgne Surge Barrier and interior pumps) as also assumed to function as intended and in their current configuration into the future. This discussion of residual inundation in this section is based on these same assumptions and, therefore, inundation information is based solely on surge and wave overtopping estimates.

9.8.1.1 INTERIOR INUNDATION

The recommended plan is designed to prevent surge overtopping and significantly limit (but not completely prevent) wave overtopping for the 1% AEP event in the intermediate RSLR scenario, through the year 2073 (the end of the study's period of evaluation). This level of performance may extend beyond the year 2073 if a low RSLR scenario is realized (see Section 8.4 for detailed discussion) but will decline over time after 2073 if the intermediate or high RSLR scenarios are realized.

Figure 9-3 and Figure 9-4 display the estimated locations and depths of flooding if a 1% or 0.2% AEP event occurs in 2073 and the project performs as designed.

As discussed in Section 3.1.1, the inundation modeling did not include the effects of rainfall and a rainfall sensitivity analysis concluded that the model of interior flooding was not very sensitive to rainfall effects. However, there is always a possibility that extreme rainfall during a hurricane event could cause variations to the extent and depth of flooding depicted in Figure 9-3 and Figure 9-4.

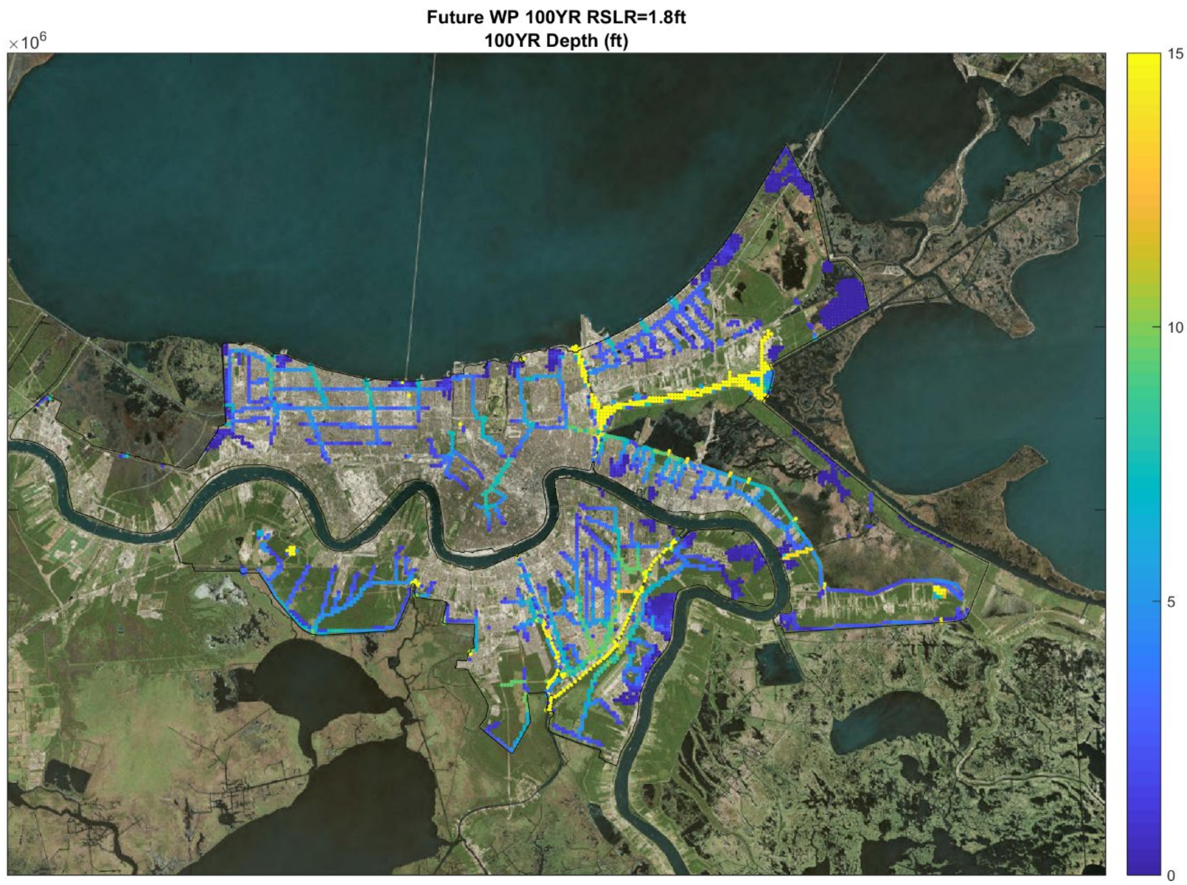


Figure 9-3. Residual Flooding for the 1% AEP Event with Full Performance of the Recommended Plan

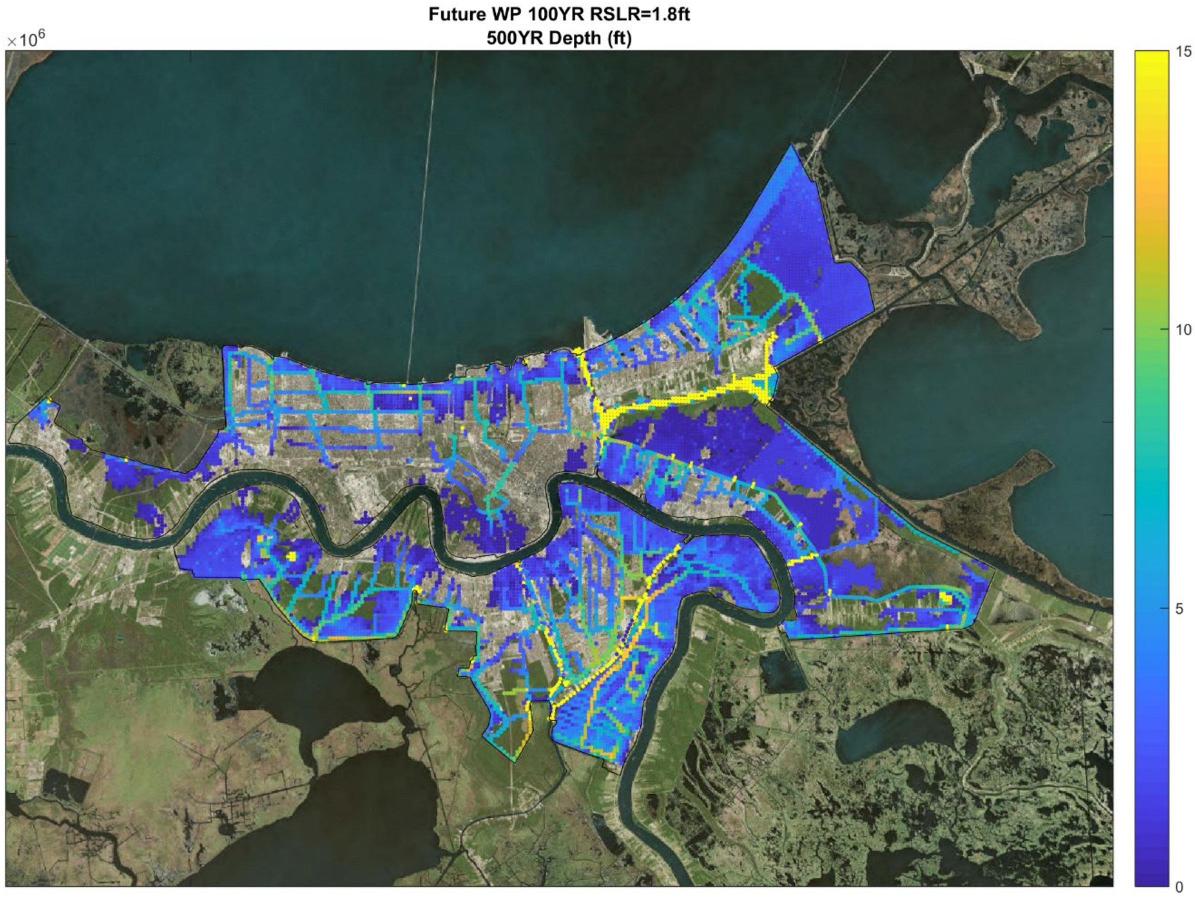


Figure 9-4. Residual Flooding for the 0.2% AEP Event with Full Performance of the Recommended Plan

9.8.1.2 RISK TRANSFER (INDUCED FLOODING)

Increasing the levee and floodwall heights may result in increased flood depths on areas exterior to the system. To consider these potential impacts, the modeled storm surge depths for the future without-project conditions were compared to surge depths for the with-project condition in the year 2073, assuming the intermediate RSLR scenario (conditions in 2078 would be expected to be similar – see discussion in Section 8.8.2). Figure 9-5 demonstrates that in the future without-project condition, current modeling indicates that the 1% AEP event produces flood depths to elevations between 7.8 and 17.1 feet (NAVD88) in the areas to the north and east of the LPV system.

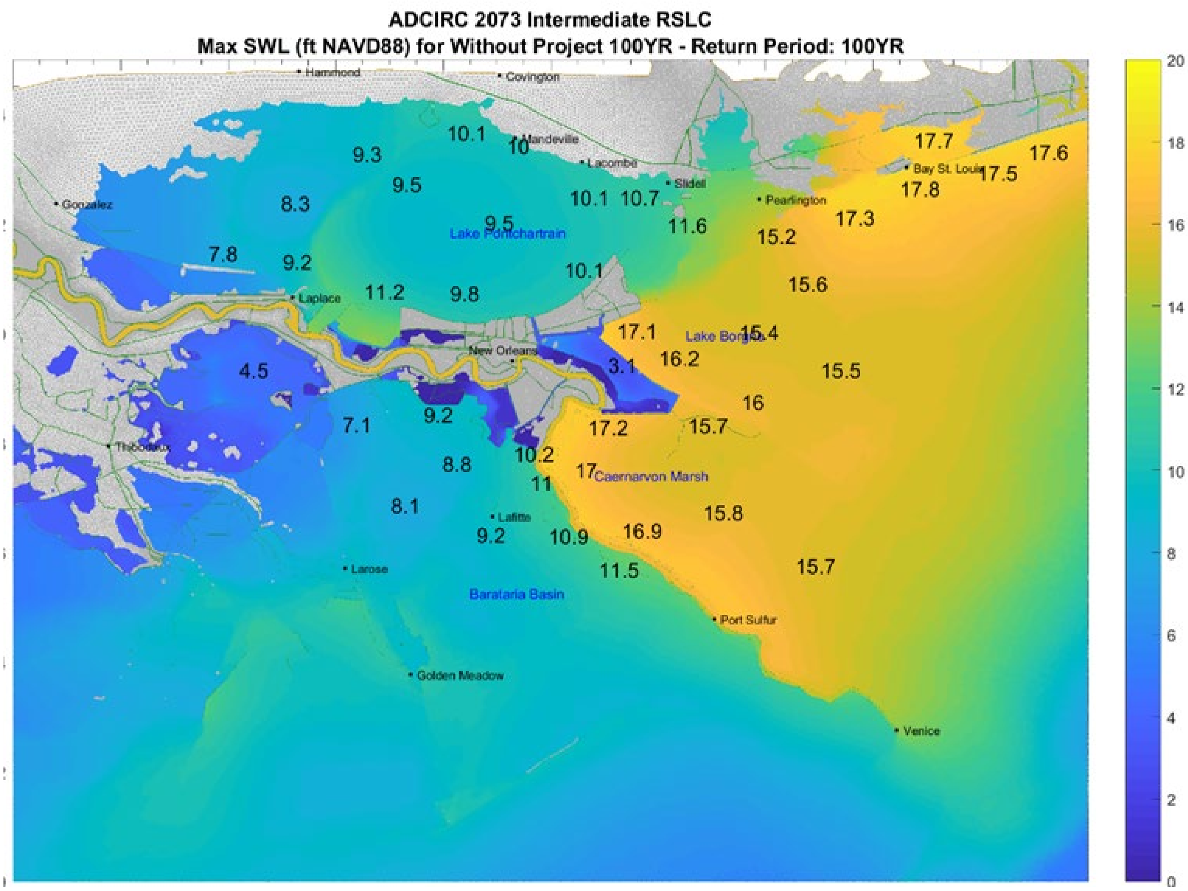


Figure 9-5. 1% AEP Future Without-Project Potential Storm Surge Depths in the LPV and WBV Area (Intermediate RSLR Scenario)

In the current with-project modeling, these 1% AEP flood depths are estimated to increase only in the area at the western end of the system and these increased depths are estimated to be less than six inches in most areas and up to one foot in areas immediately adjacent to the system. This area is largely undeveloped. These conclusions about the potential for induced flooding will be confirmed or revised during the design phase with the updated ADCIRC model when the final system design heights are determined. At that time, a determination will be made regarding whether any significant induced flooding is reasonably anticipated and the additional actions needed to address any potential induced flooding.

9.8.2 LIFE RISK

With any hurricane and storm risk reduction project, there remains life risk after project completion. This risk arises from the possibility (however small) that the project may not perform as designed or that the design may be exceeded. The detailed assessment of life risk for the recommended plan is estimated in Appendix D, which is not provided for public review due to the sensitive nature of the information contained within the appendix.

The estimated annual probability of failure of the system due to overtopping following implementation of the recommended plan is in the range of 3E-07 to 3E-06 (0.0000003 to 0.000003) and the corresponding average annual incremental life loss is 3E-04 (0.0003) lives per year The recommended plan reduces the future life safety risk associated with overtopping to a level below the societal life safety tolerable risk guideline.

9.8.3 ECONOMIC DAMAGES

With any hurricane and storm risk reduction project, there remains the risk for economic damages after project completion. The residual economic risks estimated for the Recommended Plan are related to events that exceed the project design (events greater than 1% AEP) but do not result in project non-performance. These damages are estimated to be $53 million annually.

9.9 EXECUTIVE ORDER 11988

EO 11988 requires federal agencies to recognize the significant values of floodplains and to consider the public benefits that would be realized from restoring and preserving floodplains. It is the general policy of USACE to formulate projects that, to the extent possible, avoid or minimize adverse impacts associated with use of the base floodplain and avoid inducing development in the base floodplain unless there is no practicable alternative that meets the project purpose. Screening of measures and alternatives for this study considered impacts to the floodplain and minimizing induced development. Per the procedures outlined in ER 1165-2-26 (Implementation of EO 11988 on Flood Plain Management), the study team has analyzed the potential effects of the NED plan on the overall floodplain management of the study area. USACE implementation guidance in ER 1165-2-26 states the following in Paragraph 6:

EO 11988 has as an objective the avoidance, to the extent possible, of long-and short-term adverse impacts associated with the occupancy and modification of the base floodplain and the avoidance of direct and indirect support of development in the base flood plain wherever there is a practicable alternative. Under the Order, USACE is required to provide leadership and take action to:

- Avoid development in the base flood plain unless it is the only practicable alternative;
- Reduce the hazard and risk associated with floods;
- Minimize the impact of floods on human safety, health and welfare; and
- Restore and preserve the natural and beneficial values of the base floodplain.

There are eight steps reflecting the decision-making process required in this EO. The eight steps and responses to them are summarized below.

Step 1. Determine if the proposed action is in the base floodplain.

The proposed actions are located within the base floodplain for the Mississippi River.

Step 2. If the action is in the floodplain, identify and evaluate practicable alternatives to locating in the base floodplain.

As the primary objective of the project is coastal storm risk management, there are no practicable alternatives completely outside of the base floodplain for the proposed features that would achieve this objective.

As part of the analysis conducted for the NED described throughout this report, the study team completed analysis of residual risks including any induced or transferred flood risks to determine whether coastal storm risk management measures are economically justified as providing greater benefits than costs.

Step 3. Provide public review.

The public had the opportunity to review and comment on the draft report during the 45-day public review period which began in December 2019. Public meetings occurred in January 2020 to present the Recommended Plan and allow the public to respond and ask questions. Responses to public comments on the draft GRR are included in Appendix L of the final GRR.

Step 4. Identify the impacts of the proposed action and any expected losses of natural and beneficial floodplain values.

Sections 6, 7, and 8 of this document presents an analysis of alternatives. Practicable measures and alternatives were formulated and potential impacts and benefits were evaluated both qualitatively and quantitatively. The anticipated impacts associated with the Recommended Plan are summarized in Sections 7 and 8 of this report. For each resource analyzed in Section 7, wherever there is a potential for adverse impacts, appropriate best management practices or other mitigation considerations were identified. Best management practices are also described in Section 7.

Step 5. Minimize threats to life and property and to natural and beneficial floodplain values. Restore and preserve natural and beneficial floodplain values.

Implementing the Recommended Plan would have a significant reduction to flooding impacts on human health, safety, and welfare. The proposed project is not anticipated to induce development in the floodplain above and beyond development that is expected to occur in the FWOP condition as described in Section 4. It is further assumed that new development will be built above the base 1% AEP floodplain to comply with building codes of local municipalities and to maintain participation in the NFIP, even if not able to participate in the NFIP for the without project condition. Flood insurance is recommended for both without project and with the Recommended Plan as insurance provides greater resiliency by providing financial risk management for residual risks.

Step 6. Re-evaluate alternatives.

Sections 6, 7, and 8 of this document presents an analysis of alternatives. There are no practicable alternatives completely outside of the base floodplain for the features included in the Recommended Plan that would achieve study objectives of reducing coastal storm risks.

Step 7. Issue findings and a public explanation.

Public meetings occurred January 2020 to present the Recommended Plan and allowed the public to respond and ask questions. The public has been advised that no practicable alternative to locating the proposed action in the floodplain exists with a public notice and involvement under NEPA to fulfill this requirement as indicated in Item 3 above.

Step 8. Implement the action.

The proposed project on its own does not contribute to increased development in the floodplain and does not increase coastal storm risk. The Recommended Plan is consistent with the requirements of this EO.

9.10 MEETING ENVIRONMENTAL OPERATING PRINCIPLES

USACE has reaffirmed its long-standing commitment to environmental conservation by formalizing a set of Environmental Operating Principles (EOPs) applicable to decision-making in all programs. The EOPs outline the USACE role and responsibility to sustainably use and restore natural resources in a world that is complex and changing. The recommended plan meets the intent of the EOPs.

The Recommended Plan supports each of the seven USACE EOPs. The recommended plan strives to achieve environmental sustainability by implementing a project to provide flood risk management while minimizing negative changes to the natural environment. Developing alternatives which were sensitive to environmental effects was key during the plan formulation process. While recognizing the life safety and economic benefits to be gained from hurricane and coastal storm risk reduction, the recommended plan has been developed to be sustainable but sensitive to the balance and synergy between development and nature through the use of USACE design criteria and guide specifications while striving to reduce the amount of disruption to wetland habitats. In developing mitigation solutions, coordination was conducted with multiple public resource agencies such as the USFWS, Department of Natural Resources, LDEQ, CPRAB, Louisiana Department of Transportation and Development, the NOAA, and USEPA to build knowledge to understand environmental impacts in order to collaboratively develop innovative, win-win solutions that also protect and enhance the environment. For each adverse effect identified, a responsible mitigation or action to minimize the adverse effect is identified in the Integrated EIS and will be implemented to reflect USACE commitment to accept responsibility and accountability for its actions.

9.11 LESSONS LEARNED DURING HURRICANES KATRINA AND RITA

The selected plan will be consistent with each of the Chief of Engineers' Actions for Change for Applying Lessons Learned during Hurricanes Katrina and Rita issued 24 August 2006. The twelve actions are grouped into four themes.

Actions in the first theme, Comprehensive Systems Approach, include employing integrated, comprehensive systems-based approaches; employing adaptive planning and engineering systems; and focusing on sustainability. The study evaluated LPV as both an individual project and how it effects adjacent systems and levees. The team considered all components of the levee system which entailed analyzing and discussing data and pertinent features to ensure that they would not indirectly affect other areas.

Actions in the second theme, Risk Informed Decision Making, include employing risk-based concepts in planning, design, construction, operations, and major maintenance and reviewing and inspecting completed works. The Recommended Plan for LPV was selected using a risk-informed decision making process. The Recommended Plan will reduce risk of life loss due to hurricane and storm damage and will reduce life safety risk below the USACE TRGs. The Recommended Plan was designed and informed by a methodology that considers not only the performance and potential failure modes that cause the increased risk to the system, but also accounts for the consequences of said failure modes.

Actions in the third theme, Communication of Risk to the Public, include effectively communicating risk and establishing public involvement risk reduction strategies. The report establishes the current condition of LPV levee system with regard to overtopping risk and how this condition relates to public safety. However, because prior-to-overtopping risk was not included in the analysis, the report cannot communicate the full system risk. The Levee Safety Program Manager for the New Orleans District will include this information in the communication plan for the LPV system until such time as a full risk assessment can be completed. The

Integrated EIS will be available for review on the USACE project webpage. Several meetings took place during the study process between USACE, the sponsor, the public, and other stakeholders.

Actions in the fourth theme, Professional and Technical Expertise, include continuously reassessing and updating policy for program development, planning guidance, design and construction standards; dynamic independent reviews; assessing and modifying organizational behavior; managing and enhancing technical expertise and professionalism; and investing in research. The report will be continuously reassessed during its development. The analysis has undergone District Quality Control (DQC) and ATR (Agency Technical Review) reviews for existing and future conditions, as well as DQC of the draft report with Recommended Plan. Additional DQCs, ATR, and constructability review have occurred for the final report. Finally, an Independent External Peer Review has been conducted, where a panel of subject matter experts outside of the agency (USACE) have provided comments and recommendations to the study team that have been considered for implementation.

9.12 USACE CAMPAIGN PLAN

The USACE Campaign Plan provides goals, objectives, and actions for improving the USACE contribution to the nation in the areas of warfighting; civil works processes and delivery systems; risk reduction from natural events; and preparation for the future. The four primary goals are to 1) Support National Security, 2) Deliver Integrated Water Resources Solutions, 3) Reduce Disaster Risks, and 4) Prepare for Tomorrow. The LPV Recommended Plan supports the Campaign Plan with contributions to Goals 2 and 3. The project does not make significant contributions to the other two goals.

Goal 2 (Deliver Integrated Water Resource Solutions) includes the following objectives: 2a - Deliver quality water resource solutions and services; 2b - Deliver the civil works program and innovative solutions; 2c - Develop the civil works program to meet the future needs of the nation; and 2d - Manage the life-cycle of water resources infrastructure systems to consistently deliver reliable and sustainable performance. The LPV Project supports Goal 2 by:

- identifying a plan to reduce existing and future economic and life safety hurricane and coastal storm risk related to overtopping within the LPV Project,
- coordinating with significant stakeholder groups throughout the study process, and
- recommending a sustainable and resilient hurricane and coastal storm risk management plan, with appropriate consideration and identification of the long term operation and maintenance of the risk reduction features.

Goal 3 (Reduce Disaster Risks) includes the following objectives: 3a – Enhance interagency disaster response and risk reductions capabilities; 3b – Enhance interagency disaster recovery capabilities; 3c – Enhance interagency disaster mitigation capabilities; and 3d – Deliver and advance Army Geospatial Engineering. The LPV Project supports Goal 3 by:

- contributing significantly to interagency efforts to reduce coastal storm risks in the study area before, during, and after plan implementation, and
- increasing awareness of the potential coastal storm risks among the project stakeholders through coordination and increased communication with other relevant agencies, thus enhancing interagency disaster capabilities and coordination relative to disaster preparation and response.

9.13 SPONSOR SUPPORT

The sponsor for construction is the CPRAB, who has indicated it may enter into Cooperative Endeavor Agreements or other sub-agreements for performance of the NFS's obligations and responsibilities, including the acquisition of LERRDs, OMRR&R, and other items of local cooperation with the local levee districts or other state entities. The CPRAB is fully supportive of the Recommended Plan, has identified no other locally preferred plan, and has provided a sponsor self-certification of financial capability and letter of support as part of the final report submittal.

9.14 SUMMARIZED COSTS AND BENEFITS OF THE RECOMMENDED PLAN

Table 9-3. Details of the Recommended Plan[1]

Key Factor	LPV ALTERNATIVE 2 System Levee Lifts and Floodwall Modifications to the Projected 1% AEP Event at 2078 (Intermediate SLC)
Costs	
Total Project First Cost	$1,106,000,000
Average Annual O&M Costs	$479,000
Average Annual Costs	$26,600,000
Economic Benefits - NED	
Average Annual Damages Reduced (Benefits)	$194,000,000
Average Annual Net Benefits	$167,000,000
Benefit-to-Cost Ratio (BCR)	7.3
Life Safety Risk - OSE	
Tolerability	The plan is anticipated to reduce life safety risk due to overtopping below the societal tolerable risk guideline.
Residual Risk	
Life Safety	Residual risks are high due to the extensive population protected by the levee system, even with good evacuation procedures.
Residual Average Annual Economic Damages	$53,000,000
Critical Infrastructure Damaged (remaining/FWOP)	164 / 873

1. October 2020 Price Level and FY 2021 Discount Rate (2.5%); Base year 2028.

10 PROJECT IMPLEMENTATION

Implementation of the project depends on approval of this report, additional Congressional authorization, appropriation of sufficient federal design and construction funding, and matching sponsor contributions in the form of cash, land acquisition credit, or work-in-kind credit. A PPA will also need to be executed with the CPRAB.

The features and costs of the Recommended Plan described in Section 9 are based on a Feasibility level of design and rely on several outstanding assumptions. These features will need to undergo final design prior to construction, which involves additional technical analysis and confirmation or revision of those outstanding assumptions.

The study's assumptions about the rates of subsidence, consolidation, compaction, and sea level change were key drivers in the recommended project's design and related requirements (real estate, mitigation, etc.). If the actual rates of any of these parameters vary significantly from the study's assumptions during the implementation phase, the features and requirements necessary to achieve the recommended 1% AEP level of risk reduction may be significantly greater or less than estimated in this report. It is recommended that a monitoring and adaptive management plan for the project design be developed as an early activity during the design phase to establish methods and timing for monitoring these parameters, as well as identify likely triggers that may lead to significant design changes and/or the need to re-evaluate the project. This plan would be separate from any monitoring and adaptive management plan that may be required for environmental mitigation activities.

This section documents several important aspects of the design that must be considered and/or completed prior to and during construction, as well as summarizing requirements and responsibilities associated with project implementation.

10.1 REAL ESTATE CONSIDERATIONS

Real estate estimates associated with borrow are currently based on a feasibility-level design effort and assumption that suitable agricultural land is available. The number of acres required, as well as the suitability and availability of land will have to be further assessed as each levee reach is designed during PED.

Additionally, there is no land acquisition currently estimated for mitigation requirements, as the assumption was made that mitigation bank credits would be available for purchase. If mitigation bank credits are unavailable or not sufficiently available in the future, additional acquisition may be required for construction of mitigation sites.

No utility relocations are included in the LERRDs estimate, as the recommended features are all located on the current project footprint, or that of the MRL levee project. This will need to be confirmed or revised for each design segment.

Real Estate PED efforts may include:

- Submit right-of-entry requests for surveys or field work to occur during PED.
- Reacquire temporary estates since the term of three years for the prior construction period would be expired.
- Conduct research for updated ownership information.

The sponsor will not receive credit for lands previously purchased as an item of cooperation.

10.2 DESIGN CONSIDERATIONS

10.2.1 ENVIRONMENTAL AND CULTURAL RESOURCES CONSIDERATIONS

- Specific borrow areas will be identified during pre-construction engineering and design. At that time, additional NEPA documentation, HTRW surveys, cultural resource surveys, permit acquisition, and agency coordination, as appropriate, should be conducted. USFWS recommendations for identification of borrow areas should be followed to the greatest extent practicable. See Section 7.2.1 for additional information on the generalized borrow evaluation. Coordination with CEMVN Regulatory will be necessary to avoid potential conflicts with other permitting actions.
- Impacts to SAV in Lake Pontchartrain are to be avoided to the maximum extent practicable. Pre-construction SAV surveys must be conducted and areas of SAV must be avoided accordingly. If SAV impacts can't be avoided, impacts will need to be mitigated. SAV survey requirements and avoidance language must be included in construction contract solicitation language.
- Lighted marine buoys need be placed in Lake Pontchartrain to delineate the temporary hazard of the stockpiled dredged material. This needs to be included in the construction specifications.
- Standard species protection measures will apply to dredging and other work in Lake Pontchartrain to avoid impacts to threatened and endangered sea turtles, Gulf sturgeon, and manatees; the standard species protection measures for sea turtles, Gulf sturgeon, and manatees and the Best Management Practices to avoid impacts to pallid sturgeon in the Mississippi River are to be included in construction plans and specifications.
- Pre-construction nesting bird surveys are to be conducted by USFWS and USACE. USFWS recommends that a qualified biologist inspect the proposed work sites for the presence of undocumented nesting colonies during the nesting season (e.g. February through September depending on the species). If colonies exist, work should not be conducted within 1,000 feet of the colony during the nesting season.
- Prevent colonial nesting birds from establishing active nests within the project construction right-of-way.
- Recommendations to minimize potential project impacts to eagles and their nests are provided by LDWF in Appendix L and USFWS in their National Bald Eagle Management Guidelines and these recommendations are to be followed during construction. Pre-construction surveys, buffer areas, and construction seasons may be required.
- Continue coordination with natural resource agencies to ensure final designs have all necessary approvals, avoid and minimize impacts, and enhance fish and wildlife habitat to the fullest extent practicable.
- The Louisiana Department of Natural Resources Office of Coastal Management determined that a "phased consistency determination" was the appropriate approach for this project for compliance with the Coastal Zone Management Act. Accordingly, during the design phase and prior to any construction activities, modifications to the existing consistency determination need to be submitted by USACE and approved by LDNR.
- Continue coordination with the National Park Service regarding potential impacts to Chalmette Battlefield and National Cemetery during replacement of adjacent floodwall.
- If any borrow areas are located in air quality non-attainment areas, conduct general conformity analyses as required.

- For work on the co-located LPV/MRL work, carry out any actions required by the MRL SEIS Programmatic Agreement. This includes any necessary investigations and coordination associated with construction of each project feature.
- Comply with the notification and avoidance requirements regarding manatees, nesting birds, bald eagles, Gulf sturgeon, pallid sturgeon, blue suckers, and live oak forest per LDWF recommendations provided in Appendix L.

10.2.2 HYDROLOGY AND HYDRAULICS CONSIDERATIONS

- Storm surge and wave hazard analysis. Before levee and floodwall design elevations are finalized during PED, the latest available surge and wave hazard analysis should be completed for with-project conditions. At the time of this report, CPRA (through ERDC) is in the process of conducting a new surge hazard analysis in support of recertifying the HSDRRS system for the NFIP. The updates include a new storm suite, updated ADCIRC grid and source code, and new statistical methodology. However, this analysis will only be for without project conditions Surge hazard analysis should be completed for existing and future conditions for with and without project. It is anticipated that the updated surge analysis outputs will be different than the values developed for this study. Under no circumstances should the levee designs developed during feasibility phase be used in the PED phase. The storm surge analysis conducted during PED should also be focused on determining the true impacts of the HSDRRS on water levels in communities outside the system.
- Variability and the potential range of river discharge during hurricane season should be re-visited during the design phase.
- Complete Internal and external review of the surge hazard analysis, overtopping criteria, and Monte Carlo based overtopping design scripts. Consider review of these critical assumptions by the American Society for Civil Engineers and others, as done in the past.
- A review of the relative sea level rise assumptions in the surge hazard analysis should be conducted to ensure the future condition 100YR design elevations are compliant with USACE climate change policies. Actual relative sea level change should be monitored over time (a suggested timeframe is at least every 10 years) and required design elevations and other related features reconsidered, as appropriate. Changes in relative sea level change will also affect the crossover point and the amount of co-located levees.

10.2.3 CIVIL, STRUCTURAL, AND GEOTECHNICAL ENGINEERING CONSIDERATIONS

- Complete foundation and structural design will be required for the new floodwalls and tie-ins included in the Recommended Plan. Pile curves and geotechnical parameters (unbalanced load determination, settlement-induced bending moments analysis, etc.) are required to complete the final design for each site.
- Non-replaced floodwalls and tie-ins are assumed to perform adequately but will need stability checks during PED to confirm this assumption or include additional actions.
- Settlement curve projections may be analyzed for each levee reach.

- For final design of each levee reach, profiles and cross sectional surveys will be required.

10.3 CONSTRUCTION CONSIDERATIONS

This section documents construction considerations that need to be addressed during the PED and construction phases.

Environmental

- Ensure commitments associated with the USFWS Coordination Act Report recommendations in Section 7.23.1 are followed.
- Use standard threatened and endangered species protection measures as outlined in Appendix G. Minimization measures for dredging in Lake Pontchartrain to avoid impacts to threatened and endangered sea turtles and Gulf sturgeon, manatee protection measures, and Best Management Practices to avoid impacts to pallid sturgeon are to be included in construction plans and specifications.
- Pre-construction nesting bird surveys are to be conducted by USFWS and USACE. USFWS recommends that a qualified biologist inspect the proposed work sites for the presence of undocumented nesting colonies during the nesting season (e.g. February through September depending on the species). If colonies exist, work should not be conducted within 1,000 feet of the colony during the nesting season.
- Prevent colonial nesting birds from establishing active nests within the project construction right-of-way.
- Recommendations to minimize potential project impacts to eagles and their nests are provided by LDWF in Appendix L and USFWS in their National Bald Eagle Management Guidelines and these recommendations are to be followed during construction. Pre-construction surveys, buffer areas, and construction seasons may be required.
- The Louisiana Department of Natural Resources Office of Coastal Management determined that a “phased consistency determination” was the appropriate approach for this project for compliance with the Coastal Zone Management Act. Accordingly, during the design phase and prior to any construction activities, modifications to the existing consistency determination need to be submitted by USACE and approved by LDNR.
- For specific borrow areas identified during pre-construction engineering and design, coordination with CEMVN Regulatory will be necessary to avoid potential conflicts with other permitting actions.
- General cultural resources mitigation measures as outlined in Section 5.2.1.12.1 of the CED, Phase 1 (USACE 2013) should be followed.
- For work on the co-located LPV/WRL work, follow the stipulations of the MRL SEIS Programmatic Agreement for protection of cultural and historical resources.
- If Limited English Proficiency communities are present, ensure meaningful access to project information, notifications, etc.
- Comply with the notification and avoidance requirements regarding manatees, nesting birds, bald eagles, Gulf sturgeon, pallid sturgeon, blue suckers, and live oak forest per LDWF recommendations provided in Appendix L.

10.4 OMRR&R REQUIREMENTS

The sponsor currently has Operation, Maintenance, Repair, Replacement and Rehabilitation (OMRR&R) responsibilities associated with the existing system under and existing Project Partnership Agreement (PPA). A new PPA will be executed for the work included in this report, which will continue those responsibilities into the future and they are expected to remain largely unchanged until completion of the recommended plan, except as new reaches of co-located features are added during project construction. The sponsor will gradually accrue additional cost to annual OMRR&R for the new co-located reach along the Mississippi River, which includes mowing and minor floodwall maintenance. The total additional cost of OMRR&R during the 50-year period of analysis project is anticipated to be $479,000 per year.

However, upon project completion, the non-federal sponsor will also be required to maintain the authorized level of risk reduction to account for any future settlement, subsidence or actual sea level rise as part of its OMRR&R responsibilities. These costs are highly uncertain, primarily due to uncertainties related to long-term actual relative sea level change (see Table 8-5 for scenario projections out to 2123), and have not been estimated by this study.

10.5 MITIGATION REQUIREMENTS

The proposed mitigation plan is detailed in Appendix K. The proposed mitigation plan assumes the 12.1 AAHUs of flood side BLH-wet impacts (approximately 20.3 acres) would be mitigated through the purchase of mitigation bank credits equaling 12.1 AAHUs. Purchase of credits would be dependent on the receipt of an acceptable proposal and total purchase cost. No particular bank(s) is (are) proposed for use at this time. The bank(s) from which credits would be purchased would be selected through a solicitation process, through which any mitigation bank meeting eligibility requirements and having the appropriate resource type of credits could submit a proposal to sell credits. If appropriate and cost-effective, USACE may choose to purchase mitigation bank credits from more than one bank to fulfill compensatory mitigation requirements. The mitigation bank must be in compliance with the requirements of the USACE Regulatory Program and its Mitigation Bank Instrument, which specifies the management, monitoring, and reporting that would be required by the bank. Purchase of mitigation bank credits relieves USACE and non-federal sponsor of the responsibility for monitoring, adaptive management, and demonstrating mitigation success. If borrow sites require mitigation, a mitigation plan would be included in the NEPA evaluation for those sites.

10.6 IMPLEMENTATION SCHEDULE

A preliminary implementation plan has been developed to support calculations for construction and economic costs. Based on estimates of compaction, subsidence, and sea level rise, timeframes were estimated for levee lifts and floodwall construction to maintain the 1% level of risk reduction. This plan lays out the construction features by decade over the 50-year period of analysis and is generally displayed in Table 10-1. As described in Section 9.1, there are 50 miles of levee requiring lifts. However, some reaches will require more than one lift. The miles listed in Table 10-1 include the sum of all lifts. Additional detail can be found in Appendices A and E.

Table 10-1. General Implementation Plan, by Decade

Feature	2023-2033	2034-2043	2044-2053	2054-2063	2064-2073
Levee Lift	8 lifts = 17 miles	4 lifts = 16 miles	8 lifts = 17 miles	1 lift = 7 miles	9 lifts = 35 miles
Floodwall Construction	1 wall = 400 linear ft	6 walls = 15,300 linear ft	3 wall = 700 linear ft	1 wall = 100 linear ft	

A project implementation schedule has been developed based upon the assumption that this Report will be approved in the latter half of federal FY 2021. The project schedule estimates the timeframe for required levee lifts, floodwall modifications and mitigation activities. These timeframes are based on projections of the cumulative effects of consolidation, compaction, subsidence and sea level rise. The schedule also assumes federal funding is available in the years required, sponsor matching funds are also available, and that the real estate actions are completed on schedule.

The schedule reflects the information currently available and the current departmental policies governing execution of projects. It does not reflect program and budgeting priorities inherent in either the formulation of a national civil works construction program or the perspective of higher review levels within the Executive Branch. Consequently, the schedule may be modified before it is transmitted to higher authority for implementation funding.

10.7 SPONSOR REQUIREMENTS

Federal implementation of the recommended project would be subject to the non-federal sponsor agreeing to comply with applicable federal laws and policies, including but not limited to:

1) Provide 35 percent of total hurricane and coastal storm damage risk reduction costs as further specified below:
   a) Provide 35 percent of design costs allocated by the government to hurricane and coastal storm risk reduction in accordance with the terms of a design agreement entered into prior to commencement of design work for the hurricane and coastal storm risk reduction features;
   b) Provide, during the first year of construction, any additional funds necessary to pay the full non-Federal share of design costs allocated by the government to hurricane and coastal storm damage risk reduction;
   c) Provide all lands, easements, and rights-of-way, including those required for relocations, the borrowing of material, and the disposal of dredged or excavated material; perform or ensure the performance of all relocations; and construct all improvements required on lands, easements, and rights-of-way to enable the disposal of dredged or excavated material all as determined by the government to be required or to be necessary for the construction, operation, and maintenance of the hurricane and coastal storm damage risk reduction features;
   d) Provide, during construction, any additional funds necessary to make its total contribution for hurricane and storm damage risk reduction equal to at least 35 percent of total hurricane and storm damage risk reduction costs;

2) Shall not use funds from other Federal programs, including any non-Federal contribution required as a matching share therefore, to meet any of the non-Federal obligations for the project unless the Federal agency providing the federal portion of such funds verifies in writing that expenditure of such funds for such purpose is authorized;
3) Not less than once each year, inform affected interests of the extent of risk reduction afforded by the hurricane and storm damage risk reduction features;
4) Agree to participate in and comply with applicable federal floodplain management and flood insurance programs;
5) Comply with Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b-12), which requires a non-Federal interest to prepare a floodplain management plan within one year after the date of signing a project cooperation agreement, and to implement such plan not later than one year after completion of construction of the hurricane and storm damage risk reduction features;
6) Publicize floodplain information in the area concerned and provide this information to zoning and other regulatory agencies for their use in adopting regulations, or taking other actions, to prevent unwise future development and to ensure compatibility with risk reduction levels provided by the hurricane and storm damage risk reduction features;
7) Prevent obstructions or encroachments on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) such as any new developments on project lands, easements, and rights-of-way or the addition of facilities which might reduce the level of risk reduction the hurricane and storm damage risk reduction features afford, hinder operation and maintenance of the project, or interfere with the project's proper function;
8) Comply with all applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended (42 U.S.C. 4601-4655), and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way required for construction, operation, and maintenance of the project, including those necessary for relocations, the borrowing of materials, or the disposal of dredged or excavated material; and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act;
9) Operate, maintain, repair, rehabilitate, and replace the project, or functional portions of the project, including any mitigation features, at no cost to the Federal government, in a manner compatible with the project's authorized purposes and in accordance with applicable federal and state laws and regulations and any specific directions prescribed by the Federal Government;
10) Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-Federal sponsor owns or controls for access to the project for the purpose of completing, inspecting, operating, maintaining, repairing, rehabilitating, or replacing the project;
11) Hold and save the United States free from all damages arising from the construction, operation, maintenance, repair, rehabilitation, and replacement of the project and any betterments, except for damages due to the fault or negligence of the United States or its contractors;
12) Keep and maintain books, records, documents, or other evidence pertaining to costs and expenses incurred pursuant to the project, for a minimum of 3 years after completion of the accounting for which such books, records, documents, or other evidence are required, to the extent and in such detail as will properly reflect total project costs, and in accordance with

the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments at 32 CFR Section 33.20;

13) Comply with all applicable Federal and State laws and regulations, including, but not limited to: Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d) and DoD Directive 5500.11 issued pursuant thereto; Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army"; and all applicable Federal labor standards requirements including, but not limited to, 40 U.S.C. 3141- 3148 and 40 U.S.C. 3701 – 3708 (revising, codifying and enacting without substantial change the provisions of the Davis-Bacon Act (formerly 40 U.S.C. 276a et seq.), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 et seq.), and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c et seq.);
14) Perform, or ensure performance of, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under CERCLA, Public Law 96-510, as amended (42 U.S.C. 9601-9675), that may exist in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be required for construction, operation, and maintenance of the project. However, for lands that the federal government determines to be subject to the navigation servitude, only the Federal Government shall perform such investigations unless the Federal Government provides the non-Federal sponsor with prior specific written direction, in which case the non-Federal sponsor shall perform such investigations in accordance with such written direction;
15) Assume, as between the Federal Government and the non-Federal sponsor, complete financial responsibility for all necessary cleanup and response costs of any hazardous substances regulated under CERCLA that are located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be required for construction, operation, and maintenance of the project;
16) Agree, as between the Federal Government and the non-Federal sponsor, that the non-Federal sponsor shall be considered the operator of the project for the purpose of CERCLA liability, and to the maximum extent practicable, operate, maintain, repair, rehabilitate, and replace the project in a manner that will not cause liability to arise under CERCLA; and
17) Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended (42 U.S.C. 1962d-5b), and Section 103(j) of the Water Resources Development Act of 1986, Public Law 99-662, as amended (33 U.S.C. 2213(j)), which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until each non-Federal interest has entered into a written agreement to furnish its required cooperation for the project or separable element.

10.8 COST SHARING REQUIREMENTS

The CPRAB has stated that it intended or intends to enter into cooperation endeavor agreements or other sub-agreements, in accordance with the Constitution and Laws of the state of Louisiana, for performance of CPRAB's obligations under the PPA. Some of the state entities which CPRAB may enter into cooperation endeavor agreements or other sub-agreements with include, but are not limited to:

- The Southeast Louisiana Flood Protection Authority – East

- The Pontchartrain Levee District
- Plaquemines Parish Government
- St. Charles Parish
- St. Bernard Parish
- Jefferson Parish
- Orleans Parish
- Sewerage and Water Board of New Orleans

The cost sharing requirement for this project is 65% federal and 35% non-federal. In addition to cash, the sponsor is anticipated to receive work-in-kind credit for some design and construction work, as well as credit for LERRDs acquisition.

The total project first cost, which includes the cost of the recommended plan from this report and all prior project expenditures, is approximately $1.1 billion. The federal share of the total project first cost is estimated to be approximately $719 million and the non-federal share is estimated to be approximately $387 million. The estimated value of LERRDs to be provided by the sponsor is approximately $8.6 million and the rest of the sponsor contribution will be in cash or in-kind credit. Additionally, the non-federal sponsor will maintain OMRR&R responsibility for the LPV and additionally assume responsibility for OMRR&R upon physical construction completion of each initial project feature or functional portion construction, and each incremental lift of each project feature or functional portion, at no cost to the Government, and in perpetuity, currently estimated to be approximately $479,000 annually. Table 10-2 presents the estimated cost-sharing of the total project first cost by project. Additional detail on costs by project features can be found in Section 9.2.

Table 10-2. Total Project First Cost Sharing (October 2020 price level)

Item	Federal Cost	Non-Federal Cost	Total First Cost
Coastal Storm Risk Management	$637,700,000	$334,800,000	$972,500,000
Lands, Easements, Rights of Way, Relocations and Disposal	$0	$8,600,000	$8,600,000
Subtotal	**$640,600,000**	**$344,900,000**	**$985,500,000**
Planning, Engineering and Design	$81,200,000	$43,700,000	$124,900,000
Total Project	**$718,900,000**	**$387,100,000**	**$1,106,000,000**

[1] Coastal Storm Risk Management costs include levees and floodwalls, fish and wildlife facilities (mitigation), and construction management.

The total project cost (TPC) is the total project first cost fully funded with escalation to the estimated midpoint of construction and is the cost used in Project Partnership Agreements. The TPC is provided for the sponsor's use in financial planning, as it provides information regarding the overall cost-sharing obligation. The TPC of the recommended plan is approximately $2.6 billion, with the sponsor's share being approximately $904 million.

10.9 FINANCIAL ANALYSIS

The CPRAB will have the financial capability to cost-share the estimated implementation costs and are willing to sign the PPA at the appropriate time. The organization takes advantage of both federal and state funding including general state revenues, a State Coastal Trust fund, settlement funds, and oil and gas revenue sharing from federal offshore waters. Sponsor self-certification of financial capability has been provided as part of the final report submittal.

11 PUBLIC INVOLVEMENT

Public involvement is an important part of planning and decision-making. Agencies, nongovernmental organizations, and citizens provided valuable input for the study. NEPA provides people, organizations, and governments an opportunity to review and comment on proposed major Federal actions. Engaging and receiving input from the public, interested parties, stakeholders, government agencies, and nongovernmental organizations regarding the content of the study in all stages is critical to achieving the USACE objective of enhancing trust and understanding with customers, stakeholders, teammates, and the public through strategic engagement and communication.

In accordance with CEQ Implementation Guidance for NEPA (1978; 40 CFR 1508.22), a Notice of Intent to prepare an EIS was published in the Federal Register (Volume 84, No. 63) on 2 April 2019. A public scoping meeting was held within the study area on 30 April 2019 at the USACE District Office in New Orleans, LA. Comments were accepted via written correspondence and email. Feedback received during scoping was largely related to questions regarding the relationship between the current study and the existing system of protection and implementation timelines. Information on previous studies was provided by stakeholders during scoping and was considered in preparation of the study. All scoping comments and responses can be found in Appendix L.

In accordance with NEPA, a Notice of Availability announcing the 55-day public review period for the draft report was published in the Federal Register (Volume 84, No. 240) on 13 December 2019. A public meeting was held within the study area on 22 January 2020 at 6500 Spanish Ft. Blvd New Orleans, LA. Comments were accepted in-person at the public meeting, by written correspondence, and by email. Comments were provided regarding levee failures during Hurricane Katrina, study authority, locations of proposed features, construction materials and methods, relative sea level rise, project funding, the date of the Notice of Intent in the Federal Register, and a potential source of fill material. Comments were considered, as appropriate, during feasibility level design and preparation of this report. All comments on the draft report and responses can be found in Appendix L. Comments received during the final public review will be provided to the decision-maker.

It should be noted that this report includes an appendix (Appendix D) documenting the performance and conclusions of a Semi-Quantitative Risk Assessment. Appendix D contains sensitive information about life risk as related to system performance that is not releasable to the public, resulting in the majority of the appendix being withheld from public review. The appendix has a publicly-releasable executive summary which describes the risk assessment process and the general conclusions and this executive summary was included in the publicly-released documents.

12 RECOMMENDATION

I have considered all significant aspects of this project, including environmental, social, and economic effects and engineering feasibility. I recommend that the Recommended Plan for the Lake Pontchartrain and Vicinity, Louisiana, project area as generally described in this report for implementation as a federal project, with such modifications thereof as in the discretion of the Commander, USACE may be advisable. The estimated total project first cost of the recommended plan is approximately $1.1 billion at the October 2020 (FY21) price level. OMRR&R expenses are estimated to be approximately $479,000 per year. The federal portion of the estimated total project first cost is approximately $719 million. The non-federal sponsors' portion of the estimated total project first costs is approximately $387 million.

In order to implement the Recommended Plan, Public Law 113-121, Section 3017, REHABILITATION OF EXISTING LEVEES requires modification to extend or eliminate the authorization termination date of 2024. The recommendations contained herein reflect the information available at this time and current departmental policies governing the formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of the national civil works construction program or the perspective of higher levels within the executive branch. Consequently, the recommendations may be modified before they are transmitted to Congress for authorization and/or implementation funding. However, prior to transmittal to Congress, the State of Louisiana, interested federal agencies, and other parties will be advised of any significant modifications in the recommendations and will be afforded an opportunity to comment further.

STEPHEN J. MURPHY
Colonel, Corps of Engineers
District Commander

13 LIST OF PREPARERS

Name	Role	Years of Experience
Heather Achord	Structural Engineering	14
Max Agnew	Hydraulic Engineering	11
Michele Aurand	GIS	21
Aven Bruser	Office of Counsel	11
Troy Cosgrove	Risk Assessment	25
Rob Dauenhauer	Structural Engineering	26
Bradley Drouant	Project Management	14
Jason Emery	Tribal Liaison	21
Pamela Fischer	Real Estate	11
Noah Fulmer	Cultural Resources	5
Daryl Glorioso	Office of Counsel	23
Lauren Hatten	Civil Engineering, Technical Lead	26
Michelle Kniep	Plan Formulation	25
Ben Logan	Economics	11
Steven Lowrie	Cost Engineering	12
Kat McCain	Environmental Compliance	12
Rachel Mesko	Plan Formulation	11
Joe Musso	HTRW; Air Quality	31
Landon Parr	HTRW	21
Andrew Perez	Environmental Justice; Recreation	21
Bich Quach	Geotechnical Engineering	14
Richard Radford	Aesthetics (Visual)	18
Matthew Roe	Public Affairs	13
Stephan Roth	District Counsel	19
Kip Runyon	Environmental Compliance	23
Monique Savage	Plan Formulation	11
Frank Spiess	Project Management	6

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2021

Lake Pontchartrain & Vicinity GRR
Appendix A – Levees Design

US Army Corps of Engineers
New Orleans District

U.S. Army Corps of Engineers, New Orleans District

Non-Federal Sponsor: Coastal Protection and Restoration Authority Board of Louisiana

March 2021

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TABLE OF CONTENTS

LAKE PONTCHARTRAIN & VICINITY GRR
APPENDIX A – LEVEE DESIGN

1 INTRODUCTION

1.1 OVERVIEW

This appendix describes the methodology used to calculate quantities based on the projected levee lifts required to achieve the estimated design elevations for two alternatives plans that will exclude the 1% AEP and 0.5% AEP coastal storms from the leveed area in the year 2073 for the intermediate sea level rise scenario. For the scope of this study and the size of the study area, certain reaches were chosen to represent the other reaches in the system in order to reduce the number of reaches that would need to be analyzed. Explanation of why certain reaches were chosen to represent others can be found in the Geotechnical Appendix B. This appendix contains examples of representative cross sections from the representative levee reaches around the Lake Pontchartrain and Vicinity (LPV) project areas which were used to calculate quantities for the system. The locations of the representative reaches used and discussed in this report are shown in Figure 1, highlighted in green. The quantity table in Enclosure 1 lists all of the reaches and has a representative reach column to show which representative reach was used to quantify each of the individual reaches. The below cross sections depict each of the representative sections at the time of the last levee lift, whether by USACE or by CPRAB and SLFPA-E or by Pontchartrain Levee District (PLD) as an allowed Section 408 alteration to the levee reach. The elevation of last levee lift and the design grade for each reach is stated in the paragraphs below. All elevations are referenced to NAVD88 (2004.65), unless otherwise noted.

Figure 1. Lake Pontchartrain and Vicinity Representative Reach Locations

2 REPRESENTATIVE REACHES

The following paragraphs discuss the construction history of the last lift of the representative reaches and include a map of their location and a typical cross section of the last lift. Armoring is not shown in the typical sections.

2.1 LPV-04.2A REACH 1A CROSS BAYOU TO ST. ROSE AND GULF SOUTH FLOODWALL, LPV-ARM-06 SYSTEM ARMORING, ST. CHARLES PARISH

LPV-04.2A is the representative reach for the St. Charles Levee Reaches 1A, 1B, 2A, and 2B (LPV-04.2 and LPV-05.2) which extend from the Bonnet Carre Lower Guide levee and Bayou Trepagnier to the Illinois Central Railroad (ICRR).

LPV-04.2A was last lifted to El. 17.0 by CPRAB and PLD as a Section 408 alteration and armored by USACE in 2017 under the same USACE contract, LPV-ARM-06.

The required Hurricane and Storm Damage and Risk Reduction System (HSDRRS) hydraulic design elevation for the levee is 14.5 ft. in 2007 and 16.5 ft. in 2057.

The LPV-ARM-06 contract included a lift of the 2.8-mile-long levee reach LPV04.2a and 04a.2b. The LPV 04.2a portion on the contract, was from baseline Station 260+00 to 354+18. The levee construction portion of this contract consisted of a straddle lift placing compacted embankment to elevation 17.0 and 1V:3H side slopes. At several locations, the scour protection was removed, embankment placed, and the pavement replaced to an elevation of 17.0 feet to achieve a smooth transition to the newly lifted levee. This occurred at the east side of the Cross Bayou Drainage Structure, both sides of the Gulf South Floodwall, both sides of the St. Rose Drainage Structure, both sides of the I-310 Floodwall, both sides of the Almedia Drainage Structure, both sides of the Walker Drainage Structure, and the south of the ICRR Gate.

The armoring portion of the contract consisted of placing HPTRM along the crown, a portion of the flood side slope, and on the protected side of the levee. The HPTRM was secured to the levee using percussion driven earth anchors placed at 5 ft. intervals and 12-inch metal pins placed between the percussion driven earth anchors. Once placed the HPTRM was covered with Bermuda sod and fertilized. The HPTRM in this contract abuts to concrete at several locations including tie-in at the newly placed scour protection locations, newly placed (as part of this contract) concrete ramp paving, and new concrete turn around pads. Where the HPTRM abuts to concrete, an anchor trench was placed running parallel to the edge of the concrete. In areas where the existing road was within 21 feet of the levee toe, the existing access roads had to be removed and relocated parallel to the existing road (a southeast shift). The existing access road was removed and the new access road consisted of separator geotextile and 8 inches of crushed stone.

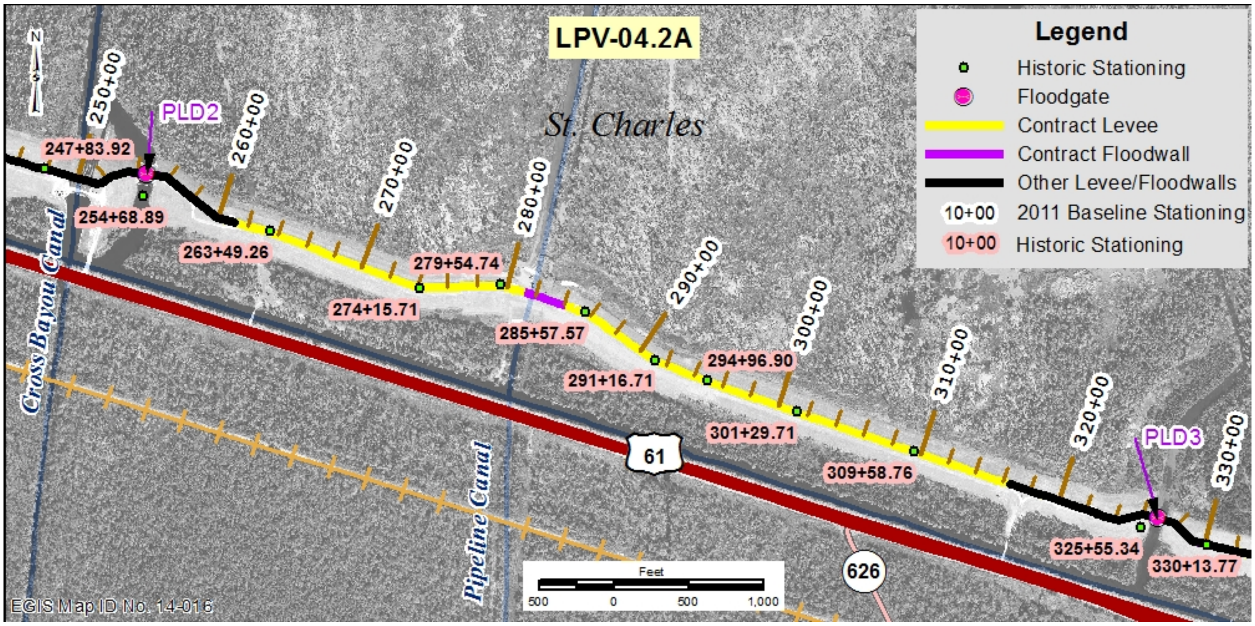

Figure 2. LPV-04.2A Levee Reach

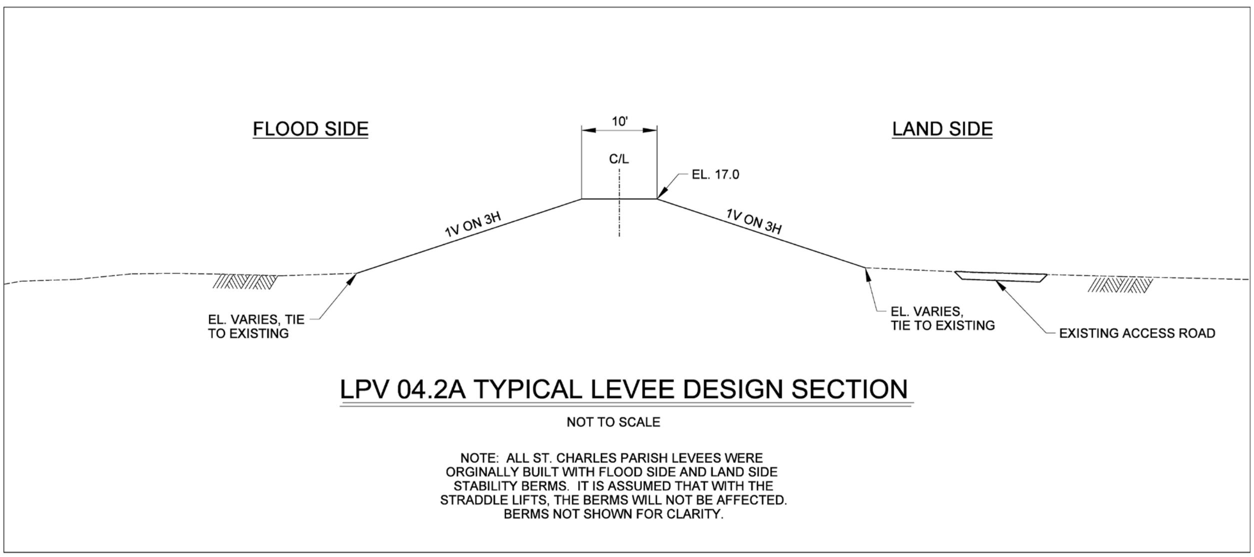

Figure 3. LPV-04.2A Typical Levee Section

2.2 LPV 103.01 ORLEANS PARISH LAKEFRONT, ORLEANS AVE CANAL TO LONDON AVE CANAL

The LPV-103.01 reach is the representative reach for LPV-102.01 (Lake Marina Ave. to Orleans Ave. Canal), LPV-103.01 (Orleans Ave. Canal to London Ave. Canal), and LPV-104.01 (London Ave. Canal to the IHNC).

LPV-103.01 was last lifted by USACE to 19.5 in 2008. The design grade is 16.0. This reach was armored in 2015.

The work within the LPV-103.01 reach was completed under three separate contracts: LPV-103.01, LPV-103.01a1, LPV-103.01a2 and LPV-ARM-02. Only the levee construction contracts, LPV-103.01 and LPV-ARM-02 will be addressed in this appendix.

This segment of the HSDRRS consists of 2.62 miles of levee and floodwall, including 2 new swing gates. The contract reach area is located on the south shore of Lake Pontchartrain in Orleans Parish. The LPV-103 reach begins along the east bank of Orleans Ave canal and continues east parallel to Lakeshore Dr. to the west bank of London Ave canal. It includes the reaches along the east side of Orleans Ave canal, both sides of Bayou St. John, and the west side of London Ave Canal. The portions of the contracts along the outfall canals extend from the lakefront levees to the interim closure structures on London Ave Canal and Orleans Ave Canal and the sector gates on Bayou St. John. Along the lakefront the levee ties into the Permanent Canal Closure and Pumps (PCCP) at London Ave canal and Orleans Ave canal.

2.2.1 LPV-103.01:

This segment begins near 2011 Baseline STA. 128+75 where it ties into the swing gate and floodwalls located at Marconi Drive (gate L-6 constructed under LPV-103.01a1). It then continues east parallel to Lakeshore Drive to the end of the contract reach at STA. 225+33 where it ties into the gate at the intersection of Lakeshore Drive and Lake Terrace (gate L-9 constructed under LPV-103.01a2), located on the west side of London Ave canal. Within the contract, STA. 222+45 to 223+79 was designated a no work area for utility crossings that went over the levee. The utilities were relocated and the levee lift was completed by Orleans Levee District Non-Flood Asset Management Authority after construction was complete. Along the east and west bank of Bayou St. John, there are two reaches of levee that were raised under LPV-103.01.

For the levee reach that parallels the lakefront, the required 1% hydraulic design elevation for the levee is 16.0 ft. in 2007 and 19.0 ft. in 2057. This levee reach was raised to a construction grade of 19.5 ft. providing approximately 3.5 ft. of overbuild to extend the period of effective risk reduction. For the levee reaches along Bayou St. John, the 1% required hydraulic design elevation is 15.0 ft. in 2007 and 16.5 ft. in 2057. This levee reach was built to elevation 16.5 ft. providing 1.5 ft. of overbuild to extend the period of effective risk reduction. The typical levee section for this contract includes a wave berm. The elevation of the wave berm must be monitored since it is a factor for establishing the required 1% hydraulic design elevation for the levee crown.

Scour protection is located throughout the reach where the levee transitions to floodwall.

2.2.2 LPV-ARM-02:

This armoring contract LPV-ARM-02 included armoring a segment of the HSDRRS from 2011 baseline STA. 37+74 to STA. 403+67, consisting of 3 miles of levee. The armoring contract is comprised of three contract reaches (LPV-102, 103, and 104) that were constructed under the original LPV contracts.

The armoring contract consisted of placing HPTRM along the flood side crown edge, levee crown, and the landside of the levee. Once placed, the HPTRM was covered with sod, fertilized and watered. The HPTRM was secured to the levee using percussion driven earth anchors placed at 5 ft. intervals and 12-inch metal pins placed between the percussion driven earth anchors. Additionally, the flood side and landside limits of the HPTRM were secured in a minimum 1 ft. by 1 ft. anchor trench. There are several locations in the contract reach where the HPTRM abuts concrete. At some locations this abutment occurs where concrete scour protection is placed at the intersection of a levee and floodwall. In addition to abutment at scour protection, the HPTRM also abuts to concrete ramps, miscellaneous concrete pads, and/or turn around pads throughout the reach. Where the HPTRM abuts to concrete, an anchor trench is placed parallel to the edge of the concrete. Existing crushed stone ramps located on the landside of the levee were concrete paved during the armoring contracts by placing 6 in thick concrete on top of the existing crushed stone.

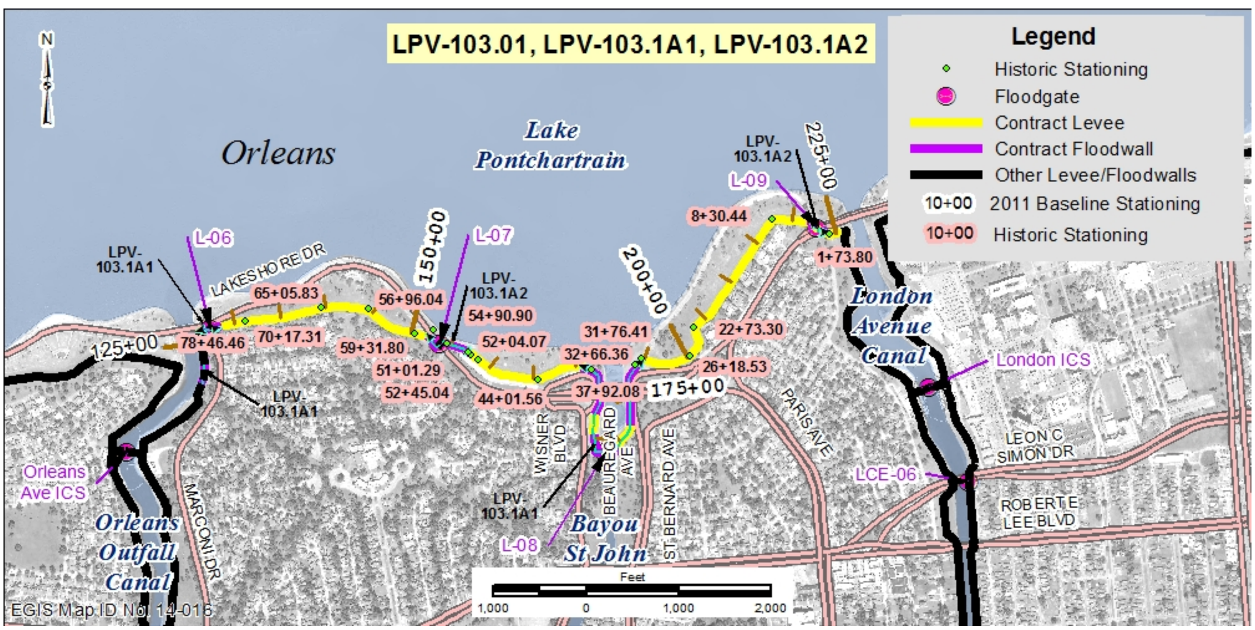

Figure 4. LPV-103.01, LPV-103.1A1, LPV-103.1A2 Levee Reaches

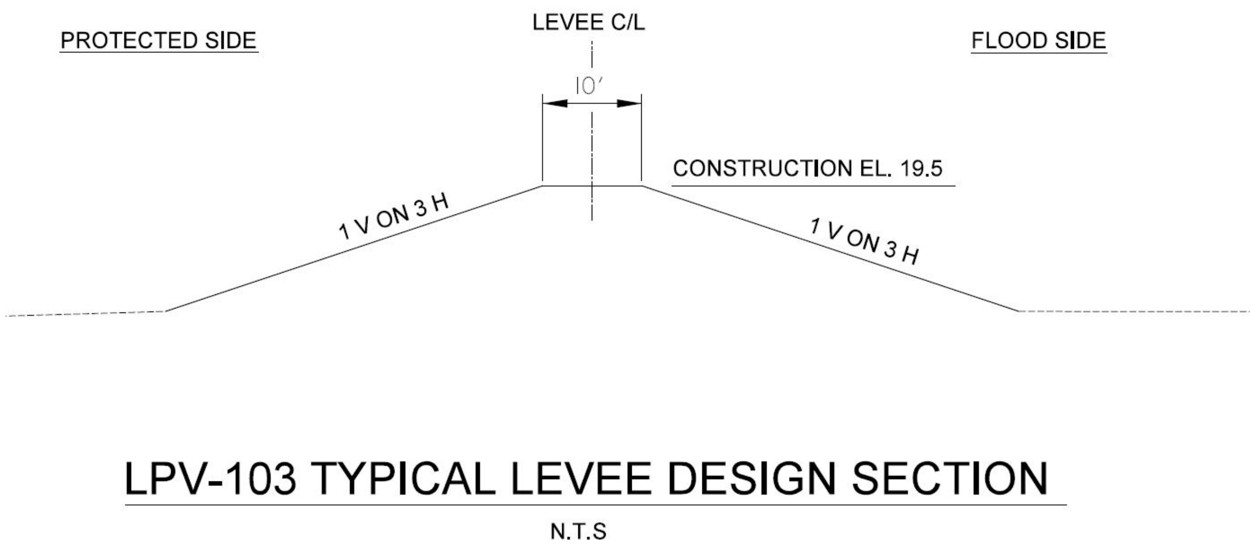

Figure 5. LPV-103 Typical Levee Section

2.3 LPV-109.02A

The LPV-109.02A reach is the representative reach for LPV-108 (Paris Road to Southpoint), LPV-109.02A (South Point to the CSX Railroad), and LPV-111.01 (CSX RR to Michoud Canal).

The last completed lift of this reach by USACE raised it to EL 18.5 in 2011. The design grade is 17. This contract is currently being lifted by CPRAB and SLFPA-E as a Section 408 alteration to the levee to previous construction grade plus six inches and armored by USACE under the same contract. Completion is estimated in early 2021.

This segment of the HSDRRS consists of 7.5 miles of levee and floodwall. There are two floodgates located where the reach crosses U.S. Highway (Hwy) 11 and U.S. Highway (Hwy) 90. The contract reach also includes four drainage structures and two pump stations. The contract reach is located on the south shore of Lake Pontchartrain in Orleans Parish, along the eastern side of the Bayou Sauvage National Wildlife Refuge. The levee portions of the contract were identified by five hydraulic reaches, each with its own design – reaches “NE31”, “NE10-A”, “NE10-B”, “NE10-C” and “NE11-A”. Only levee construction work will be addressed in the following sections.

2.3.1 LPV-109.02A1-2009

Prior to construction of the LPV-109.02a levee, this contract was constructed to install a test section for the wick drains. The test section included excavation of the existing berm, installation of the sand drainage blanket, placement of the wick drains, and then placement of embankment fill on top. Wick drains were used to accelerate consolidation and settlement of foundation soils to minimize the need for future lifts. The test section was installed between Baseline STA 1029+00 to Baseline STA 1032+00. The wick drain test section was removed during construction of LPV-109.02a. Refer to as-built drawing C-612 for details on removal of wick drain section.

2.3.2 LPV-109.02A2 - 2010

This contract was designed, awarded, and constructed prior to construction of the LPV-109.02a Levee enlargement. The contract was approximately 38,500 ft. long and extended from South Point to CSX railroad (RR) crossing. The purpose of the contract was to place a 2 ft. to 3 ft. sand drainage blanket, to improve the foundation of the levee, which would be offset from the existing levee and constructed under LPV-109.02a.

2.3.3 LPV-109.02A - 2011

The contract begins at 2011 Baseline STA 663+75. The work between 2011 B/L STA 663+75 and B/L STA 662+00, was constructed within the LPV-108 Right of Way. It extends to the drainage structure, which extends from B/L STA 667+01 to B/L STA 668+05. The levee resumes on the southeast side of the Drainage Structure No. 1 and continues to STA 719+81, where it ties into the I-10 crossing over the levee. The I-10 crossing was constructed under a separate contract designated as LPV-109.02b. From STA 663+75 to STA 719+81, the levee was constructed to elevation 18.5 ft. The required 1% hydraulic design elevation for the levee in this reach (hydraulic reach “NE31”) is 16.5 ft. in 2007 and 18.0 ft. in 2057.

The LPV-109.02a levee resumes on the south east side of the I-10 crossing at Baseline STA 724+38 and it continues southeast to approximate STA 761+30, where it ties into the concrete T-Wall monoliths constructed for the Hwy11 crossing. The required 1% hydraulic design elevation for the levee in this reach (hydraulic reach “NE10-A”), is 17 ft. in 2007 and 18.0 ft. in 2057. The levee ends and the T-Wall monoliths begin at approximate STA 724+38.

The levee resumes at STA 765+52 on the southeast side of the Hwy 11 crossing and continues to approximate STA 799+30, where there is a pump station (identified as Pump Station 1 on the as-built drawings). The drainage pipes for the pump station were constructed up and over the levee. Adjacent to the pump station is a Drainage Structure No. 2. The levee resumes on the southeast side of the drainage structure at STA 802+39 and continues to Drainage Structure No. 3, which begins at STA 928+33. The drainage structure ends and the levee resumes at STA 930+83. The levee continues to approximate STA 940+00, where it ties-into the T-Wall monoliths for the Hwy 90 crossing. From STA 765+52 to STA 940+00, the levee was constructed to an elevation of 19 ft. The hydraulic reach changes approximately at STA 799+76. Within this reach there are two hydraulic reaches, “NE10-B” and “NE10-C”. The required 1% hydraulic design elevation for “NE10-B” is 17 ft. in 2007 and 18 ft. in 2057. The required 1% hydraulic design elevation for “NE10-C” is 17 ft. in 2007 and 19 ft. in 2057. The typical levee section for both of these reaches includes a wave berm.

The levee ends and the T-Wall monoliths for the Hwy 90 crossing begin at approximate STA 940+00.

The levee resumes at STA 943+82.62 on the southeast side of the Hwy 90 crossing and continues to approximate STA 1055+00, where it connects to Drainage Structure No. 4. From STA 943+82.62 to STA 1055+00, the levee was constructed to an elevation of 25 ft. The required 1% hydraulic design elevation for the levee in this reach (hydraulic reach “NE11-A”), is 22 ft. in 2007 and 23.5 ft. in 2057. From STA 1028+00 to STA 1033+00, there is a wick drain test section constructed under LPV-109.02a1. During construction, the wick drain test section was removed, and rebuilt in conformance with the plans and specifications of the contract.

On the south side of the drainage structure, beginning at STA 1058+57 and extending to STA 1060+00 is floodwall. LPV-109.02a contract ends at STA 1060+00, and ties into the T-Wall constructed under LPV-110.

Throughout the contract reach the levee was offset from the original levee centerline towards the landside. The levee enlargement includes a wave berm and a stability berm. Throughout the contract reach a drainage blanket was placed (under LPV-109.02a2), and wick drains were installed prior to placing embankment for the levee enlargement. A 12-inch layer of 6-inch stone riprap was placed where the landside stability berm ties into the existing ground.

2.3.4 LPV-109.02A ADDITIONAL WORK -2011

2.3.4.1 LEVEE LIFT

This contract is currently being lifted by by the Government on behalf of CPRAB and SLFPA-E as a Section 408 alteration to the levee to the prior construction grade plus six inches. Initial Construction of the levee was completed in June 2011. In January 2013, prior to the completion of construction of the levee, a survey of the levee showed portions of the levee crown were below the initial construction grade. MVM Hired Labor Crew placed embankment to elevation 19 ft. From STA 724+42 to STA 781+85 a total of 2,227 ft. (non-continuous) was raised with a straddle of the levee centerline. From STA 745+80 to STA 938+85, a total 1,955 ft. (non-continuous) was raised by placing a cap on the levee crown (hydraulic reaches “NE10-A”, “NE10-B” and “NE10-C”). Levee maintenance lift was designated as LPV-109.02a3.

2.3.4.2 HWY 11 REMEDIAL ACTION

After completion of the construction contract, a Top-of-Wall survey was performed in October 2011. The data from the Top-of-Wall survey and a site visit confirmed differential movement of the floodwall monoliths. After completing the engineering analysis, remedial action was taken to reduce any potential future settlement in the area, and to reduce the stresses in the piles. Remedial action was completed by Keiland, which consisted of degrading the soil adjacent to monoliths to elevation 6 ft. Joints in the slope pavement which had separated were cleaned and filled with cold-mix asphalt. The vertical joints in the monoliths were repaired. The bypass ramp was repaired, and a 22-inch drainage culvert was installed.

2.3.4.3 VEGETATIVE FREE ZONE

Within the LPV-109.02a contract, the toe of the landside stability berm is at the edge of the U.S. Fish and Wildlife Refuge. In order to avoid clearing vegetation in the wildlife refuge, the stability berm was reanalyzed and it was determined that the effective width of the stability berm could be reduced by 15 ft. to accommodate the vegetative free zone. The non-federal sponsor is required to keep the stability berm free and clear of vegetation.

2.3.5 LPV-ARM-05 SYSTEM ARMORING (LPV-109)

This contract is currently being armored be USACE in 2019 to 2020. The armoring contract also includes a lift to the prior construction grade plus 6 inches by the Government on behalf of CPRAB and SLFPA-E as a Section 408 alteration. The armoring contract will consist of placing HPTRM along the crown and land side of the levee. Once placed, the HPTRM was covered with sod, fertilized and watered. The HPTRM was secured to the levee using percussion driven earth anchors placed at 5 ft. intervals and 12-inch metal pins placed between the percussion driven earth anchors. Additionally, the flood side and landside limits of the HPTRM were secured in a minimum 1 ft. by 1 ft. anchor trench.

There are a few locations in the contract reach where the HPTRM abuts a concrete surface. This abutment occurs where concrete scour protection is placed at the intersection of a levee and ramp. Where the HPTRM abuts concrete, the HPTRM is placed underneath the concrete.

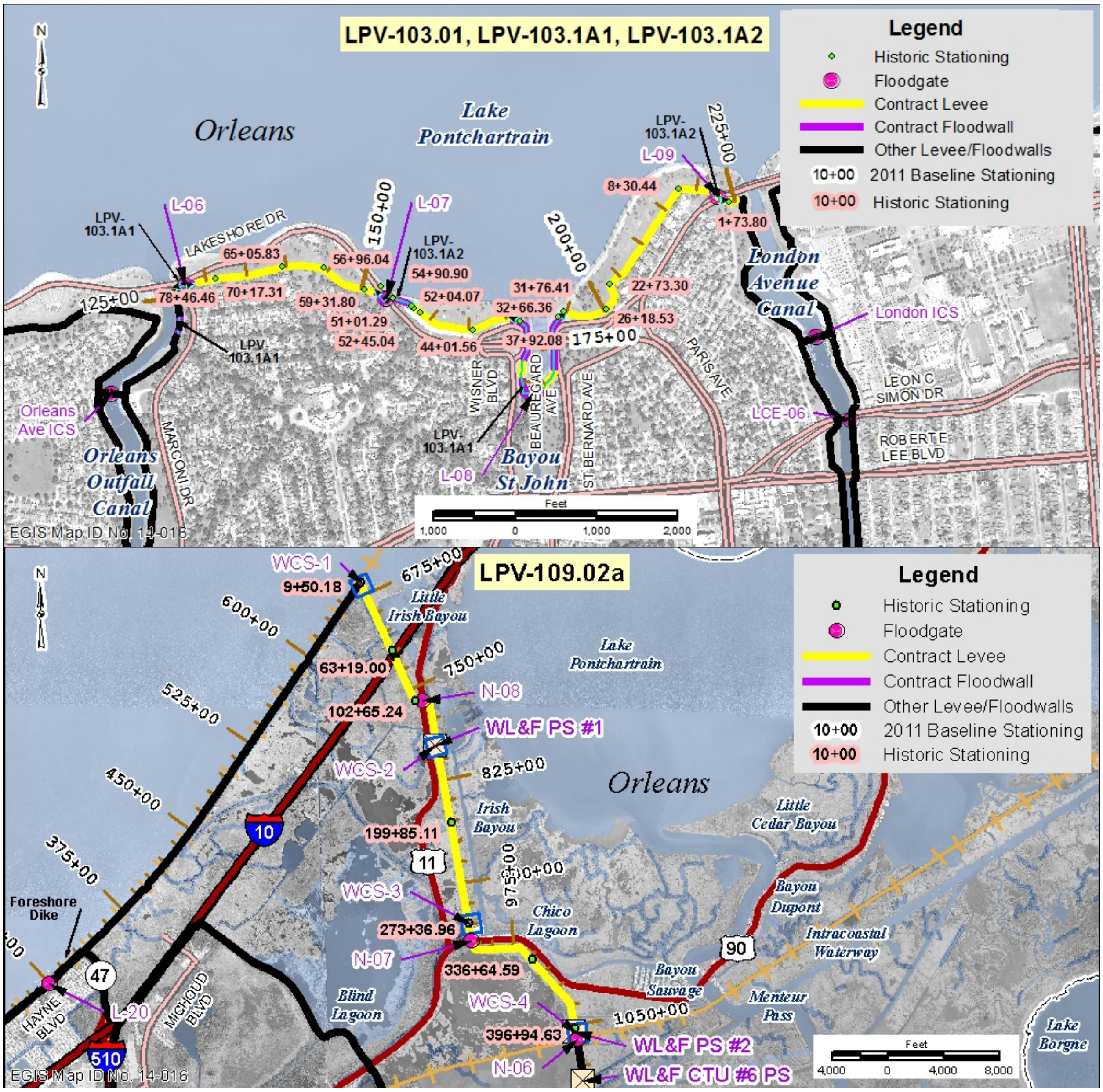

Figure 6. LPV-0109.02a Levee Reach

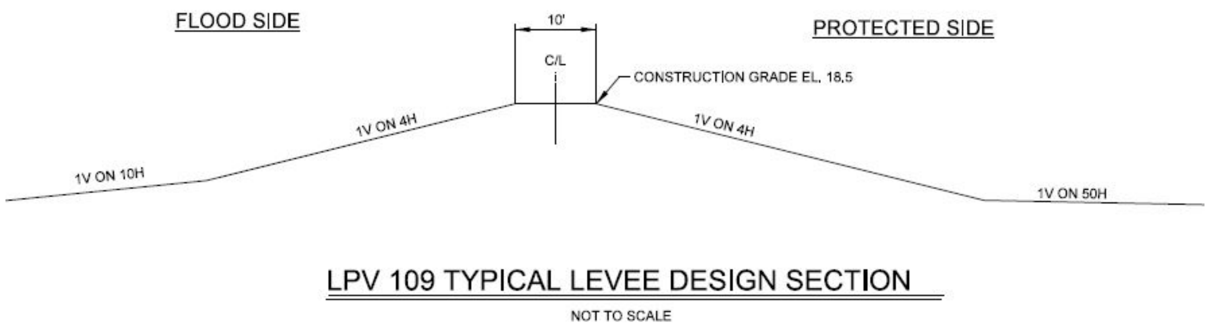

Figure 7. LPV-109 Typical Levee Section

2.4 LPV-00.2 REACH 1 LAKEFRONT LEVEE.

The LPV-00.2 reach is the representative reach for all of the Jefferson Parish Lakefront Levee reaches including Reach 1 (LPV-00.2), Reach 2 (LPV-1.1), Reach 3 (LPV-02.2), Reach 4 (LPV-Reach 19.2) and Reach 5 (LPV-20.1).

The LPV-00.2 segment of the HSDRRS consists of approximately 2.0 miles of levee along the East Jefferson lakefront. The contract begins at 2011 Baseline STA. 708+05.60, which is adjacent to the northern most end of the West Return Floodwall and proceeds East to STA. 813+91.89 where it ties-in to the floodwall of Pump Station #4 (Duncan). The required 1% hydraulic design elevation for the levee is 15.5 ft. in 2007 and 17.5 ft. in 2057. The Phase 1 contract (LPV-00.1) constructed the levee to an elevation of 17.0 ft. This levee reach was last lifted by CPRAB and SLFPA-E as an allowed Section 408 alteration in 2017 to elevation 17.0. The Jefferson Parish Lakefront levees contain a layer of high strength geotextile fabric at their base.

2.4.1 LPV-00.2

The USACE contract (LPV-00.2) expanded the crown of the levee to 10 ft. wide and softened the side slopes but did not add additional elevation since the levee elevation was already above the required 1% hydraulic elevation and therefore provided at least 1ft of overbuild achieving a construction grade of approximately elevation 16.5 ft. The typical levee section for this contract includes a wave berm. The elevation for the wave berm must be monitored since it was a factor for establishing the required 1% hydraulic design elevation for the levee crown.

On the protected side of the levee there is a stability berm and an adjacent landside rainfall runoff collection and drainage system that runs parallel to the levee for the entire levee reach, which was not impacted by this contract. The landside rainfall runoff collection and drainage system is not essential to the function of the system.

Foreshore protection was constructed under contract LPV-01.2 on the flood side to provide erosion protection from daily wave action. Some additional features of this levee reach are (1) an all-weather access roadway that runs the entire length of the levee reach and (2) ramps that cross the levee.

2.4.2 LPV-ARM-08 SYSTEM ARMORING (LPV-00.2)

This contract was armored in 2017-2018 and consisted of placing HPTRM along the crown and landside of the levee. Once placed, the HPTRM was covered with sod, fertilized and watered. The HPTRM was secured to the levee using percussion driven earth anchors placed at 5 ft. intervals and 12-inch metal pins placed between the percussion driven earth anchors. Additionally, the flood side and landside limits of the HPTRM were secured in a minimum 1 ft. by 1 ft. anchor trench. There are a few locations in the contract reach where the HPTRM abuts concrete. This abutment occurs where concrete scour protection is placed at the intersection of a levee and ramp. Where the HPTRM abuts a hardened surface, the HPTRM is placed underneath the hardened surface.

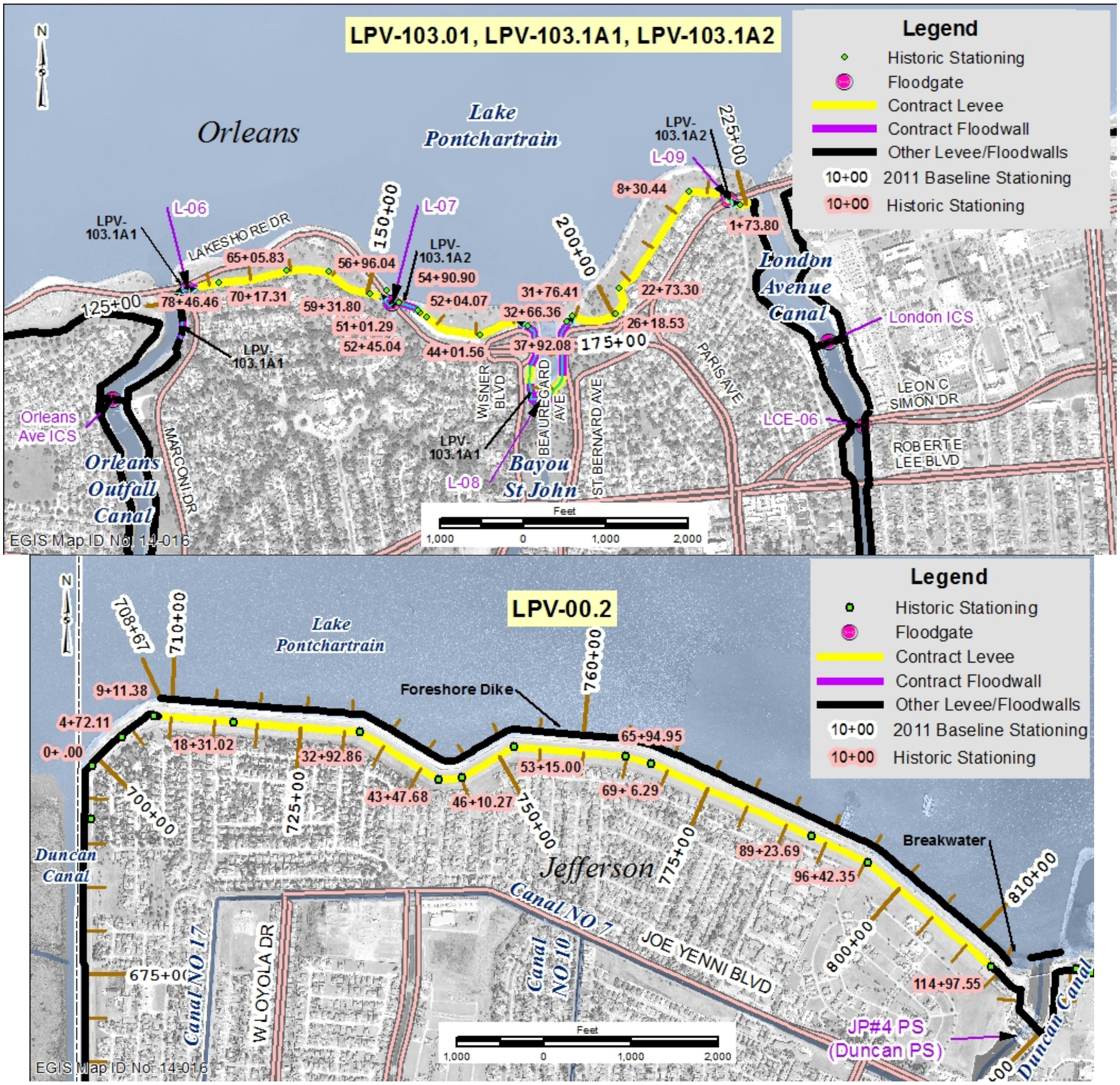

Figure 8. LPV-00.2 Levee Reach

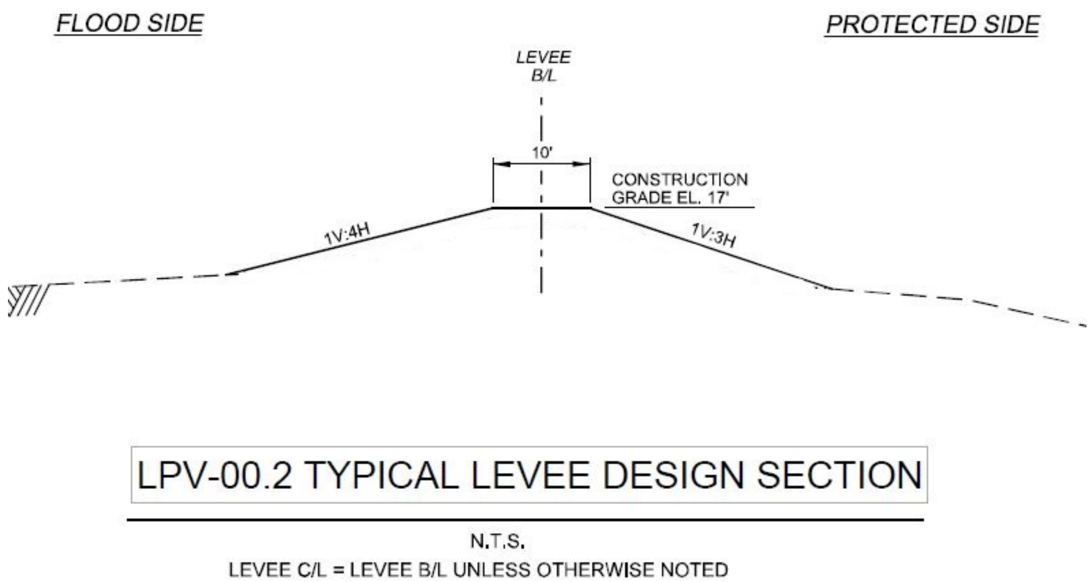

Figure 9. LPV-00.2 Typical Levee Section

2.5 LPV-MRL-1

This levee reach was not part of LPV HSDRRS system as it was north of the east bank 2011 1% HSDRRS cross over point at river mile 77.3. The new 2073 cross over point, however, is at river mile 90.5 for the intermediate condition. For explanation on adjusted crossover points see the H&H appendix. Included in the Lake Borgne Levee District, this levee reach of the LPV MRL starts east of the IHNC Lock runs along the MRL to Caernarvon. The MR&T design grade or MRL 1973 refined project grade for the reach varies from EL 21.5 to 19.8. The 1% 2011 HSDRRS design grade is EL 18.5. The MRL levees have a crushed stone surfacing crown and concrete slope paving (CSP) on the flood side slope. Between the upstream limit of this reach and the new crossover point at river mile 90.5 is a portion of the LPV-MRL-2 reach. This reach was not armored.

Several areas in this reach are highly industrial on both sides of levee which would involve complex utility relocations and land acquisitions. A flood side shift is required in most areas however in some areas the flood side batture is very narrow. For these reasons, floodwall as opposed to levee is the recommended plan between B/L STA 320+00 to 345+00, B/L STA 372+00 to 425+00, and B/L STA 450+00 to 488+00; and other areas would require a flood side shift. A previous report done in 2011 also confirmed these recommendations. The report is titled “Hurricane Storm Damage and Risk Reduction System & Mississippi River Levees Co-Located Areas, 65% Engineering Alternatives Report, Permanent Measures, East Bank, St. Bernard Parish, Louisiana.”

There are some areas of the MRL where bank factors of safety are critical and land side shifts or construction of sub-aqueous rock stability berms could be required. Analysis will be required during the PED phase.

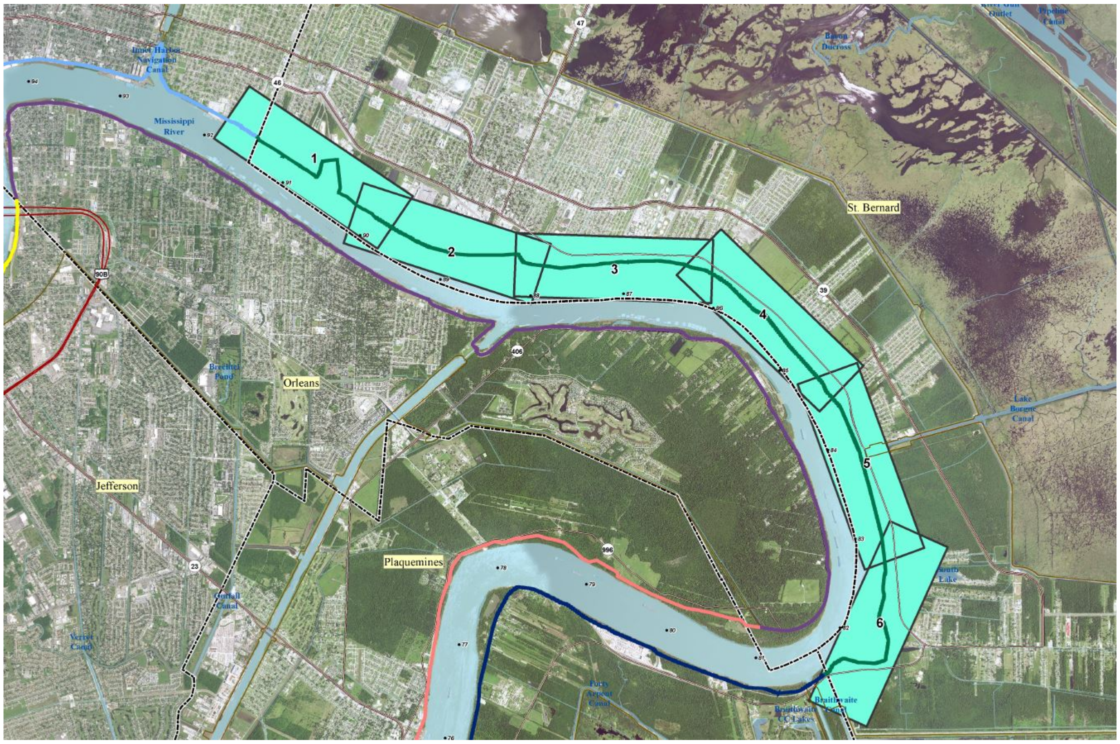

Figure 10. LPV-MRL-1 Levee Reach

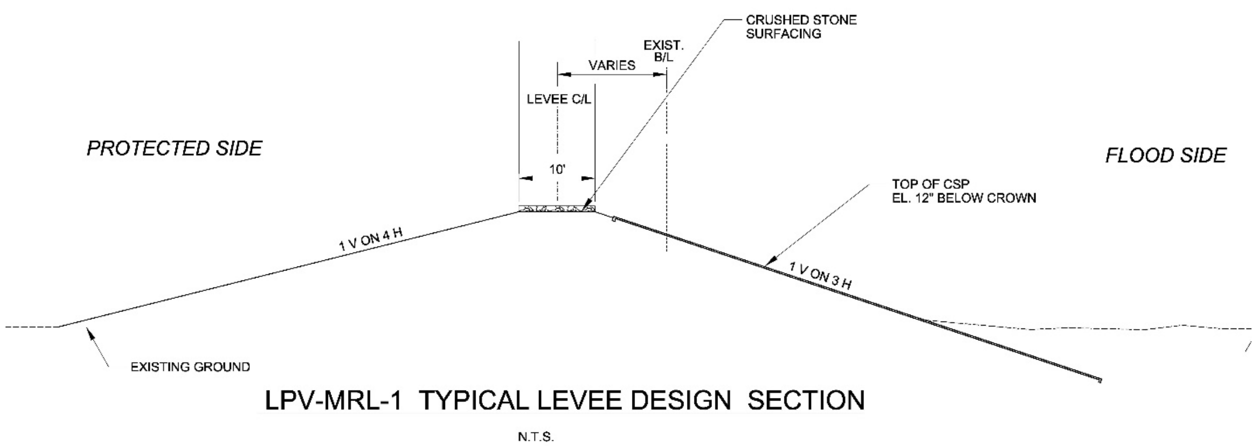

Figure 11. LPV-MRL-1 Typical Levee Section

2.6 LPV-MRL-23B BONNET CARRE LOWER GUIDE LEVEE

The LPV-MRL-23B reach is only representative of itself. This reach is the most western section of the HSDRRS system and is the Bonnet Carre Lower Guide Levee along the eastern side of the Bonnet Carre Spillway between the Mississippi River and Airline Highway (LA Hwy 61). The last lift was in 2003 to EL 12.5. It was determined that no additional lift would be required under the scope of this study. This reach was not armored.

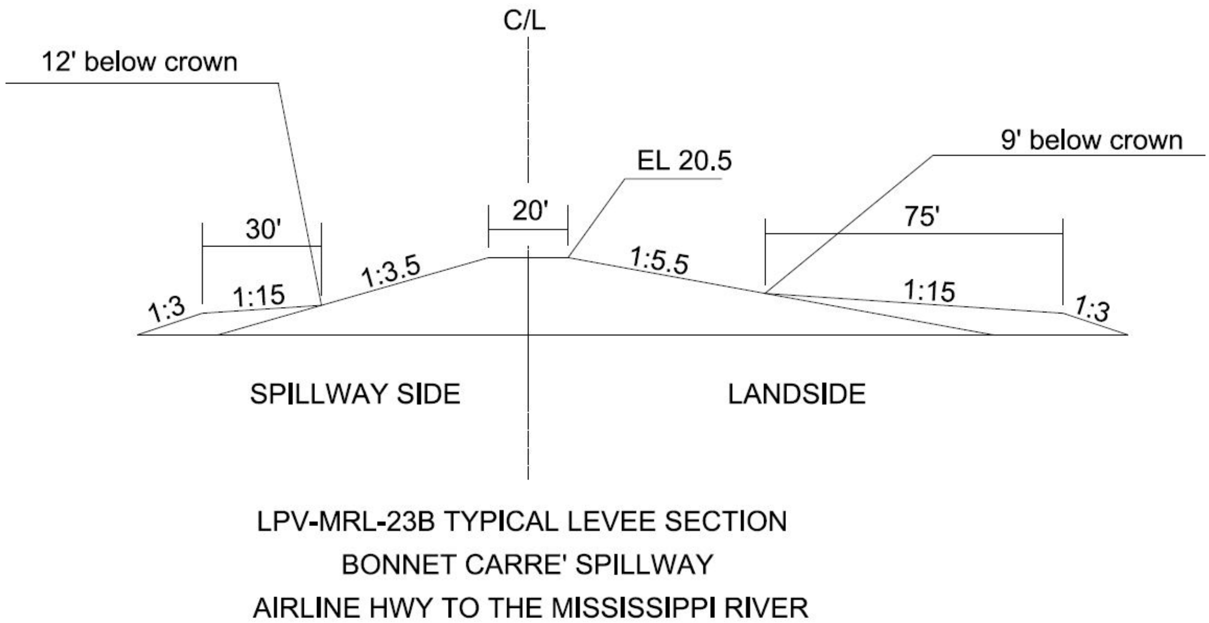

Figure 12. LPV-MRL-23B Typical Levee Section

3 QUANTITY CALCULATION – INTERMEDIATE 1% DESIGN STORM

Due to the enormity of the entire system, representative reaches were chosen and lift schedules were developed for some reaches and applied to representative reaches. For explanation on development of lift schedules refer to the Geotechnical Appendix B. The following table represents the results of the geotechnical analysis and lift schedules for each reach. These represent conservative estimates of when the next lift may be required and should NOT be interpreted as predictions of when a reach may become deficient. A short term delay in first lifts is not expected to adversely affect project performance.

Contract ID	Contract	1st Lift			2nd Lift			3rd Lift		
		Year	Height (FT)	Fill (CY)	Year	Height (FT)	Fill (CY)	Year	Height (FT)	Fill (CY)
Lake Pontchartrain and Vicinity										
LPV-MRL-23B	Bonne Carre Guide Levee	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
LPV-00.2	Reach 1 Lakefront Levee	2025	2	95,608	2044	2	95,608	2063	1	47,804
LPV-01.1	Reach 2 Lakefront Levee	2025	2	73,339	2044	2	73,339	2063	1	36,670
LPV-02.2	Reach 3 Lakefront Levee	2025	2	106,462	2044	2	106,462	2063	1	53,231
LPV-03d.2	Airport Runway 10 Levee	2024	3	18,037	2036	3	18,037	2047	3	18,037
LPV-04.2	Levee - Reach 1A and 1B from Cross Bayou to ICRR	2024	3	177,166	2036	3	177,166	2047	3	177,166
LPV-05.2	Levee - Reach 2A and 2B Bayou Trepagnier to Cross BayouGood Hope	2024	3	214,916	2036	3	214,916	2047	3	214,916
LPV-19.2	Reach 4 Lakefront Levee	2025	2	59,530	2044	2	59,530	2063	1	29,765
LPV-20.1	Reach 5 Lakefront Levee	2025	2	108,771	2044	2	108,771	2063	1	54,385
LPV-102.01	Lake Marina Ave to Orleans Ave Canal	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
LPV-103.01	Orleans Ave Canal to London Ave Canal	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
LPV-104.01	London Ave Canal to IHNC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
LPV-108	Paris Road to South Point	2069	1	163,353	N/A	N/A	N/A	N/A	N/A	N/A
LPV-109.02a	South Point to CSX RR	2069	1	141,266	N/A	N/A	N/A	N/A	N/A	N/A
LPV-111.01	CSX RR to Michoud Canal	2069	1	231,060	N/A	N/A	N/A	N/A	N/A	N/A
LPV-MRL-1	IHNC to Caernarvon, Lake Borgne Levee District	2040	3	611,441	2053	3	650,515	2063	3	650,515

Figure 13. Intermediate 1% Design Storm Lift Schedules

3.1 LEVEE LIFT QUANTITY CALCULATION ASSUMPTIONS

Quantities for each lift were calculated based on cross sectional area. Although some areas may require a flood side shift due to right of way restrictions, it was assumed due to the scope of the study, that for the quantities, all lifts are straddle lifts and no berms are affected. The only site investigations that were done was a profile survey of the levee crown elevations.

Some levee reaches have concrete paved transitions from levee to floodwall. It is assumed that with each lift, the slope paving would need to be removed and replaced to 1 foot below the levee design elevation. Demolished existing slope pavement could potentially, as done in the past, be stockpiled as a dike at the toe to act as a wave break during high river stages.

Silt fence quantities were calculated by doubling the reach length, assuming it would be required on both sides of the levee, and a 25% contingency was added for staging areas.

Embankment quantities were calculated using cross sectional areas. Clearing and grubbing and seeding and mulching quantities are assumed to be the same, in acres per lift.

Staging areas and access routes are assumed to be the same as during the previous lifts.

Quantities calculated for each reach are located in Enclosure 1 at the end of this appendix.

3.2 ARMORING

It is assumed that all previously placed armoring for each reach would need to be removed before each lift and then replaced after construction of each lift. Armoring consists of either HPTRM or ACB. As previously done, because MRL levees have all-weather access roads on the crown, so ACBs were placed on these reaches as the method of armoring. All other reaches have HPTRM with the exception of LPV-108. This reach has an adjacent railroad and the crown is used for access so ACBs were also applied to this reach.

3.2.1 LPV-MRL-1 AND LPV-108

The HPTRM will be placed on the landside of the levee and generally extend a distance of 15-ft. past the land side levee toe and terminate in an anchor trench. After the initial placement of the HPTRM on the land side, the HPTRM is anchored using percussion driven earth anchors in a specific pattern so that the HPTRM maintains contract with the levee surface. Additional steel pins are used, in between the percussion driven earth anchors to further anchor the HPTRM.

ACBs will be placed on the crown of the levee, extending down the land and flood side levee slopes for a distance of approximately 7 feet. On the flood side, the ACBs will terminate in an anchor trench. On the land side, the ACBs and filter fabric are placed on top of the HPTRM and anchored. As part of the installation of the ACBs, crushed stone was added and graded on the levee crown and side slopes.

3.2.2 ALL OTHER LPV REACHES

HPTRM armoring is placed from a distance of 4 feet down the flood side slope from the levee crown and extends across the levee crown, down the land side slope, and then extends an additional 15 feet past the landside toe. The HPTRM was secured to the levee using percussion driven earth anchors placed at 5 ft. intervals and 12-inch metal pins placed between the percussion driven earth anchors. Additionally, the flood side and landside limits of the HPTRM were secured in a minimum 1 ft. by 1 ft. anchor trench. Once placed the HPTRM was covered with Bermuda sod and fertilized.

3.3 MRL SLOPE PAVING

LPV-MRL-1 has concrete slope paving on the flood side slope. It is assumed for this alternative that the slope paving will need to be removed and replaced with expansion of the levee footprint. The quantities are included in enclosure 1.

3.4 FORESHORE FRONTING PROTECTION RIPRAP

Along the LPV Lakefront, foreshore protection was added per HSDRRS guidelines to prevent foreshore shore erosion along the lakefront. It is assumed that to maintain the 1% level of protection additional foreshore riprap would need to be replaced. It is assumed that additional 15 foot width of riprap, approximately 4 ft. in depth would need to be added to the existing riprap. Quantities are calculated in enclosure 1 at the end of this appendix.

4 QUANTITY CALCULATION – INTERMEDIATE 0.5% DESIGN STORM

Hydraulic design elevations were calculated for the 0.5% intermediate design or 200 year storm. For explanation on these calculations see the H&H appendix. Due to time constraints, lift schedules and curves were not developed for this option. Design elevations for the 200 year storm were interpolated from the 100 and 500 year intermediate design storm elevations to come up with an estimation of lifts. The increase in lift from the 100 year elevation was either added to the last 100 year lift or an additional lift was added, in keeping with the previous maximum lift of 3 feet. See enclosure 2 for lift schedules and estimates quantities. The same assumptions from the 1% design quantity calculations apply. This alternative is not the selected plan.

5 GENERAL ASSUMPTIONS

5.1 UTILITY RELOCATIONS

Because all lifts would generally straddle the footprint of a previous lift, it is assumed that no utility relocations would be required. If relocation of any existing utility that cross the levees as permitted is required, the utility would need to be lifted by and at the expense of the utility owner, at no cost to the Government.

For the intermediate and high 1% design storms, the new footprint was compared to the existing right of way limits for the last levee lift for the representative reaches to determine if any new right of way would be required. Generally, all lifts should be within the existing ROW limits for the intermediate condition with the exception of temporary access and staging areas. For the high condition, the only areas that stood out as possibly needing additional right of way were along the New Orleans Lakefront and the LPV MRL and are provided below for informational purposes only as it was not the selected alternative.

5.1.1 NEW ORLEANS LAKEFRONT

For the LPV-103 reach a lift would be bounded by Lakeshore Drive at the beginning project in the vicinity of C/L Sta. 62+89 to 65+22. In the vicinity of Sta. 101+00 an additional right-of-way may be required on the flood side and along Bayou St. John on the east side, because the existing right of way limit is already at the existing toe. A possible t-wall may be required here between Sta. 119+31.70 to 121+10.55.

At LPV-104, between Sta. 9+00 and 14+00, the existing levee toe abuts the U.S. Naval & Marine Reserve property therefore a flood side shift is probably required however no additional easement should be required for the intermediate condition. Between Sta. 17+71 and 19+97, for the intermediate condition, if a land side shift is done, no additional easement will be required. From 65+50 to 69+00 and from 78+70 to 80+60, the existing flood side toe abuts Lakeshore Dr. therefore a land side shift might be required. All shifts would need to be analyzed for stability. This was not done during this phase of this study.

5.1.2 LPV MRL

A flood side shift toward the river should prevent the need for additional easements. Between Stations 320+00 to 345+00, 372+00 to 425+00, and 450+00 to 488+00 it was determined that a floodwall would be the most feasible alternative. The batture is narrow and there is a steep underwater slope. A landside shift isn't feasible due to an adjacent railroad.

6 REFERENCES

Lake Pontchartrain and Vicinity (LPV), Hurricane Damage Risk and Reduction System, LPV-ARM-08, LPV Levee System Armoring – LPV-00.2 Jefferson Parish Lakefront Levee Reach 1, Volume 3 OMRR&R Manual, Aug. 2019

Lake Pontchartrain and Vicinity (LPV), Hurricane Damage Risk and Reduction System, LPV-ARM-06, LPV-04.2a, Reach 1A from Cross Bayou to St. Rose and Gulf South Floodwall, Volume 3 OMRR&R Manual, Feb. 2020

Lake Pontchartrain and Vicinity (LPV), Hurricane Damage Risk and Reduction System, LPV-ARM-06, LPV-04.2b, Reach 1B from I-310 to Walker Drainage Structure, Volume 3 OMRR&R Manual, Feb. 2020

Lake Pontchartrain and Vicinity (LPV), Hurricane Damage Risk and Reduction System, LPV-ARM-02, Levee High Performance Turf Reinforcement Mat (HPTRM) Armoring Reaches LPV-102, LPV-103, and LPV-104, Volume 3 OMRR&R Manual, April 2017.

Lake Pontchartrain and Vicinity (LPV), Hurricane Damage Risk and Reduction System, LPV-109.02, Volume 3 OMRR&R Manual, Dec. 2017.

APPENDIX A - ENCL 1 - 1% DESIGN STORM

2/13/2021

Lake Pontchartrain and Vicinity

Contract ID	Contract	Representative Reach	Length (FT)	X-Section Distance(FT)	transitions	Toe to toe width (FT)	Silt Fence (LF/Lift)	Seeding and Mulching , C&G (Ac/Lift)	1st Lift			2nd Lift			3rd Lift			4th Lift			ARMORING	FORESHORE PROTECTION	FORESHORE DREDGING	FORESHORE PROTECTION	Contract ID	Slope Paving
									Year	Height (FT)	Fill (CY)	Year	Height (FT)	Fill (CY)	Year	Height (FT)	Fill (CY)	Year	Height (FT)	Fill (CY)	LPV	(CY)	(CY)	(SF)		(SQ)
Lake Pontchartrain and Vicinity																									N/A	N/A
LPV-MRL-23B	Bonne Carre Guide Levee	BC levee	12715	120	N/A	70	31,788	43.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A		N/A
LPV-00.2	Reach 1 Lakefront Levee	LPV 00.2	10667	207	2	121	26,668	63.4	2025	2	95,608	2044	2	95,608	2063	1	47,804	N/A	N/A	N/A	ARM-08	23704	19810	5926	LPV-00.2	N/A
LPV-01.1	Reach 2 Lakefront Levee		7616	141	4	130	19,040	30.8	2025	2	73,339	2044	2	73,339	2063	1	36,670	N/A	N/A	N/A	ARM-10	16924	14144	4231	LPV-01.1	N/A
LPV-02.2	Reach 3 Lakefront Levee		11977	206	2	120	29,943	70.8	2025	2	106,462	2044	2	106,462	2063	1	53,231	N/A	N/A	N/A		26616	22243	6654	LPV-02.2	N/A
LPV-03d.2	Airport Runway 10 Levee	LPV 04.2	1691	157	2	96	4,228	7.6	2024	3	18,037	2036	3	18,037	2047	3	18,037	N/A	N/A	N/A	ARM-03	N/A	N/A	N/A	N/A	N/A
LPV-04.2	Levee - Reach 1A and 1B from Cross Bayou to ICRR		19445	218	12	82	48,613	121.6	2024	3	177,166	2036	3	177,166	2047	3	177,166	N/A	N/A	N/A	ARM-06	N/A	N/A	N/A	N/A	N/A
LPV-05.2	Levee - Reach 2A and 2B Bayou Trepagnier to Cross BayouGood Hope		23588	218	10	82	58,971	147.6	2024	3	214,916	2036	3	214,916	2047	3	214,916	N/A	N/A	N/A	ARM-01	N/A	N/A	N/A	N/A	N/A
LPV-19.2	Reach 4 Lakefront Levee	LPV 00.2	7802	166	4	103	19,506	37.2	2025	2	59,530	2044	2	59,530	2063	1	29,765	N/A	N/A	N/A	ARM-07	17339	14490	4335	LPV-19.2	N/A
LPV-20.1	Reach 5 Lakefront Levee		9178	125	2	160	22,944	32.9	2025	2	108,771	2044	2	108,771	2063	1	54,385	N/A	N/A	N/A		20395	17044	5099	LPV-20.1	N/A
LPV-102.01	Lake Marina Ave to Orleans Ave Canal	LPV 103	5458	200	2	140	13,645	31.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ARM-02	N/A	N/A	N/A	LPV-102.01	N/A
LPV-103.01	Orleans Ave Canal to London Ave Canal		6817	200	14	106	17,043	39.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	LPV-103.01	N/A
LPV-104.01	London Ave Canal to IHNC		9994	200	9	140	24,986	57.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	LPV-104.01	N/A
LPV-108	Paris Road to South Point	LPV 109	32430	135	3	136	81,076	103	2069	1	163,353	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ARM-04	N/A	N/A	N/A	LPV-108	N/A
LPV-109.02a	South Point to CSX RR		38142	110	6	100	95,354	12.5	2069	1	141,266	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ARM-05	N/A	N/A	N/A	LPV-109.02a	N/A
LPV-111.01	CSX RR to Michoud Canal		27124	230	4	230	67,811	143	2069	1	231,060	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ARM-09	N/A	N/A	N/A	LPV-111.01	N/A
LPV-MRL-1	IHNC to Caernarvon, Lake Borgne Levee District	LPV-MRL-1	39121	200	N/A	145	97,802	180	2040	3	611,441	2053	3	650,515	2063	3	650,515	N/A	N/A	N/A	N/A	N/A	N/A	N/A	LPV-MRL-1	19560

APPENDIX A - ENCL 2 0.5% DESIGN STORM 11/22/2020

Lake Pontchartrain and Vicinity Quantities

Contract ID	Contract	Representative Reach	Length (FT)	X-Section Distance(FT)	transitions	Toe to toe	Silt Fence (LF/Lift)	S&M , C&G (Ac/Lift)	1st Lift Height (FT)	1st Lift Fill (CY)	2nd Lift Height (FT)	2nd Lift Fill (CY)	3rd Lift Height (FT)	3rd Lift Fill (CY)	4th Lift Height (FT)	4th Lift Fill (CY)	ARMORING CONTRACT	FORESHORE PROTECTION (CY)	FORESHORE PROTECTION (SF)	Slope Paving (SQ)
LPV-MRL-23B	Bonne Carre Guide Levee	BC levee	12965	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
LPV-00.2	Reach 1 Lakefront Levee	LPV 00.2	10448	207	2	121	26,120	62.1	3	140,468	3	600,760	1.5	70,234	N/A	N/A	ARM-08	23218	5804	N/A
LPV-01.1	Reach 2 Lakefront Levee		4210	141	4	130	10,525	17	3	60,811	3	164,892	1.5	30,406	N/A	N/A	ARM-10	9356	2339	N/A
LPV-02.2	Reach 3 Lakefront Levee		19234	206	2	120	48,085	113.7	3	256,453	3	1,100,612	1.5	128,227	N/A	N/A		42742	10686	N/A
LPV-03d.2	Airport Runway 10 Levee	LPV 04.2	1565	151	2	96	3,913	6.8	2	11,129	2	11,129	2	11,129	1	5,564	ARM-03	3478	869	N/A
LPV-04.2	Levee - Reach 1A from Cross Bayou to St. Rose and Gulf South Floodwall		15561	218	12	82	38,903	97.3	2	94,519	2	628,203	2	94,519	1.5	70,889	ARM-06	N/A	N/A	N/A
LPV-05.2	Levee - Reach 2A Shell Pipeline to Goodhope and Shell Pipeline Floodwall		15022	450	10	82	37,555	194	2	91,245	2	1,251,833	2	91,245	1.5	68,434	ARM-01	N/A	N/A	N/A
LPV-19.2	Reach 4 Lakefront Levee	LPV 00.2	14116	166	4	103	35,290	67.2	3	161,550	3	650,904	1.5	80,775	N/A	N/A	ARM-07	31369	7842	N/A
LPV-20.1	Reach 5 Lakefront Levee		7471	125	2	160	18,678	26.8	3	132,818	3	259,410	1.5	66,409	N/A	N/A		16602	4151	N/A
LPV-102.01	Lake Marina Ave to Orleans Ave Canal	LPV 103	5800	200	2	140	14,500	33.3	3	90,222	N/A	N/A	N/A	N/A	N/A	N/A	ARM-02	12889	3222	N/A
LPV-103.01	Orleans Ave Canal to London Ave Canal		3900	200	14	106	9,750	22.4	3	45,933	N/A	N/A	N/A	N/A	N/A	N/A		8667	2167	N/A
LPV-104.01	London Ave Canal to IHNC		100000	200	9	140	250,000	573.9	3	1,555,556	N/A	N/A	N/A	N/A	N/A	N/A		222222	55556	N/A
LPV-106	IHNC to Paris Road Floodwall		25400	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	112889	14111	N/A
LPV-108	Paris Road to South Point	LPV 109	33264	135	3	136	83,160	103	2	335,104	2	335,104	2	335,104	N/A	N/A	ARM-04	147840	18480	N/A
LPV-109.02a	South Point to CSX RR		5280	110	6	100	13,200	12.5	2	39,111	2	39,111	2	39,111	N/A	N/A	ARM-05	N/A	N/A	N/A
LPV-111.01	CSX RR to Michoud Canal		27456	230	4	230	68,640	145	2	467,769	2	467,769	2	467,769	N/A	N/A	ARM-09	N/A	N/A	N/A
LPV-MRL-1	IHNC to Caernarvon	LPV-MRL-1	60460	200	N/A	145	151,150	278	3	974,078	3	974,078	3	974,078	N/A	N/A	N/A	N/A	N/A	30230

2021

Lake Pontchartrain & Vicinity GRR

Appendix B – Geotechnical Engineering

US Army Corps of Engineers
New Orleans District

U.S. Army Corps of Engineers, New Orleans District

Non-Federal Sponsor: Coastal Protection and Restoration Authority Board of Louisiana

March 2021

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LAKE PONTCHARTRAIN & VICINITY GRR
APPENDIX B – GEOTECHNICAL ENGINEERING

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LAKE PONTCHARTRAIN & VICINITY GRR APPENDIX B – GEOTECHNICAL ENGINEERING

1 INTRODUCTION

1.1 OVERVIEW

The appendix documents geotechnical analyses for levee lifts and T-wall raise for future conditions of 2073 intermediate project grades.

1.2 SCOPE

The scope of this appendix is to project lift schedules to the year 2073, based on the previously developed lift schedules to the year 2057, and to perform stability analysis for Gulf Intracoastal Waterways (GIWW), Goodhope floodwalls, and MRL-LPV-1. Settlement-induced bending moment (SIBM) caused by levee lifts on adjacent T-wall transition, and additional stability measures from the lifts were not included in the analyses. 100-year analysis only looked at RSLR, not settlement.

1.2.1 STUDY AREA

The study area is bounded by Lake Pontchartrain to the North, Lake Borgne to the East, and Mississippi River to the South.

1.3 GEOTECHNICAL TERMINOLOGY

Consolidation: settlement of soil as a result of dissipation of pore water pressure over time.

Shear strength: the internal resistance per unit area that the soil mass can offer to resist failure and sliding along any plane inside it.

Stability berm: an earthen structure built laterally and adjacent to a levee slope to help keep it stable from sliding.

2 FUTURE WITH PROJECT/ACTION CONDITION

2.1 PRIOR ANALYSIS

“Previously developed lift schedules” or “prior lift schedules” were last prepared in 2014 to estimate levee lifts needed to ensure that previously established design grades were maintained from settlement over time. Consolidation settlement of the foundation was caused by the volume change in saturated cohesive soils due to expulsion of the water that occupies the void spaces. The volume change was induced by the levee load that compresses the soil layers.

The process of developing prior lift schedules involved creating consolidation parameters from subsurface exploration and testing, estimating stress increase from levee load, and using Settle3D computer program.

Shrinkage and consolidation of levee fill were also considered in the development of lift schedules.

Due to the non-uniform nature of soil's physical structure and substance, settlement was estimated and lift schedules were developed for planning purposes only.

2.2 LIFT SCHEDULE ANALYSIS

Survey of levee elevations was performed in November and December 2018. Survey was performed in eight reaches which consist of different levee segments. Settlement was estimated and lift schedules developed for the reaches with prior analyses.

First, lift schedules previously developed to 2057 for segments of each reach were compared to each other and the segment with representative settlement curves was selected. It should be noted that in some cases lift schedules for all levee segments of a certain reach were not previously developed.

Secondly, previously constructed lift was drawn with year and elevation, on the prior lift schedule. Thirdly, the November or December 2018 average survey values of the control segment were plotted. Since survey elevation included the 6-inch thick articulated concrete block if the levee was armored, the survey was lowered 6 inches for the actual levee crown. A settlement curve was then drawn from the actual lift elevation to the survey elevation.

If this settlement curve intersected the new design grade, another levee lift was drawn. The thickness of the lift was similar to the thickness of the prior schedule, or was modified to reduce the number of lifts to save costs. Subsequent lifts were developed as similar shaped curves.

Survey Reach 1 consisted of Bonnet Carre Lower Guide levee. Prior lift schedules was "St Charles Reach 2 Generalized Lift Schedule" and consisted of the design grade from 2007 to 2057 and three lift schedules. The three lift schedules were in red, blue and black, in 2011, 2015 and 2023, respectively. Intermediate design grade for 2073 was drawn on prior lift schedules.   Previously constructed lift (+20.5 in 2003) and 2018 average survey (+20.0) were also drawn. Settlement curve was then drawn from lift elevation to survey elevation (no armor was assumed). Since settlement curve stayed above the intermediate design grade to 2073, no lifts were required.

Survey Reach 2 consisted of the following levee segments in St Charles Parish: LPV-03d.2, LPV-04.2a, PV-04.2b, LPV-05.2a and LPV-05.2b. Segment LPV-04.2a was selected as the representative segment because its settlement curves in the prior lift schedules were similar to those of most other segments in the reach. Prior lift schedules were shown as dash lines and consisted of the design grade from 2007 to 2057 and four lift schedules. The four lift schedules were in 2012, 2016, 2024 and 2038. Design grade or 100-year new in 2073 was drawn in red. Actual lift (2017 to 17) and 2018 high, average and low surveys were also drawn. Settlement curve was then drawn in red from lift elevation to survey elevation. Since the settlement curve intersected the design grade in 2024, a levee lift was required. The lift thickness was approximately 3 feet, similar to thickness of prior lift schedules between 2 feet and 3 feet. Subsequent lifts of similar shapes to the settlement curve were then drawn also in red.

Due to the pandemic telework condition, it was not possible to remove the bold grey solid lines from prior work.

Lift schedules for Survey Reaches 3 (Jefferson Lakefront), 4 (Orleans Parish Lakefront), and 5 (Orleans East) were also developed.

Since there were no prior lift schedules for Survey Reach 6 (Chalmette), and Reaches 7 and 8 (MRL Orleans and MRL Lake Borgne), no lift schedules were developed.

An MRL is typically raised to the 1973 required flowline plus freeboard. Since the levees were already previously constructed to those elevations, any lift to bring the levee back to those elevations will have minimum settlement if any at all. The foundation for those levees have had years to consolidate, over 100 years in some places. A 6-inch over-build is typically used to account for any potential settlement/shrinkage.

2.3 FLOODWALL STABILITY ANALYSIS

Stability was analyzed for raising the GIWW and Goodhope T-walls 1 ½ foot and 1 foot to elevations +27.5 and +18, respectively. GeoStudio Slope/W version 2019 with Spencer’s method of analysis was used. HSDRRS criteria for minimum factors of safety apply. Non-optimized block and optimized fully-specified slip surfaces at each stratum were analyzed. The St. Charles Return floodwall was not analyzed due to lack of cross section data.

HSDRRS Slope Stability Design Factors of Safety

Analysis Condition	Required Minimum Factor of Safety	
	Spencer Method[1]	Method of Planes[2]
End of Construction[3]	1.3	1.3
Design Hurricane[4] (SWL)	1.5	1.3
Design Hurricane (SWL) w/ dry PS borrow pit[10]	1.3	1.3
Water at Project Grade (levees)[5]	1.4 (1.5)[6]	1.2
Water at Construction Grade (levees)[5]	1.2	N/A
Extreme Hurricane (water @ top of I-walls)[5]	1.4 (1.5)[6]	1.3
Extreme Hurricane (water @ top of T-walls)[5a]	1.4 (1.5)[6]	1.2
Low Water (hurricane condition)[7]	1.4	1.3
Low Water (non-hurricane condition)[8] S-case	1.4	1.3
Water at Project Grade Utility Crossing[9]	1.5 (1.4)	1.3 (1.2)

Unbalanced loads exist for all monoliths of GIWW floodwall (N1 thru N11) except for N12 and N13 sections.

For Goodhope T-wall, N1 section did not meet the minimum factor of safety and will be replaced, while N3 and N6 sections did meet the requirement. The other monoliths were not analyzed due to lack of cross section data.

2.4 LEVEE STABILITY ANALYSIS

Stability was analyzed for raising the LPV-MRL-1 to the 2073 design grades while shifting the centerline to the flood side to avoid additional right-of-way need on the protected side.

Boring data was collected and strengthlines created. Surveys were conducted in 2020 and representative cross sections selected. GeoStudio Slope/W version 2019 with Spencer's method of analysis was used, and HSDRRS criteria for minimum factors of safety apply. Since Still Water Level (SWL) and Low Water Level (LWL) were not available, Water at Project Grade (WPG) or High Water Level (HWL) was used.

Centerline borings for LPV-MRL-1 consisted of E-84.75-UCL, EB-85.8U, CSA-2, EB-86.7U, E-85.3-UCL, E-89.3-U, E-85.5-U, and EB-86.2U drilled in 1972 to 2009 with depths of 130 feet to 150 feet. Toe borings consisted of EB-86.35UFT, EB-86.8UFT, EB-86.05UPT, EB-85.5UFT, E-85.05-UPT, CSA-3FT, CSA-1PT, and E-89.3-UT drilled in 1978 to 2009 with depths of 90 feet to 230 feet.

The required factor of safety was not met for LPV-MRL-1. Since an extensive geotechnical report was prepared in 2011, recommendations from the report was used. The report is titled Hurricane Storm Damage and Risk Reduction System & Mississippi River Levees Co-Located Areas, 65% Engineering Alternatives Report, Permanent Measures, East Bank, St. Bernard Parish, Louisiana. The followings are recommendations from the report:

Station 255+00 to station 372+00: flood side shift

Station 425+00 to station 450+00: flood side shift

Station 450+00 to station 488+00: T-wall

Station 372+00 to station 425+00: T-wall

Station 488+00 to station 611+60: flood side shift

2.5 ASSUMPTIONS AND RISK

Since most settlement curves were developed from actual settlement of levees – from latest lift to November or December 2018 survey data, and prior settlement analysis, risk should be reasonable. SIBM was not considered at this stage and risk should be reasonable.

3 LEVEE COMPOSITION

A typical levee is constructed of high plasticity clay or low plasticity clay with less than 35% sand and 9% organic material. The clay is compacted to at least 90% maximum dry density at a moisture content of within +5% to -3% optimum moisture content.

4 SETTLEMENT MONITORING / CONSTRUCTION IMPLEMENTATION

An initial construction grade is typically approximately 2-3 feet higher than the design grade at the start of the design life. The purpose for that is: to account for a settlement balance, allow for strength gain in the foundation due to consolidation, minimize the increase in required levee footprint, and maintain the constructed crown at or above the design life for approx. 5-7 years. When the time-rate settlement curve (i.e. placed at the construction grade elevation) is scheduled to cross the assumed linearly-varying design elevation line on the lift schedule/plot, another lift is required. If authority/funding is in place, MVN or the NFS will start looking into this approximately a year or so before the time-rate settlement curve theoretically crosses the design line so that surveys can be taken to verify the theoretical calculations. After the first lift, a balance is also aimed for construction lift height, foundation conditions, and lift duration. It is usually the intent to stay within the ROW limits for additional lifts.

5 CONCLUSION

LPV levee segments can require a number of lifts to maintain the 1% of 2073 intermediate project grade. Lift schedules and estimated quantities are in Appendix A Civil.

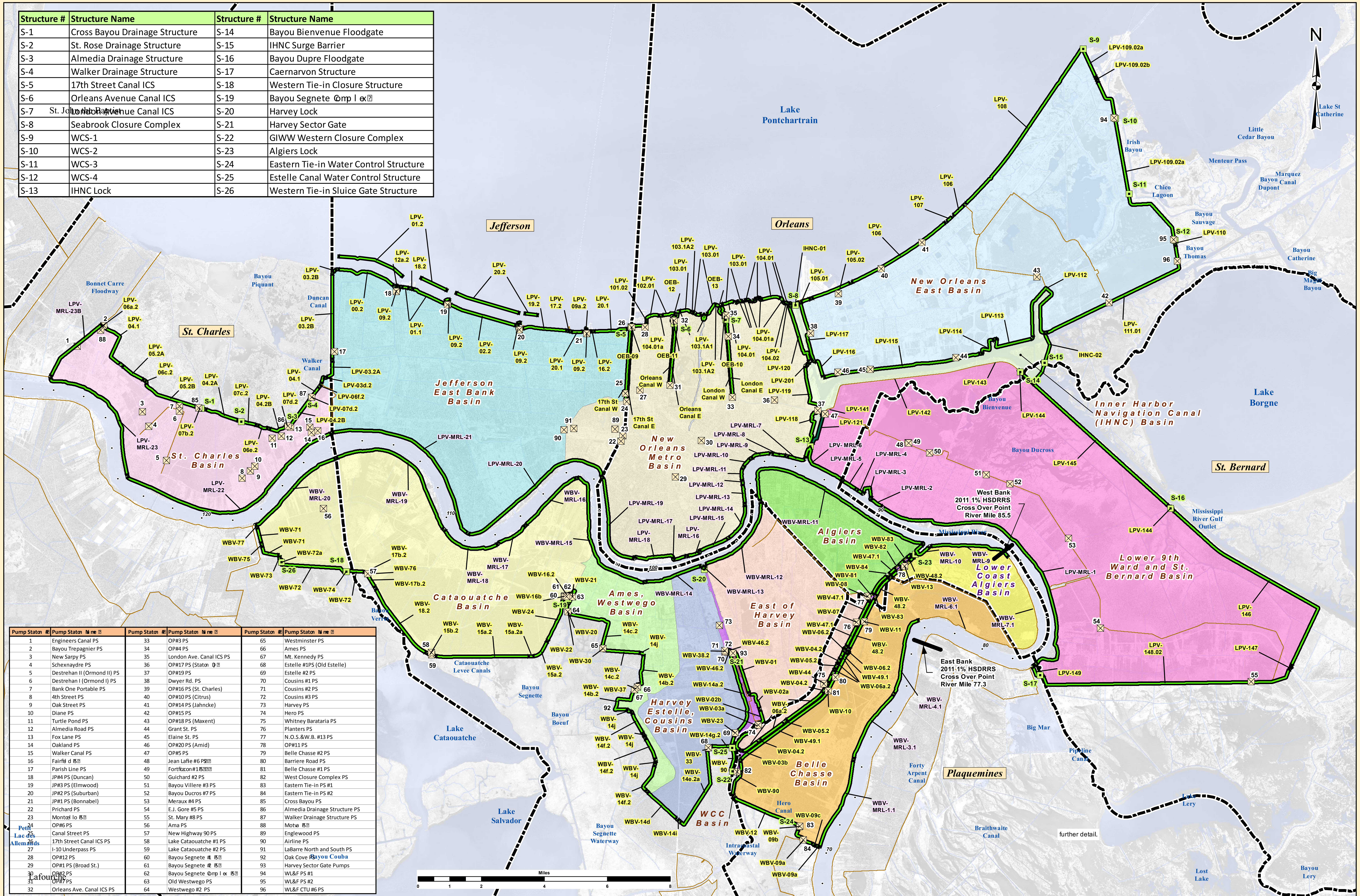
Lift Schedule Projections

LPV-WBV GRR Future Levee Lifts
Table of Representative Levee, Latest Lift, Armor, and Prior Analysis
LPV

Survey Reach	Levee Segment	Representative Levee Segment	Latest Lift Year	Latest Lift Elevation	Armor Year	Note
1	Bonnet Carre Lower Guide (LPV-MRL-23b)		2003	20.5		No armoring assumed
2	St Charles Parish (LPV-03d.2,04.2a, 04.2b, 05.2a, 05.2b)	04.2a (Cross Bayou to I-310)	2017	17	2017	
3	Jefferson Lakefront (LPV-00.2, 01.1, 02.2, 19.2, 20.1)	00.2 Reach 1 Lakefront Levee	2017	17	2018	
4	Orleans Parish Lakefront (LPV-102, 103, 104)	103 (Orleans to London Ave canal)	2008	19.5	2015	
5	Orleans East (LPV-108, 109.02a, 111.01)	109	2011	18.5	2018	
6	Chalmette					No prior lift schedules
7	MRL Orleans Levee District					No prior lift schedules
8	MRL Lake Borgne Levee District					No prior lift schedules

Hurricane & Storm Damage Risk Reduction System (HSDRRS) Map

Structure #	Structure Name	Structure #	Structure Name
S-1	Cross Bayou Drainage Structure	S-14	Bayou Bienvenue Floodgate
S-2	St. Rose Drainage Structure	S-15	IHNC Surge Barrier
S-3	Almedia Drainage Structure	S-16	Bayou Dupre Floodgate
S-4	Walker Drainage Structure	S-17	Caernarvon Structure
S-5	17th Street Canal ICS	S-18	Western Tie-in Closure Structure
S-6	Orleans Avenue Canal ICS	S-19	Bayou Segnete Complex
S-7	London Avenue Canal ICS	S-20	Harvey Lock
S-8	Seabrook Closure Complex	S-21	Harvey Sector Gate
S-9	WCS-1	S-22	GIWW Western Closure Complex
S-10	WCS-2	S-23	Algiers Lock
S-11	WCS-3	S-24	Eastern Tie-in Water Control Structure
S-12	WCS-4	S-25	Estelle Canal Water Control Structure
S-13	IHNC Lock	S-26	Western Tie-in Sluice Gate Structure



Pump Station #	Pump Station Name	Pump Station #	Pump Station Name	Pump Station #	Pump Station Name
1	Engineers Canal PS	33	OP#3 PS	65	Westminster PS
2	Bayou Trepagnier PS	34	OP#4 PS	66	Ames PS
3	New Sarpy PS	35	London Ave. Canal ICS PS	67	Mt. Kennedy PS
4	Schexnaydre PS	36	OP#17 PS (Station D)	68	Estelle #1PS (Old Estelle)
5	Destrehan II (Ormond II) PS	37	OP#19 PS	69	Estelle #2 PS
6	Destrehan I (Ormond I) PS	38	Dwyer Rd. PS	70	Cousins #1 PS
7	Bank One Portable PS	39	OP#16 PS (St. Charles)	71	Cousins #2 PS
8	4th Street PS	40	OP#10 PS (Citrus)	72	Cousins #3 PS
9	Oak Street PS	41	OP#14 PS (Jahncke)	73	Harvey PS
10	Diane PS	42	OP#15 PS	74	Hero PS
11	Turtle Pond PS	43	OP#18 PS (Maxent)	75	Whitney Barataria PS
12	Almedia Road PS	44	Grant St. PS	76	Planters PS
13	Fox Lane PS	45	Elaine St. PS	77	N.O.S.&W.B. #13 PS
14	Oakland PS	46	OP#20 PS (Amid)	78	OP#11 PS
15	Walker Canal PS	47	OP#5 PS	79	Belle Chasse #2 PS
16	Fairfield PS	48	Jean Lafitte #6 PS	80	Barriere Road PS
17	Parish Line PS	49	Fortification #1 PS	81	Belle Chasse #1 PS
18	JP#4 PS (Duncan)	50	Guichard #2 PS	82	West Closure Complex PS
19	JP#3 PS (Elmwood)	51	Bayou Villere #3 PS	83	Eastern Tie-in PS #1
20	JP#2 PS (Suburban)	52	Bayou Ducros #7 PS	84	Eastern Tie-in PS #2
21	JP#1 PS (Bonnabel)	53	Meraux #4 PS	85	Cross Bayou PS
22	Prichard PS	54	E.J. Gore #5 PS	86	Almedia Drainage Structure PS
23	Monticello PS	55	St. Mary #8 PS	87	Walker Drainage Structure PS
24	OP#6 PS	56	Ama PS	88	Motiva PS
25	Canal Street PS	57	New Highway 90 PS	89	Englewood PS
26	17th Street Canal ICS PS	58	Lake Cataouatche #1 PS	90	Airline PS
27	I-10 Underpass PS	59	Lake Cataouatche #2 PS	91	LaBarre North and South PS
28	OP#12 PS	60	Bayou Segnete #1 PS	92	Oak Cove PS
29	OP#1 PS (Broad St.)	61	Bayou Segnete #2 PS	93	Harvey Sector Gate Pumps
30	OP#2 PS	62	Bayou Segnete Complex PS	94	WL&F PS #1
31	OP#7 PS	63	Old Westwego PS	95	WL&F PS #2
32	Orleans Ave. Canal ICS PS	64	Westwego #2 PS	96	WL&F CTU #6 PS

U.S. ARMY CORPS
OF ENGINEERS
NEW ORLEANS DISTRICT
Engineering Office

Legend

- HSDRRS Pump Station
- HSDRRS Structures
- Other Levees
- HSDRRS System
- Parishes (GDT)

H&H BASIN

- LPV Inner Harbor Navigation Canal (IHNC) Basin
- LPV Jefferson East Bank Basin
- LPV Lower 9th Ward and St. Bernard Basin
- LPV New Orleans Metro Basin
- LPV New Orleans East Basin
- LPV St. Charles Basin
- WBV Algiers Basin
- WBV Ames, Westwego Basin
- WBV Belle Chasse Basin
- WBV Cataouatche Basin
- WBV East of Harvey Basin
- WBV GIWW West Closure Complex Basin
- WBV Lower Coast Algiers Basin
- WBV Harvey Estelle, Cousins Basin

Last Modified : 3/10/2013

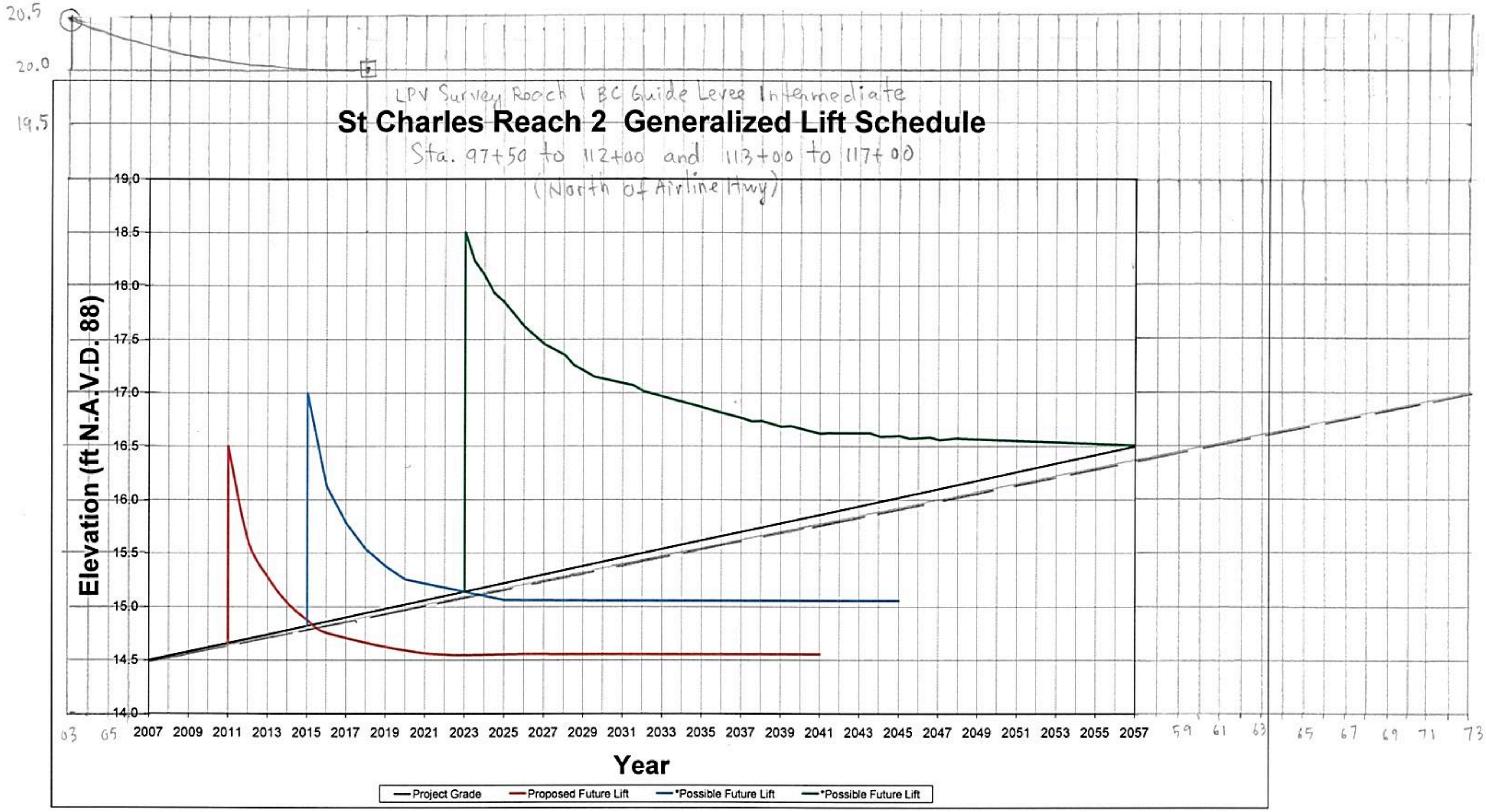
IMAGERY
Projected coordinate system name: NAD_1983_UTM_Zone_15N
Geographic coordinate system name: GCS_North_American_1983
Resolution: 1.000000

Hurricane & Storm Damage Risk Reduction System (HSDRRS) Map

EGIS Map ID No. 11-004

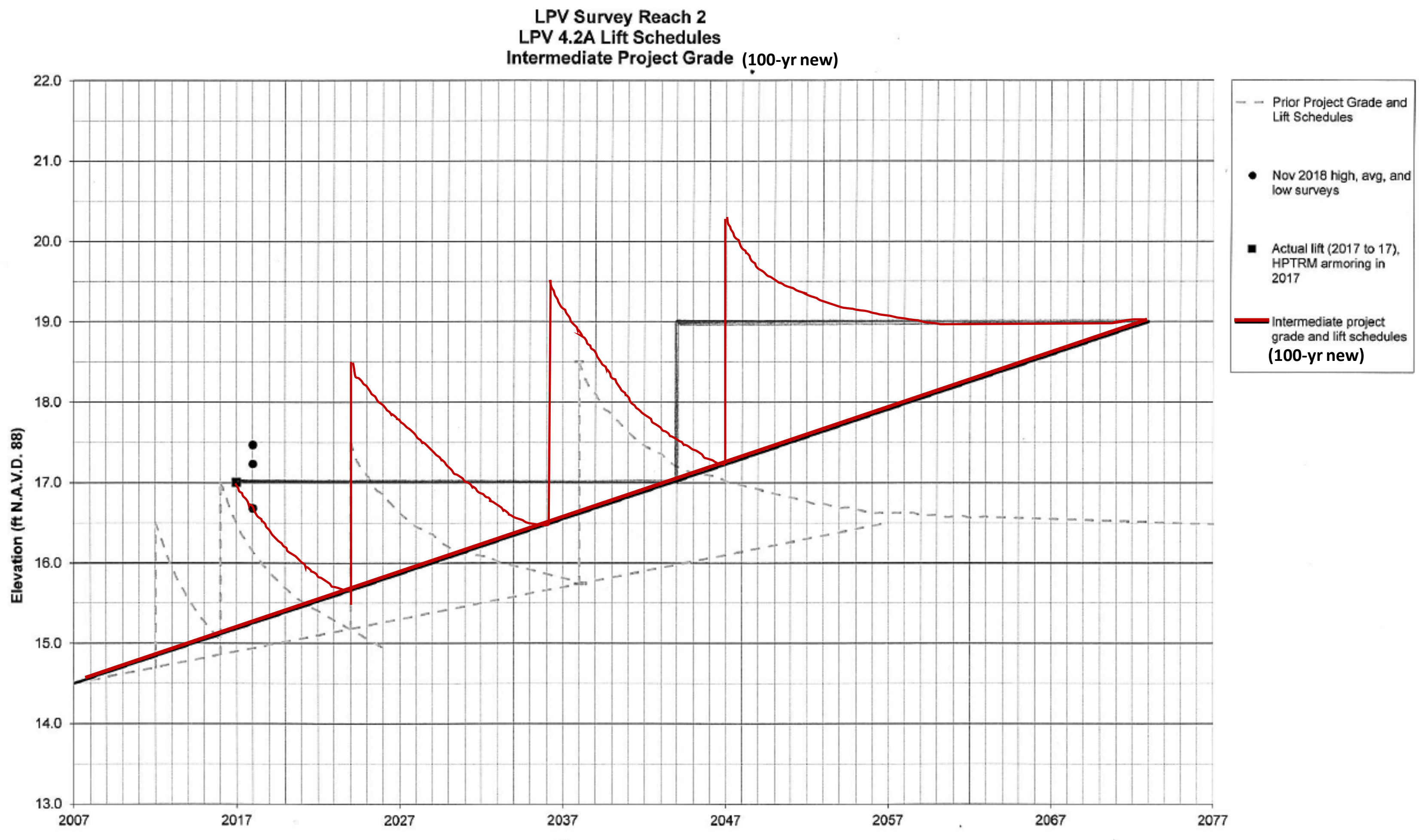
Survey Reaches for LPV GRR Study

Last Modified: 2/3/2021
EGIS Map ID. 19-002-002

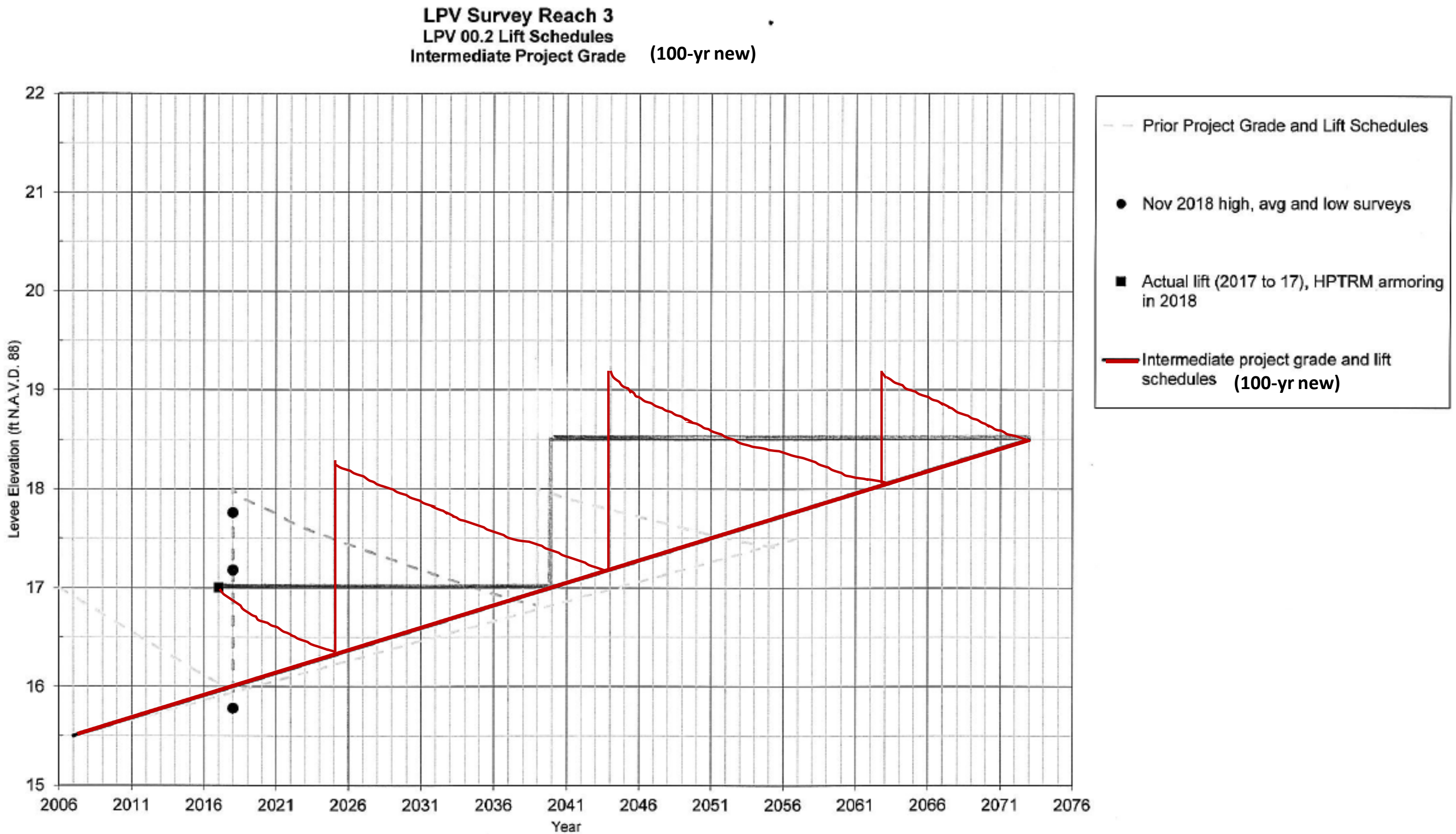


*Note: Subsequent Lifts shall be evaluated in the future for final levee design

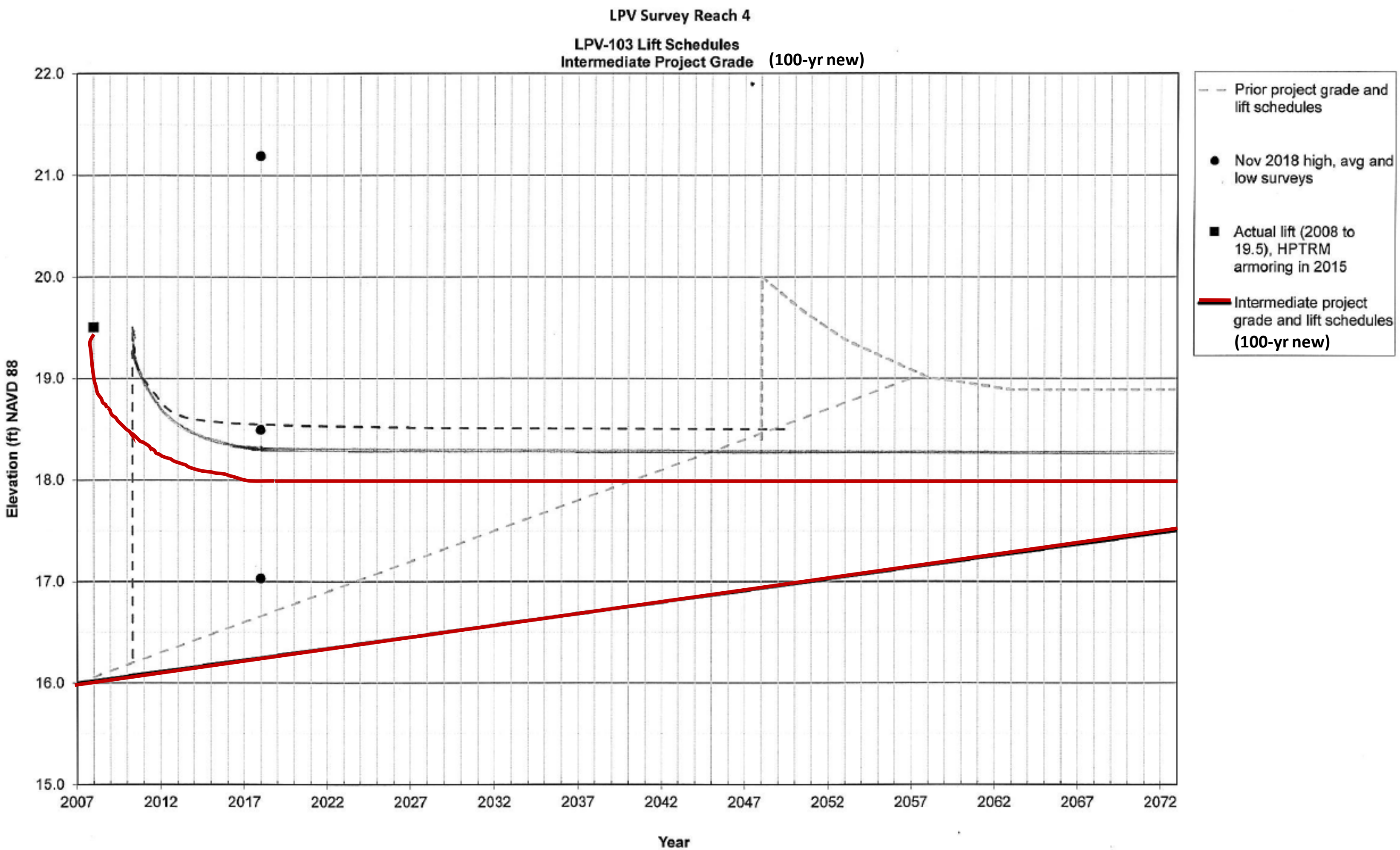
— — Project grade intermediate
—— Settlement curve
⊙ Last levee lift (2003 to 20.5 NGVD)
⊡ Avg survey (Nov '18) NAVD 88 (2009.55)
Assume no armoring

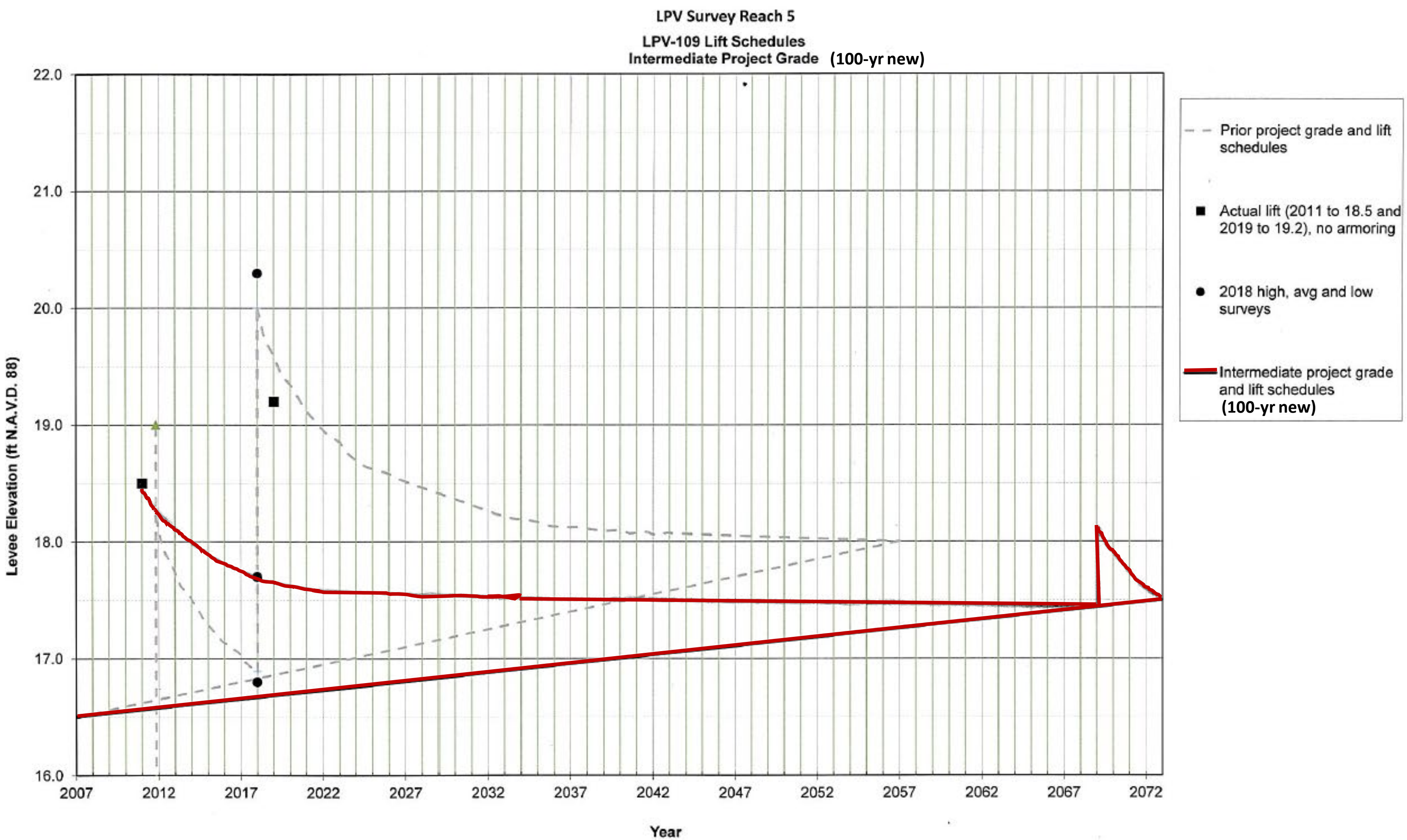


LPV Survey Reach 2
LPV 4.2A Lift Schedules
Intermediate Project Grade (100-yr new)
Elevation (ft N.A.V.D. 88)
22.0
21.0
20.0
19.0
18.0
17.0
16.0
15.0
14.0
13.0
2007
2017
2027
2037
2047
2057
2067
2077
Prior Project Grade and Lift Schedules
Nov 2018 high, avg, and low surveys
Actual lift (2017 to 17), HPTRM armoring in 2017
Intermediate project grade and lift schedules (100-yr new)
57.9%

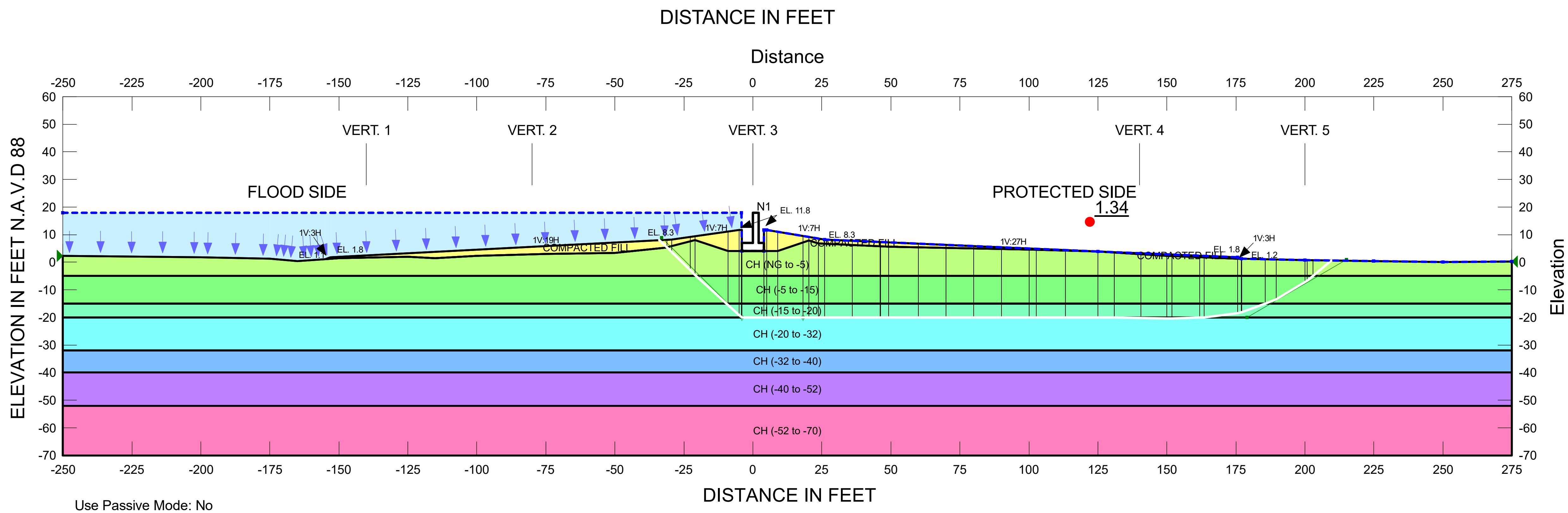


LPV Survey Reach 3
LPV 00.2 Lift Schedules
Intermediate Project Grade
(100-yr new)
Levee Elevation (ft N.A.V.D. 88)
22
21
20
19
18
17
16
15
2006
2011
2016
2021
2026
2031
2036
2041
2046
2051
2056
2061
2066
2071
2076
Year
Prior Project Grade and Lift Schedules
Nov 2018 high, avg and low surveys
Actual lift (2017 to 17), HPTRM armoring in 2018
Intermediate project grade and lift schedules
(100-yr new)


LPV Survey Reach 4
LPV-103 Lift Schedules
Intermediate Project Grade (100-yr new)
Elevation (ft) NAVD 88
22.0
21.0
20.0
19.0
18.0
17.0
16.0
15.0
2007
2012
2017
2022
2027
2032
2037
2042
2047
2052
2057
2062
2067
2072
Year
Prior project grade and lift schedules
Nov 2018 high, avg and low surveys
Actual lift (2008 to 19.5), HPTRM armoring in 2015
Intermediate project grade and lift schedules (100-yr new)


LPV Survey Reach 5
LPV-109 Lift Schedules
Intermediate Project Grade (100-yr new)
Levee Elevation (ft N.A.V.D. 88)
22.0
21.0
20.0
19.0
18.0
17.0
16.0
2007
2012
2017
2022
2027
2032
2037
2042
2047
2052
2057
2062
2067
2072
Year
Prior project grade and lift schedules
Actual lift (2011 to 18.5 and 2019 to 19.2), no armoring
2018 high, avg and low surveys
Intermediate project grade and lift schedules (100-yr new)

T-Wall Stability Analyses



Use Passive Mode: No

LPV-WBV-GRR
GOODHOPE SECTION N1

TOW EL -20 FULLY-SPECIFIED

Color	Name	Model	Unit Weight (pcf)	Cohesion (psf)	Weight Fn	Cohesion Fn	Cohesion Spatial Fn	Phi' (°)	Piezometric Line
	CH (-15 to -20)	Spatial Mohr-Coulomb			CH (-15 to -20)		CH (-15 to -20)	0	1
	CH (-20 to -32)	Spatial Mohr-Coulomb			CH (-20 to -32)		CH (-20 to -32)	0	1
	CH (-32 to -40)	Spatial Mohr-Coulomb			CH (-32 to -40)		CH (-32 to -40)	0	1
	CH (-40 to -52)	Spatial Mohr-Coulomb			CH (-40 to -52)		CH (-40 to -52)	0	1
	CH (-5 to -15)	Spatial Mohr-Coulomb			CH (-5 to -15)	CH (-5 to -15)		0	1
	CH (-52 to -70)	Spatial Mohr-Coulomb			CH (-52 to -70)	CH (-52 to -70)		0	1
	CH (NG to -5)	Spatial Mohr-Coulomb			CH (NG to -5)	CH (NG to -5)		0	1
	COMPACTED FILL	Undrained (Phi=0)	115	600					1

Name: N1_TOW_Fully-spec
File Name: Goodhope Monolith N1.gsz
Directory: G:\F&MHOME\QuachB\LPV-WBV GRR levee lifts\FLD floodwall stability\Goodhope\
Last Edited By: Quach, Bich N CIV USARMY CEMVN (US)

N1_TOW_Fully-spec

File Information

- File Version: 10.00
- Title: Goodhope Monolith N6
- Created By: Chaisson, Kathryn MVN
- Last Edited By: Quach, Bich N CIV USARMY CEMVN (US)
- Revision Number: 37
- Date: 05/05/2020
- Time: 03:05:33 PM
- Tool Version: 10.0.0.17401
- File Name: Goodhope Monolith N1.gsz
- Directory: G:\F&MHOME\QuachB\LPV-WBV GRR levee lifts\FLD floodwall stability\Goodhope\
- Last Solved Date: 05/05/2020
- Last Solved Time: 03:06:22 PM

Project Settings

- Unit System: U.S. Customary Units

Analysis Settings

N1_TOW_Fully-spec

- Kind: SLOPE/W
- Method: Spencer
- Settings
  - PWP Conditions from: Piezometric Line
    - Apply Phreatic Correction: No
    - Use Staged Rapid Drawdown: No
  - Unit Weight of Water: 62.4 pcf
- Slip Surface
  - Direction of movement: Left to Right
  - Use Passive Mode: No
  - Slip Surface Option: Fully-Specified
  - Critical slip surfaces saved: 1
  - Optimize Critical Slip Surface Location: Yes
  - Optimizations Settings
    - Maximum Iterations: 3,000
    - Convergence Tolerance: 1e-07
    - Starting Points: 8
    - Ending Points: 16
    - Complete Passes per Insertion: 1
    - Driving Side Maximum Convex Angle: 5 °
    - Resisting Side Maximum Convex Angle: 1 °
  - Tension Crack Option: (none)
- Distribution
  - F of S Calculation Option: Constant
- Advanced
  - Geometry Settings
    - Minimum Slip Surface Depth: 0.1 ft
    - Number of Slices: 30
  - Factor of Safety Convergence Settings
    - Maximum Number of Iterations: 100
    - Tolerable difference in F of S: 0.01
  - Solution Settings
    - Search Method: Root Finder
    - Tolerable difference between starting and converged F of S: 3

Maximum iterations to calculate converged lambda: 20
Max Absolute Lambda: 2

Materials

COMPACTED FILL
Model: Undrained (Phi=0)
Unit Weight: 115 pcf
Cohesion: 600 psf
Pore Water Pressure
Piezometric Line: 1

CH (NG to -5)
Model: Spatial Mohr-Coulomb
Weight Fn: CH (NG to -5)
Cohesion Fn: CH (NG to -5)
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

CH (-5 to -15)
Model: Spatial Mohr-Coulomb
Weight Fn: CH (-5 to -15)
Cohesion Fn: CH (-5 to -15)
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

CH (-15 to -20)
Model: Spatial Mohr-Coulomb
Weight Fn: CH (-15 to -20)
Cohesion Spatial Fn: CH (-15 to -20)
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

CH (-20 to -32)
Model: Spatial Mohr-Coulomb
Weight Fn: CH (-20 to -32)
Cohesion Spatial Fn: CH (-20 to -32)
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

CH (-32 to -40)
Model: Spatial Mohr-Coulomb
Weight Fn: CH (-32 to -40)
Cohesion Spatial Fn: CH (-32 to -40)
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

CH (-40 to -52)
Model: Spatial Mohr-Coulomb
Weight Fn: CH (-40 to -52)
Cohesion Spatial Fn: CH (-40 to -52)
Phi': 0 °

Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

CH (-52 to -70)

Model: Spatial Mohr-Coulomb
Weight Fn: CH (-52 to -70)
Cohesion Fn: CH (-52 to -70)
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fully Specified Slip Surfaces

Fully Specified Slip Surface 1

	X	Y
	-33 ft	9 ft
	-4 ft	-20 ft
	18.2 ft	-20 ft
	179 ft	-20 ft
	215 ft	1 ft

Slip Surface Limits

Left Coordinate: (-250, 2.3) ft
Right Coordinate: (275, 0.3) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X	Y
Coordinate 1	-250 ft	18 ft
Coordinate 2	-4.1 ft	18 ft
Coordinate 3	-4 ft	4 ft
Coordinate 4	4 ft	4 ft
Coordinate 5	4 ft	11.75 ft
Coordinate 6	5 ft	11.75 ft
Coordinate 7	26 ft	8.25 ft
Coordinate 8	125 ft	3.95 ft
Coordinate 9	175.5 ft	1.75 ft
Coordinate 10	177 ft	1.25 ft
Coordinate 11	200 ft	0.7 ft
Coordinate 12	225 ft	0.4 ft
Coordinate 13	250 ft	0.1 ft
Coordinate 14	275 ft	0.3 ft

Cohesion Functions

CH (NG to -5)

Model: Spline Data Point Function
Function: Cohesion vs. X

Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 475 psf
Data Points: X (ft), Cohesion (psf)
Data Point: (-225, 100)
Data Point: (-120, 100)
Data Point: (-80, 300)
Data Point: (0, 475)
Data Point: (140, 300)
Data Point: (200, 100)
Data Point: (275, 100)

CH (-5 to -15)

Model: Spline Data Point Function
Function: Cohesion vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 150 psf
Data Points: X (ft), Cohesion (psf)
Data Point: (-225, 100)
Data Point: (-120, 100)
Data Point: (-80, 140)
Data Point: (0, 150)
Data Point: (140, 140)
Data Point: (200, 100)
Data Point: (275, 100)

CH (-52 to -70)

Model: Spline Data Point Function
Function: Cohesion vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 1,200 psf
Data Points: X (ft), Cohesion (psf)
Data Point: (-225, 900)
Data Point: (-120, 900)
Data Point: (-80, 1,000)
Data Point: (0, 1,200)
Data Point: (140, 1,000)
Data Point: (200, 900)
Data Point: (275, 900)

Unit Weight Functions

CH (NG to -5)

Model: Spline Data Point Function
Function: Unit Weight vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 118 pcf
Data Points: X (ft), Unit Weight (pcf)
Data Point: (-225, 80)
Data Point: (-120, 80)
Data Point: (-80, 100)
Data Point: (0, 118)
Data Point: (140, 100)
Data Point: (200, 80)
Data Point: (275, 80)

CH (-5 to -15)

Model: Spline Data Point Function
Function: Unit Weight vs. X

Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 99 pcf
Data Points: X (ft), Unit Weight (pcf)
Data Point: (-225, 97)
Data Point: (-120, 97)
Data Point: (-80, 102)
Data Point: (0, 99)
Data Point: (140, 102)
Data Point: (200, 97)
Data Point: (275, 97)

CH (-15 to -20)

Model: Spline Data Point Function
Function: Unit Weight vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 99 pcf
Data Points: X (ft), Unit Weight (pcf)
Data Point: (-225, 97)
Data Point: (-120, 97)
Data Point: (-80, 102)
Data Point: (0, 99)
Data Point: (140, 102)
Data Point: (200, 97)
Data Point: (275, 97)

CH (-20 to -32)

Model: Spline Data Point Function
Function: Unit Weight vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 106 pcf
Data Points: X (ft), Unit Weight (pcf)
Data Point: (-225, 106)
Data Point: (-120, 106)
Data Point: (-80, 102)
Data Point: (0, 106)
Data Point: (140, 102)
Data Point: (200, 106)
Data Point: (275, 106)

CH (-32 to -40)

Model: Spline Data Point Function
Function: Unit Weight vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 102 pcf
Data Points: X (ft), Unit Weight (pcf)
Data Point: (-225, 99)
Data Point: (-120, 99)
Data Point: (-80, 104)
Data Point: (0, 102)
Data Point: (140, 104)
Data Point: (200, 99)
Data Point: (275, 99)

CH (-40 to -52)

Model: Spline Data Point Function
Function: Unit Weight vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 100 pcf

Data Points: X (ft), Unit Weight (pcf)
    Data Point: (-225, 99)
    Data Point: (-120, 99)
    Data Point: (-80, 98)
    Data Point: (0, 100)
    Data Point: (140, 98)
    Data Point: (200, 99)
    Data Point: (275, 99)

CH (-52 to -70)

Model: Spline Data Point Function
Function: Unit Weight vs. X
    Curve Fit to Data: 100 %
    Segment Curvature: 0 %
Y-Intercept: 120 pcf
Data Points: X (ft), Unit Weight (pcf)
    Data Point: (-225, 123)
    Data Point: (-120, 123)
    Data Point: (-80, 122)
    Data Point: (0, 120)
    Data Point: (140, 122)
    Data Point: (200, 123)
    Data Point: (275, 123)

Spatial Functions

CH (-15 to -20)

Model: Linear Interpolation
Limit Range By: Data Values
Data Points: X (ft), Y (ft), Cohesion (psf)
    Data Point: (-225, -15, 125)
    Data Point: (-120, -15, 125)
    Data Point: (-80, -15, 140)
    Data Point: (0, -15, 225)
    Data Point: (140, -15, 140)
    Data Point: (200, -15, 125)
    Data Point: (275, -15, 125)
    Data Point: (-225, -20, 125)
    Data Point: (-120, -20, 125)
    Data Point: (-80, -20, 182)
    Data Point: (0, -20, 225)
    Data Point: (140, -20, 182)
    Data Point: (200, -20, 125)
    Data Point: (275, -20, 125)

CH (-20 to -32)

Model: Linear Interpolation
Limit Range By: Data Values
Data Points: X (ft), Y (ft), Cohesion (psf)
    Data Point: (-225, -20, 125)
    Data Point: (-120, -20, 125)
    Data Point: (-80, -20, 182)
    Data Point: (0, -20, 225)
    Data Point: (140, -20, 182)
    Data Point: (200, -20, 125)
    Data Point: (275, -20, 125)
    Data Point: (-225, -32, 200)
    Data Point: (-120, -32, 200)
    Data Point: (-80, -32, 282)
    Data Point: (0, -32, 337)
    Data Point: (140, -32, 282)
    Data Point: (200, -32, 200)

Data Point: (275, -32, 200)

CH (-32 to -40)

Model: Linear Interpolation
Limit Range By: Data Values
Data Points: X (ft), Y (ft), Cohesion (psf)
Data Point: (-225, -32, 251)
Data Point: (-120, -32, 251)
Data Point: (-80, -32, 282)
Data Point: (0, -32, 337)
Data Point: (140, -32, 282)
Data Point: (200, -32, 251)
Data Point: (275, -32, 251)
Data Point: (-225, -40, 315)
Data Point: (-120, -40, 315)
Data Point: (-80, -40, 350)
Data Point: (0, -40, 409)
Data Point: (140, -40, 350)
Data Point: (200, -40, 315)
Data Point: (275, -40, 315)

CH (-40 to -52)

Model: Linear Interpolation
Limit Range By: Data Values
Data Points: X (ft), Y (ft), Cohesion (psf)
Data Point: (-225, -40, 315)
Data Point: (-120, -40, 315)
Data Point: (-80, -40, 350)
Data Point: (0, -40, 409)
Data Point: (140, -40, 350)
Data Point: (200, -40, 315)
Data Point: (275, -40, 315)
Data Point: (-225, -52, 412)
Data Point: (-120, -52, 412)
Data Point: (-80, -52, 450)
Data Point: (0, -52, 520)
Data Point: (140, -52, 450)
Data Point: (200, -52, 412)
Data Point: (275, -52, 412)

Points

	X	Y
Point 1	-250 ft	-70 ft
Point 2	275 ft	-70 ft
Point 3	-250 ft	-52 ft
Point 4	275 ft	-52 ft
Point 5	-250 ft	-40 ft
Point 6	275 ft	-40 ft
Point 7	-250 ft	-32 ft
Point 8	275 ft	-32 ft
Point 9	-250 ft	-20 ft
Point 10	275 ft	-20 ft
Point 11	-250 ft	-15 ft
Point 12	275 ft	-15 ft
Point 13	-250 ft	-5 ft
Point 14	275 ft	-5 ft
Point 15	-9 ft	4 ft
Point 16	9 ft	4 ft
Point 17	26 ft	8.25 ft

Point 18	4 ft	11.75 ft
Point 19	-5 ft	11.75 ft
Point 20	5 ft	11.75 ft
Point 21	175.5 ft	1.75 ft
Point 22	23.75 ft	6.9 ft
Point 23	49.75 ft	5.6 ft
Point 24	20.3 ft	7.8 ft
Point 25	100 ft	4.5 ft
Point 26	125 ft	3.95 ft
Point 27	150 ft	2.25 ft
Point 28	175 ft	1.3 ft
Point 29	200 ft	0.7 ft
Point 30	225 ft	0.4 ft
Point 31	250 ft	0.1 ft
Point 32	275 ft	0.3 ft
Point 33	177 ft	1.25 ft
Point 34	-29.5 ft	8.25 ft
Point 35	-153 ft	1.75 ft
Point 36	-20.9 ft	8 ft
Point 37	-31.6 ft	5.3 ft
Point 38	-50 ft	3.4 ft
Point 39	-75 ft	3 ft
Point 40	-100 ft	2.3 ft
Point 41	-115.2 ft	1.5 ft
Point 42	-125 ft	2 ft
Point 43	-165 ft	0.4 ft
Point 44	-150 ft	1.4 ft
Point 45	-175 ft	1.3 ft
Point 46	-200 ft	1.9 ft
Point 47	-250 ft	2.3 ft
Point 48	-155 ft	1.1 ft
Point 49	-4 ft	4 ft
Point 50	4 ft	4 ft
Point 51	-4 ft	11.75 ft

Regions

	Material	Points	Area
Region 1	CH (-52 to -70)	1,3,4,2	9,450 ft²
Region 2	CH (-40 to -52)	3,5,6,4	6,300 ft²
Region 3	CH (-32 to -40)	5,7,8,6	4,200 ft²
Region 4	CH (-20 to -32)	7,9,10,8	6,300 ft²
Region 5	CH (-15 to -20)	9,11,12,10	2,625 ft²
Region 6	CH (-5 to -15)	11,13,14,12	5,250 ft²
Region 7	COMPACTED FILL	26,27,28,33,21	21.75 ft²
Region 8	CH (NG to -5)	13,47,46,45,43,48,44,42,41,40,39,38,37,36,15,49,50,16,24,22,23,25,26,27,28,33,29,30,31,32,14	4,107.4 ft²
Region 9	COMPACTED FILL	48,35,34,19,51,49,15,36,37,38,39,40,41,42,44	393.48 ft²

Region 10	COMPACTED FILL	50,18,20,17,26,25,23,22,24,16	191.74 ft²

Slip Results

Slip Surfaces Analysed: 2 of 2 converged

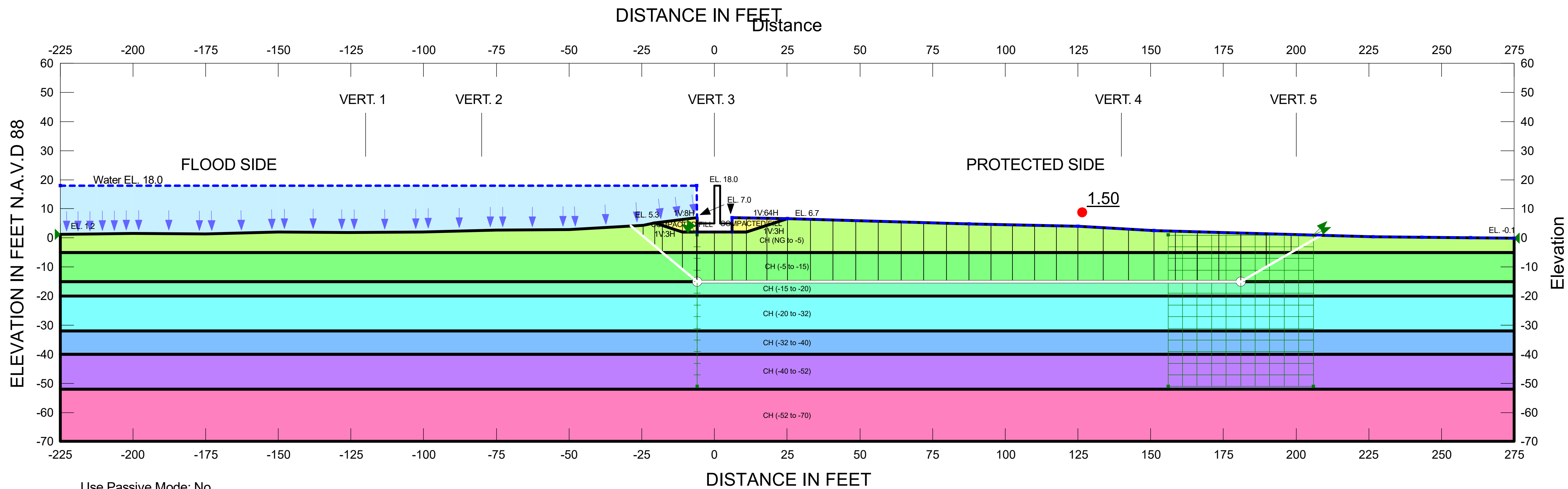
Current Slip Surface

Slip Surface: 2
Factor of Safety: 1.34
Volume: 5,461.2929 ft³
Weight: 564,617.31 lbf
Resisting Moment: 2,433,585.1 lbf·ft
Activating Moment: 1,818,130.7 lbf·ft
Resisting Force: 47,850.162 lbf
Activating Force: 35,603.413 lbf
Slip Rank: 1 of 2 slip surfaces
Exit: (209.48505, 0.58617942) ft
Entry: (-33.889127, 8.0189933) ft
Radius: 91.206897 ft
Center: (91.215699, 10.008206) ft

Slip Slices

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Base Material
Slice 1	-32.543607 ft	6.7102054 ft	704.48318 psf	346.62712 psf	0 psf	600 psf	0 psf	COMPACTED FILL
Slice 2	-30.349043 ft	4.5755525 ft	837.68552 psf	709.78548 psf	-0 psf	408.61147 psf	0 psf	CH (NG to -5)
Slice 3	-26.088665 ft	0.43148033 ft	1,096.2756 psf	1,170.92 psf	0 psf	417.93105 psf	0 psf	CH (NG to -5)
Slice 4	-21.788665 ft	-3.7009744 ft	1,354.1408 psf	1,668.34 psf	0 psf	427.3373 psf	0 psf	CH (NG to -5)
Slice 5	-14.95 ft	-9.9669632 ft	1,745.1385 psf	2,522.7343 psf	0 psf	148.13125 psf	0 psf	CH (-5 to -15)
Slice 6	-7 ft	-17.251223 ft	2,199.6763 psf	3,248.3325 psf	0 psf	219.21715 psf	0 psf	CH (-15 to -20)
Slice 7	-4.55 ft	-19.496058 ft	2,339.754 psf	3,480.6823 psf	0 psf	222.31362 psf	0 psf	CH (-15 to -20)
Slice 8	-4.0776786 ft	-19.928826 ft	2,171.7588 psf	3,335.1432 psf	0 psf	222.77777 psf	0 psf	CH (-15 to -20)
Slice 9	-4.0276786 ft	-19.974639 ft	1,737.8175 psf	3,152.4498 psf	0 psf	222.8244 psf	0 psf	CH (-15 to -20)
Slice 10	0 ft	-20 ft	1,497.6 psf	2,554.7455 psf	0 psf	225 psf	0 psf	CH (-15 to -20)
Slice 11	4.5 ft	-20 ft	1,981.2 psf	3,442.1872 psf	0 psf	223.61786 psf	0 psf	CH (-15 to -20)
Slice 12	7 ft	-20 ft	1,960.4 psf	3,401.7382 psf	0 psf	222.85 psf	0 psf	CH (-15 to -20)
Slice 13	13.6 ft	-20 ft	1,891.76 psf	3,271.5885 psf	0 psf	220.82286 psf	0 psf	CH (-15 to -20)
Slice 14	19.25 ft	-20 ft	1,833 psf	3,158.3891 psf	0 psf	219.0875 psf	0 psf	CH (-15 to -20)
Slice 15	22.025 ft	-20 ft	1,804.14 psf	3,101.6071 psf	0 psf	218.23518 psf	0 psf	CH (-15 to -20)
Slice 16	24.875 ft	-20 ft	1,774.5 psf	3,043.4429 psf	0 psf	217.35982 psf	0 psf	CH (-15 to -20)
Slice 17	30.999985 ft	-20 ft	1,749.2485 psf	2,989.7847 psf	0 psf	215.47858 psf	0 psf	CH (-15 to -20)

Slice 18	40.999955 ft	-20 ft	1,722.1456 psf	2,929.2457 psf	0 psf	212.40716 psf	0 psf	CH (-15 to -20)
Slice 19	46.140475 ft	-20 ft	1,708.2132 psf	2,898.6268 psf	0 psf	210.82828 psf	0 psf	CH (-15 to -20)
Slice 20	47.765381 ft	-20 ft	1,703.8092 psf	2,889.0174 psf	0 psf	210.3292 psf	0 psf	CH (-15 to -20)
Slice 21	54.570111 ft	-20.000002 ft	1,685.3665 psf	2,848.6272 psf	0 psf	208.2392 psf	0 psf	CH (-20 to -32)
Slice 22	64.960705 ft	-20.000005 ft	1,657.205 psf	2,787.1325 psf	0 psf	205.04783 psf	0 psf	CH (-20 to -32)
Slice 23	75.00843 ft	-20.000003 ft	1,629.9725 psf	2,728.266 psf	0 psf	201.96173 psf	0 psf	CH (-20 to -32)
Slice 24	84.98944 ft	-19.999996 ft	1,602.9205 psf	2,670.3522 psf	0 psf	198.89608 psf	0 psf	CH (-15 to -20)
Slice 25	94.99648 ft	-19.999989 ft	1,575.798 psf	2,612.8503 psf	0 psf	195.82245 psf	0 psf	CH (-15 to -20)
Slice 26	101.37008 ft	-19.999985 ft	1,558.5233 psf	2,576.522 psf	0 psf	193.86481 psf	0 psf	CH (-15 to -20)
Slice 27	107.96953 ft	-19.999835 ft	1,540.6275 psf	2,539.1463 psf	0 psf	191.83686 psf	0 psf	CH (-15 to -20)
Slice 28	119.09945 ft	-19.999028 ft	1,510.4116 psf	2,476.6228 psf	0 psf	188.41251 psf	0 psf	CH (-15 to -20)
Slice 29	127.96413 ft	-19.998039 ft	1,486.2999 psf	2,429.063 psf	0 psf	185.68167 psf	0 psf	CH (-15 to -20)
Slice 30	135.73706 ft	-20.065136 ft	1,469.3567 psf	2,394.8916 psf	0 psf	183.85412 psf	0 psf	CH (-20 to -32)
Slice 31	145.27293 ft	-20.198846 ft	1,451.7777 psf	2,347.3351 psf	0 psf	178.61136 psf	0 psf	CH (-20 to -32)
Slice 32	150.97166 ft	-20.278753 ft	1,441.2724 psf	2,312.1567 psf	0 psf	173.79367 psf	0 psf	CH (-20 to -32)
Slice 33	156.93335 ft	-20.146189 ft	1,416.794 psf	2,261.3873 psf	0 psf	167.0456 psf	0 psf	CH (-20 to -32)
Slice 34	162.6667 ft	-19.978223 ft	1,390.7274 psf	2,199.3428 psf	0 psf	160.35282 psf	0 psf	CH (-15 to -20)
Slice 35	169.45501 ft	-19.166091 ft	1,321.5969 psf	2,087.2707 psf	0 psf	150.4517 psf	0 psf	CH (-15 to -20)
Slice 36	176.25 ft	-18.277675 ft	1,234.1269 psf	1,922.1924 psf	0 psf	141.83577 psf	0 psf	CH (-15 to -20)
Slice 37	177.05956 ft	-18.171828 ft	1,211.8332 psf	1,880.4012 psf	0 psf	140.92194 psf	0 psf	CH (-15 to -20)
Slice 38	181.34409 ft	-16.58202 ft	1,106.2359 psf	1,743.3204 psf	0 psf	133.79594 psf	0 psf	CH (-15 to -20)
Slice 39	187.58387 ft	-14.245555 ft	951.12965 psf	1,470.2086 psf	0 psf	108.27742 psf	0 psf	CH (-5 to -15)
Slice 40	194.79935 ft	-10.356253 ft	697.67049 psf	1,077.7989 psf	0 psf	103.4671 psf	0 psf	CH (-5 to -15)
Slice 41	200.41751 ft	-6.9697294 ft	478.27848 psf	714.77184 psf	0 psf	100 psf	0 psf	CH (-5 to -15)
Slice 42	201.85233 ft	-5.859031 ft	407.89651 psf	628.20296 psf	0 psf	100 psf	0 psf	CH (-5 to -15)
Slice 43	206.17734 ft	-2.2069103 ft	176.76561 psf	304.67619 psf	0 psf	100 psf	0 psf	CH (NG to -5)



Use Passive Mode: No

LPV-WBV-GRR
GOODHOPE SECTION N3

TOW BLOCK

Color	Name	Model	Unit Weight (pcf)	Cohesion (psf)	Weight Fn	Cohesion Fn	Cohesion Spatial Fn	Phi' (°)	Piezometric Line
	CH (-15 to -20)	Spatial Mohr-Coulomb			CH (-15 to -20)		CH (-15 to -20)	0	1
	CH (-20 to -32)	Spatial Mohr-Coulomb			CH (-20 to -32)		CH (-20 to -32)	0	1
	CH (-32 to -40)	Spatial Mohr-Coulomb			CH (-32 to -40)		CH (-32 to -40)	0	1
	CH (-40 to -52)	Spatial Mohr-Coulomb			CH (-40 to -52)		CH (-40 to -52)	0	1
	CH (-5 to -15)	Spatial Mohr-Coulomb			CH (-5 to -15)	CH (-5 to -15)		0	1
	CH (-52 to -70)	Spatial Mohr-Coulomb			CH (-52 to -70)	CH (-52 to -70)		0	1
	CH (NG to -5)	Spatial Mohr-Coulomb			CH (NG to -5)	CH (NG to -5)		0	1
	COMPACTED FILL	Undrained (Phi=0)	115	600					1

The profile of monolith N3 is based on cross sections taken at B/L Sta. NOs. 144+62, 144+75, and 145+00

Name: N3_TOW_Block (2)
File Name: Goodhope Monolith N3.gsz   Directory: G:\F&MHOME\QuachB\LPV-WBV GRR levee lifts\FLD floodwall stability\Goodhope\
Last Edited By: Quach, Bich N CIV USARMY CEMVN (US)

N3_TOW_Block (2)

File Information

File Version: 10.00
Title: Goodhope Monolith N3
Created By: Chaisson, Kathryn MVN
Last Edited By: Quach, Bich N CIV USARMY CEMVN (US)
Revision Number: 40
Date: 05/06/2020
Time: 01:05:50 PM
Tool Version: 10.0.0.17401
File Name: Goodhope Monolith N3.gsz
Directory: G:\F&MHOME\QuachB\LPV-WBV GRR levee lifts\FLD floodwall stability\Goodhope\
Last Solved Date: 05/06/2020
Last Solved Time: 01:06:36 PM

Project Settings

Unit System: U.S. Customary Units

Analysis Settings

N3_TOW_Block (2)

Kind: SLOPE/W
Method: Spencer
Settings
- PWP Conditions from: Piezometric Line
  - Apply Phreatic Correction: No
  - Use Staged Rapid Drawdown: No
- Unit Weight of Water: 62.4 pcf

Slip Surface
- Direction of movement: Left to Right
- Use Passive Mode: No
- Slip Surface Option: Block
- Critical slip surfaces saved: 1
- Restrict Block Crossing: Yes
- Optimize Critical Slip Surface Location: No
- Tension Crack Option: (none)

Distribution
- F of S Calculation Option: Constant

Advanced
- Geometry Settings
  - Minimum Slip Surface Depth: 0.1 ft
  - Number of Slices: 30
- Factor of Safety Convergence Settings
  - Maximum Number of Iterations: 100
  - Tolerable difference in F of S: 0.01
- Solution Settings
  - Search Method: Root Finder

Tolerable difference between starting and converged F of S: 3
Maximum iterations to calculate converged lambda: 20
Max Absolute Lambda: 2

Materials

COMPACTED FILL

Model: Undrained (Phi=0)
Unit Weight: 115 pcf
Cohesion: 600 psf
Pore Water Pressure
Piezometric Line: 1

CH (NG to -5)

Model: Spatial Mohr-Coulomb
Weight Fn: CH (NG to -5)
Cohesion Fn: CH (NG to -5)
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

CH (-5 to -15)

Model: Spatial Mohr-Coulomb
Weight Fn: CH (-5 to -15)
Cohesion Fn: CH (-5 to -15)
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

CH (-15 to -20)

Model: Spatial Mohr-Coulomb
Weight Fn: CH (-15 to -20)
Cohesion Spatial Fn: CH (-15 to -20)
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

CH (-20 to -32)

Model: Spatial Mohr-Coulomb
Weight Fn: CH (-20 to -32)
Cohesion Spatial Fn: CH (-20 to -32)
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

CH (-32 to -40)

Model: Spatial Mohr-Coulomb
Weight Fn: CH (-32 to -40)
Cohesion Spatial Fn: CH (-32 to -40)

Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

CH (-40 to -52)

Model: Spatial Mohr-Coulomb
Weight Fn: CH (-40 to -52)
Cohesion Spatial Fn: CH (-40 to -52)
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

CH (-52 to -70)

Model: Spatial Mohr-Coulomb
Weight Fn: CH (-52 to -70)
Cohesion Fn: CH (-52 to -70)
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Slip Surface Limits

Left Coordinate: (-225, 1.2) ft
Right Coordinate: (275, -0.1) ft

Slip Surface Block

Left Grid
Upper Left: (-6, 1) ft
Lower Left: (-6, -51) ft
Lower Right: (-6, -51) ft
X Increments: 1
Y Increments: 13
Starting Angle: 125 °
Ending Angle: 145 °
Angle Increments: 4
Right Grid
Starting Angle: 25 °
Ending Angle: 45 °
Upper Left: (156, 1) ft
Lower Left: (156, -51) ft
Lower Right: (206, -51) ft
X Increments: 10
Y Increments: 13
Angle Increments: 4

Piezometric Lines

Piezometric Line 1

Coordinates

	X	Y
Coordinate 1	-225 ft	18 ft
Coordinate 2	-6.1 ft	18 ft
Coordinate 3	-6 ft	2 ft
Coordinate 4	6 ft	2 ft
Coordinate 5	6 ft	7 ft
Coordinate 6	25.1 ft	6.7 ft
Coordinate 7	87.6 ft	4.9 ft
Coordinate 8	125 ft	4 ft
Coordinate 9	151.1 ft	2.5 ft
Coordinate 10	226.5 ft	0.4 ft
Coordinate 11	243.3 ft	0.3 ft
Coordinate 12	260 ft	0.1 ft
Coordinate 13	275 ft	-0.1 ft

Cohesion Functions

CH (NG to -5)

Model: Spline Data Point Function
Function: Cohesion vs. X
  Curve Fit to Data: 100 %
  Segment Curvature: 0 %
Y-Intercept: 475 psf
Data Points: X (ft), Cohesion (psf)
  Data Point: (-225, 100)
  Data Point: (-120, 100)
  Data Point: (-80, 300)
  Data Point: (0, 475)
  Data Point: (140, 300)
  Data Point: (200, 100)
  Data Point: (275, 100)

CH (-5 to -15)

Model: Spline Data Point Function
Function: Cohesion vs. X
  Curve Fit to Data: 100 %
  Segment Curvature: 0 %
Y-Intercept: 150 psf
Data Points: X (ft), Cohesion (psf)
  Data Point: (-225, 100)
  Data Point: (-120, 100)
  Data Point: (-80, 140)
  Data Point: (0, 150)
  Data Point: (140, 140)
  Data Point: (200, 100)
  Data Point: (275, 100)

CH (-52 to -70)

Model: Spline Data Point Function

Function: Cohesion vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 1,200 psf
Data Points: X (ft), Cohesion (psf)
Data Point: (-225, 900)
Data Point: (-120, 900)
Data Point: (-80, 1,000)
Data Point: (0, 1,200)
Data Point: (140, 1,000)
Data Point: (200, 900)
Data Point: (275, 900)

Unit Weight Functions

CH (NG to -5)

Model: Spline Data Point Function
Function: Unit Weight vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 118 pcf
Data Points: X (ft), Unit Weight (pcf)
Data Point: (-225, 80)
Data Point: (-120, 80)
Data Point: (-80, 100)
Data Point: (0, 118)
Data Point: (140, 100)
Data Point: (200, 80)
Data Point: (275, 80)

CH (-5 to -15)

Model: Spline Data Point Function
Function: Unit Weight vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 83 pcf
Data Points: X (ft), Unit Weight (pcf)
Data Point: (-225, 80)
Data Point: (-120, 80)
Data Point: (-80, 80)
Data Point: (0, 83)
Data Point: (140, 80)
Data Point: (200, 80)
Data Point: (275, 80)

CH (-15 to -20)

Model: Spline Data Point Function
Function: Unit Weight vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 99 pcf
Data Points: X (ft), Unit Weight (pcf)
Data Point: (-225, 97)

Data Point: (-120, 97)
Data Point: (-80, 102)
Data Point: (0, 99)
Data Point: (140, 102)
Data Point: (200, 97)
Data Point: (275, 97)

CH (-20 to -32)

Model: Spline Data Point Function
Function: Unit Weight vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 106 pcf
Data Points: X (ft), Unit Weight (pcf)
Data Point: (-225, 106)
Data Point: (-120, 106)
Data Point: (-80, 102)
Data Point: (0, 106)
Data Point: (140, 102)
Data Point: (200, 106)
Data Point: (275, 106)

CH (-32 to -40)

Model: Spline Data Point Function
Function: Unit Weight vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 102 pcf
Data Points: X (ft), Unit Weight (pcf)
Data Point: (-225, 99)
Data Point: (-120, 99)
Data Point: (-80, 104)
Data Point: (0, 102)
Data Point: (140, 104)
Data Point: (200, 99)
Data Point: (275, 99)

CH (-40 to -52)

Model: Spline Data Point Function
Function: Unit Weight vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 100 pcf
Data Points: X (ft), Unit Weight (pcf)
Data Point: (-225, 99)
Data Point: (-120, 99)
Data Point: (-80, 98)
Data Point: (0, 100)
Data Point: (140, 98)
Data Point: (200, 99)
Data Point: (275, 99)

CH (-52 to -70)

Model: Spline Data Point Function
Function: Unit Weight vs. X

Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 120 pcf
Data Points: X (ft), Unit Weight (pcf)
Data Point: (-225, 123)
Data Point: (-120, 123)
Data Point: (-80, 122)
Data Point: (0, 120)
Data Point: (140, 122)
Data Point: (200, 123)
Data Point: (275, 123)

Spatial Functions

CH (-15 to -20)

Model: Linear Interpolation
Limit Range By: Data Values
Data Points: X (ft), Y (ft), Cohesion (psf)
Data Point: (-225, -15, 125)
Data Point: (-120, -15, 125)
Data Point: (-80, -15, 140)
Data Point: (0, -15, 225)
Data Point: (140, -15, 140)
Data Point: (200, -15, 125)
Data Point: (275, -15, 125)
Data Point: (-225, -20, 125)
Data Point: (-120, -20, 125)
Data Point: (-80, -20, 182)
Data Point: (0, -20, 225)
Data Point: (140, -20, 182)
Data Point: (200, -20, 125)
Data Point: (275, -20, 125)

CH (-20 to -32)

Model: Linear Interpolation
Limit Range By: Data Values
Data Points: X (ft), Y (ft), Cohesion (psf)
Data Point: (-225, -20, 125)
Data Point: (-120, -20, 125)
Data Point: (-80, -20, 182)
Data Point: (0, -20, 225)
Data Point: (140, -20, 182)
Data Point: (200, -20, 125)
Data Point: (275, -20, 125)
Data Point: (-225, -32, 200)
Data Point: (-120, -32, 200)
Data Point: (-80, -32, 282)
Data Point: (0, -32, 337)
Data Point: (140, -32, 282)
Data Point: (200, -32, 200)
Data Point: (275, -32, 200)

CH (-32 to -40)

Model: Linear Interpolation
Limit Range By: Data Values
Data Points: X (ft), Y (ft), Cohesion (psf)
Data Point: (-225, -32, 251)
Data Point: (-120, -32, 251)
Data Point: (-80, -32, 282)
Data Point: (0, -32, 337)
Data Point: (140, -32, 282)
Data Point: (200, -32, 251)
Data Point: (275, -32, 251)
Data Point: (-225, -40, 315)
Data Point: (-120, -40, 315)
Data Point: (-80, -40, 350)
Data Point: (0, -40, 409)
Data Point: (140, -40, 350)
Data Point: (200, -40, 315)
Data Point: (275, -40, 315)

CH (-40 to -52)

Model: Linear Interpolation
Limit Range By: Data Values
Data Points: X (ft), Y (ft), Cohesion (psf)
Data Point: (-225, -40, 315)
Data Point: (-120, -40, 315)
Data Point: (-80, -40, 350)
Data Point: (0, -40, 409)
Data Point: (140, -40, 350)
Data Point: (200, -40, 315)
Data Point: (275, -40, 315)
Data Point: (-225, -52, 412)
Data Point: (-120, -52, 412)
Data Point: (-80, -52, 450)
Data Point: (0, -52, 520)
Data Point: (140, -52, 450)
Data Point: (200, -52, 412)
Data Point: (275, -52, 412)

Points

	X	Y
Point 1	-225 ft	-70 ft
Point 2	275 ft	-70 ft
Point 3	-225 ft	-52 ft
Point 4	275 ft	-52 ft
Point 5	-225 ft	-40 ft
Point 6	275 ft	-40 ft
Point 7	-225 ft	-32 ft
Point 8	275 ft	-32 ft
Point 9	-225 ft	-20 ft
Point 10	275 ft	-20 ft
Point 11	-225 ft	-15 ft
Point 12	275 ft	-15 ft

Point 13	-225 ft	-5 ft
Point 14	275 ft	-5 ft
Point 15	-6 ft	7 ft
Point 16	-6 ft	5 ft
Point 17	-6 ft	2 ft
Point 18	-11 ft	2 ft
Point 19	6 ft	2 ft
Point 20	6 ft	5 ft
Point 21	6 ft	7 ft
Point 22	11 ft	2 ft
Point 23	-225 ft	1.2 ft
Point 24	-212.6 ft	1.3 ft
Point 25	-175 ft	1.3 ft
Point 26	-150 ft	2 ft
Point 27	-126 ft	1.9 ft
Point 28	-100.5 ft	2.1 ft
Point 29	-75 ft	2.7 ft
Point 30	-50 ft	2.8 ft
Point 31	-24.5 ft	4.4 ft
Point 32	25.1 ft	6.7 ft
Point 33	87.6 ft	4.9 ft
Point 34	125 ft	4 ft
Point 35	151.1 ft	2.5 ft
Point 36	226.5 ft	0.4 ft
Point 37	243.3 ft	0.3 ft
Point 38	275 ft	-0.1 ft
Point 39	-20.6 ft	5.2 ft
Point 40	-200.2 ft	1.5 ft
Point 41	260 ft	0.1 ft

Regions

	Material	Points	Area
Region 1	CH (-52 to -70)	1,3,4,2	9,000 ft²
Region 2	CH (-40 to -52)	3,5,6,4	6,000 ft²
Region 3	CH (-32 to -40)	5,7,8,6	4,000 ft²
Region 4	CH (-20 to -32)	7,9,10,8	6,000 ft²
Region 5	CH (-15 to -20)	9,11,12,10	2,500 ft²
Region 6	CH (-5 to -15)	11,13,14,12	5,000 ft²
Region 7	CH (NG to -5)	13,23,24,40,25,26,27,28,29,30,31,39,18,17,19,22,32,33,34,35,36,37,41,38,14	3,819.9 ft²
Region 8	COMPACTED FILL	39,15,16,17,18	44.5 ft²

Region 9	COMPACTED FILL	19,20,21,32,22	59.5 ft²

Slip Results

Slip Surfaces Analysed: 3395 of 3850 converged

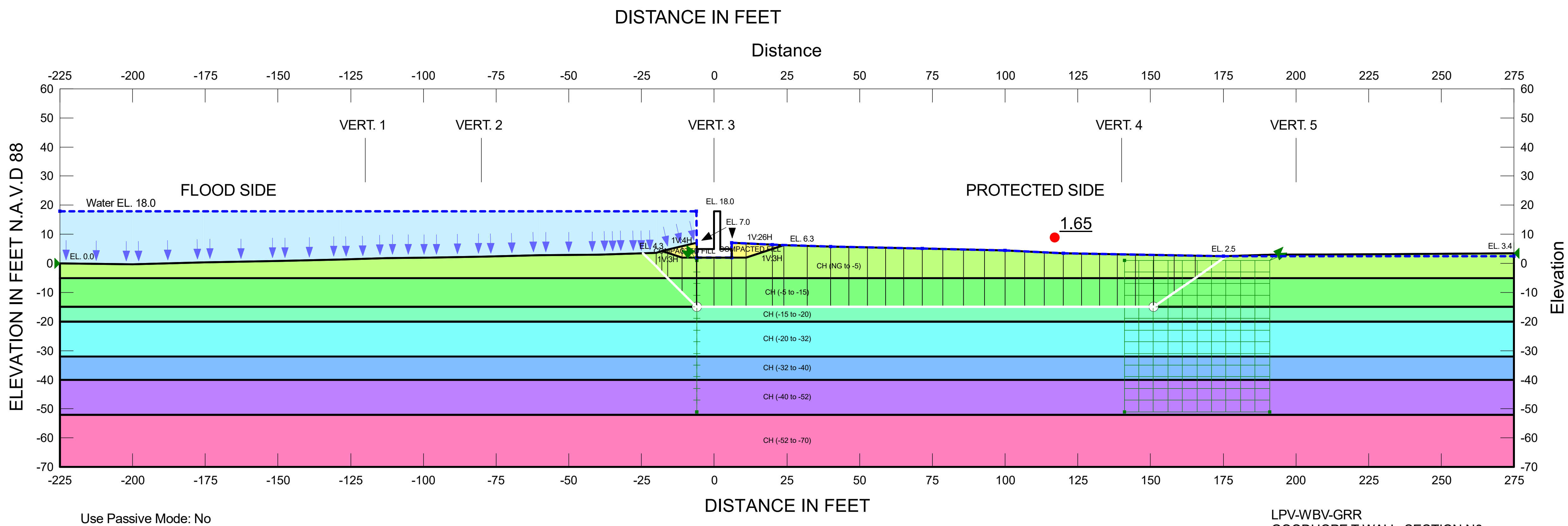
Current Slip Surface

Slip Surface: 1,292
Factor of Safety: 1.50
Volume: 4,115.4191 ft³
Weight: 385,991.36 lbf
Resisting Moment: 1,375,209.6 lbf·ft
Activating Moment: 916,074.72 lbf·ft
Resisting Force: 35,634.86 lbf
Activating Force: 23,768.855 lbf
Slip Rank: 1 of 3,850 slip surfaces
Exit: (208.53998, 0.90021286) ft
Entry: (-28.798586, 4.1302848) ft
Radius: 85.782608 ft
Center: (89.903665, 4.9378028) ft

Slip Slices

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Base Material
Slice 1	-26.649293 ft	2.326814 ft	978.00681 psf	825.15737 psf	-0 psf	416.70467 psf	0 psf	CH (NG to -5)
Slice 2	-22.55 ft	-1.1129011 ft	1,192.645 psf	1,220.9874 psf	0 psf	425.67188 psf	0 psf	CH (NG to -5)
Slice 3	-19.258768 ft	-3.8745727 ft	1,364.9733 psf	1,557.4158 psf	0 psf	432.87145 psf	0 psf	CH (NG to -5)
Slice 4	-14.458768 ft	-7.9022509 ft	1,616.3005 psf	2,101.0309 psf	0 psf	148.19265 psf	0 psf	CH (-5 to -15)
Slice 5	-8.55 ft	-12.860296 ft	1,925.6825 psf	2,545.4498 psf	0 psf	148.93125 psf	0 psf	CH (-5 to -15)
Slice 6	-6.065613 ft	-14.944944 ft	1,712.4444 psf	2,401.4359 psf	0 psf	149.2418 psf	0 psf	CH (-5 to -15)
Slice 7	-6.015613 ft	-14.986899 ft	1,215.8624 psf	2,073.9363 psf	0 psf	149.24805 psf	0 psf	CH (-5 to -15)
Slice 8	-3 ft	-15 ft	1,060.8 psf	1,653.8723 psf	0 psf	149.625 psf	0 psf	CH (-5 to -15)
Slice 9	3 ft	-15 ft	1,060.8 psf	1,656.3834 psf	0 psf	149.78571 psf	0 psf	CH (-5 to -15)
Slice			1,370.3497	2,220.7294		149.39286		CH (-5 to

10	8.5 ft	-15 ft	psf	psf	0 psf	psf	0 psf	-15)
Slice 11	14.525 ft	-15 ft	1,364.4446 psf	2,204.4529 psf	0 psf	148.9625 psf	0 psf	CH (-5 to -15)
Slice 12	21.575 ft	-15 ft	1,357.5349 psf	2,183.3166 psf	0 psf	148.45893 psf	0 psf	CH (-5 to -15)
Slice 13	29.00625 ft	-15 ft	1,347.06 psf	2,151.5753 psf	0 psf	147.92812 psf	0 psf	CH (-5 to -15)
Slice 14	36.81875 ft	-15 ft	1,333.02 psf	2,112.7632 psf	0 psf	147.37009 psf	0 psf	CH (-5 to -15)
Slice 15	44.63125 ft	-15 ft	1,318.98 psf	2,074.4031 psf	0 psf	146.81205 psf	0 psf	CH (-5 to -15)
Slice 16	52.44375 ft	-15 ft	1,304.94 psf	2,036.495 psf	0 psf	146.25402 psf	0 psf	CH (-5 to -15)
Slice 17	60.25625 ft	-15 ft	1,290.9 psf	1,999.0389 psf	0 psf	145.69598 psf	0 psf	CH (-5 to -15)
Slice 18	68.06875 ft	-15 ft	1,276.86 psf	1,962.0349 psf	0 psf	145.13795 psf	0 psf	CH (-5 to -15)
Slice 19	75.88125 ft	-15 ft	1,262.82 psf	1,925.4828 psf	0 psf	144.57991 psf	0 psf	CH (-5 to -15)
Slice 20	83.69375 ft	-15 ft	1,248.78 psf	1,889.3828 psf	0 psf	144.02187 psf	0 psf	CH (-5 to -15)
Slice 21	91.34 ft	-15 ft	1,236.144 psf	1,856.3706 psf	0 psf	143.47571 psf	0 psf	CH (-5 to -15)
Slice 22	98.82 ft	-15 ft	1,224.912 psf	1,826.367 psf	0 psf	142.94143 psf	0 psf	CH (-5 to -15)
Slice 23	106.3 ft	-15 ft	1,213.68 psf	1,796.7097 psf	0 psf	142.40714 psf	0 psf	CH (-5 to -15)
Slice 24	113.78 ft	-15 ft	1,202.448 psf	1,767.3985 psf	0 psf	141.87286 psf	0 psf	CH (-5 to -15)
Slice 25	121.26 ft	-15 ft	1,191.216 psf	1,738.4336 psf	0 psf	141.33857 psf	0 psf	CH (-5 to -15)
Slice 26	129.35 ft	-15 ft	1,170 psf	1,692.7652 psf	0 psf	140.76071 psf	0 psf	CH (-5 to -15)
Slice 27	138.05 ft	-15 ft	1,138.8 psf	1,630.9726 psf	0 psf	140.13929 psf	0 psf	CH (-5 to -15)
Slice 28	146.75 ft	-15 ft	1,107.6 psf	1,560.9334 psf	0 psf	135.5 psf	0 psf	CH (-5 to -15)
Slice 29	154.8375 ft	-15 ft	1,085.5045 psf	1,506.2484 psf	0 psf	130.10833 psf	0 psf	CH (-5 to -15)
Slice 30	162.3125 ft	-15 ft	1,072.5134 psf	1,468.4257 psf	0 psf	125.125 psf	0 psf	CH (-5 to -15)
Slice 31	169.7875 ft	-15 ft	1,059.5224 psf	1,431.6405 psf	0 psf	120.14167 psf	0 psf	CH (-5 to -15)
Slice 32	177.2625 ft	-15 ft	1,046.5314 psf	1,395.8928 psf	0 psf	115.15833 psf	0 psf	CH (-5 to -15)
Slice 33	185.33013 ft	-12.5 ft	876.5104 psf	1,226.8227 psf	0 psf	109.77992 psf	0 psf	CH (-5 to -15)
Slice 34	193.99038 ft	-7.5 ft	549.45948 psf	776.10469 psf	0 psf	104.00641 psf	0 psf	CH (-5 to -15)
Slice 35	203.43024 ft	-2.0498936 ft	192.96701 psf	294.44621 psf	0 psf	100 psf	0 psf	CH (NG to -5)



Use Passive Mode: No

LPV-WBV-GRR
GOODHOPE T-WALL, SECTION N6

TOW BLOCK

Color	Name	Model	Unit Weight (pcf)	Cohesion (psf)	Weight Fn	Cohesion Fn	Cohesion Spatial Fn	Phi' (°)	Piezometric Line
	CH (-15 to -20)	Spatial Mohr-Coulomb			CH (-15 to -20)		CH (-15 to -20)	0	1
	CH (-20 to -32)	Spatial Mohr-Coulomb			CH (-20 to -32)		CH (-20 to -32)	0	1
	CH (-32 to -40)	Spatial Mohr-Coulomb			CH (-32 to -40)		CH (-32 to -40)	0	1
	CH (-40 to -52)	Spatial Mohr-Coulomb			CH (-40 to -52)		CH (-40 to -52)	0	1
	CH (-5 to -15)	Spatial Mohr-Coulomb			CH (-5 to -15)	CH (-5 to -15)		0	1
	CH (-52 to -70)	Spatial Mohr-Coulomb			CH (-52 to -70)	CH (-52 to -70)		0	1
	CH (NG to -5)	Spatial Mohr-Coulomb			CH (NG to -5)	CH (NG to -5)		0	1
	COMPACTED FILL	Undrained (Phi=0)	115	600					1

The profile of monolith N6 is based on cross sections taken at B/L Sta. NOs. 146+75, 147+00, and 147+13

Name: N6_TOW_Block (2)
File Name: Goodhope Monolith N6.gsz Directory: G:\F&MHOME\QuachB\LPV-WBV GRR levee lifts\FLD floodwall stability\Goodhope\
Last Edited By: Quach, Bich N CIV USARMY CEMVN (US)

N6_TOW_Block (2)

File Information

File Version: 10.00
Title: Goodhope Monolith N6
Created By: Chaisson, Kathryn MVN
Last Edited By: Quach, Bich N CIV USARMY CEMVN (US)
Revision Number: 35
Date: 05/06/2020
Time: 03:30:55 PM
Tool Version: 10.0.0.17401
File Name: Goodhope Monolith N6.gsz
Directory: G:\F&MHOME\QuachB\LPV-WBV GRR levee lifts\FLD floodwall stability\Goodhope\
Last Solved Date: 05/06/2020
Last Solved Time: 03:31:24 PM

Project Settings

Unit System: U.S. Customary Units

Analysis Settings

N6_TOW_Block (2)

- Kind: SLOPE/W
- Method: Spencer
- Settings
  - PWP Conditions from: Piezometric Line
    - Apply Phreatic Correction: No
    - Use Staged Rapid Drawdown: No
  - Unit Weight of Water: 62.4 pcf
- Slip Surface
  - Direction of movement: Left to Right
  - Use Passive Mode: No
  - Slip Surface Option: Block
  - Critical slip surfaces saved: 1
  - Restrict Block Crossing: Yes
  - Optimize Critical Slip Surface Location: No
  - Tension Crack Option: (none)
- Distribution
  - F of S Calculation Option: Constant
- Advanced
  - Geometry Settings
    - Minimum Slip Surface Depth: 0.1 ft
    - Number of Slices: 30
  - Factor of Safety Convergence Settings
    - Maximum Number of Iterations: 100
    - Tolerable difference in F of S: 0.01
  - Solution Settings
    - Search Method: Root Finder
    - Tolerable difference between starting and converged F of S: 3
    - Maximum iterations to calculate converged lambda: 20
    - Max Absolute Lambda: 2

Materials

COMPACTED FILL

Model: Undrained (Phi=0)
Unit Weight: 115 pcf
Cohesion: 600 psf
Pore Water Pressure
Piezometric Line: 1

CH (NG to -5)

Model: Spatial Mohr-Coulomb
Weight Fn: CH (NG to -5)
Cohesion Fn: CH (NG to -5)
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

CH (-5 to -15)

Model: Spatial Mohr-Coulomb
Weight Fn: CH (-5 to -15)
Cohesion Fn: CH (-5 to -15)
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

CH (-15 to -20)

Model: Spatial Mohr-Coulomb
Weight Fn: CH (-15 to -20)
Cohesion Spatial Fn: CH (-15 to -20)
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

CH (-20 to -32)

Model: Spatial Mohr-Coulomb
Weight Fn: CH (-20 to -32)
Cohesion Spatial Fn: CH (-20 to -32)
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

CH (-32 to -40)

Model: Spatial Mohr-Coulomb
Weight Fn: CH (-32 to -40)
Cohesion Spatial Fn: CH (-32 to -40)
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

CH (-40 to -52)

Model: Spatial Mohr-Coulomb

Weight Fn: CH (-40 to -52)
Cohesion Spatial Fn: CH (-40 to -52)
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

CH (-52 to -70)

Model: Spatial Mohr-Coulomb
Weight Fn: CH (-52 to -70)
Cohesion Fn: CH (-52 to -70)
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Slip Surface Limits

Left Coordinate: (-225, 0) ft
Right Coordinate: (275, 3.4) ft

Slip Surface Block

Left Grid
Upper Left: (-6, 1) ft
Lower Left: (-6, -51) ft
Lower Right: (-6, -51) ft
X Increments: 1
Y Increments: 13
Starting Angle: 125 °
Ending Angle: 145 °
Angle Increments: 4
Right Grid
Starting Angle: 25 °
Ending Angle: 45 °
Upper Left: (141, 1) ft
Lower Left: (141, -51) ft
Lower Right: (191, -51) ft
X Increments: 10
Y Increments: 13
Angle Increments: 4

Piezometric Lines

Piezometric Line 1

Coordinates

	X	Y
Coordinate 1	-225 ft	18 ft
Coordinate 2	-6.1 ft	18 ft
Coordinate 3	-6 ft	2 ft
Coordinate 4	6 ft	2 ft
Coordinate 5	6 ft	7 ft
Coordinate 6	20 ft	6.4 ft
Coordinate 7	40 ft	5.7 ft

Coordinate 8	71.5 ft	5.1 ft
Coordinate 9	100 ft	4.5 ft
Coordinate 10	120.1 ft	3.4 ft
Coordinate 11	175 ft	2.5 ft
Coordinate 12	275 ft	2.5 ft

Cohesion Functions

CH (NG to -5)

Model: Spline Data Point Function
Function: Cohesion vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 475 psf
Data Points: X (ft), Cohesion (psf)
Data Point: (-225, 100)
Data Point: (-120, 100)
Data Point: (-80, 300)
Data Point: (0, 475)
Data Point: (140, 300)
Data Point: (200, 100)
Data Point: (275, 100)

CH (-5 to -15)

Model: Spline Data Point Function
Function: Cohesion vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 150 psf
Data Points: X (ft), Cohesion (psf)
Data Point: (-225, 100)
Data Point: (-120, 100)
Data Point: (-80, 140)
Data Point: (0, 150)
Data Point: (140, 140)
Data Point: (200, 100)
Data Point: (275, 100)

CH (-52 to -70)

Model: Spline Data Point Function
Function: Cohesion vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 1,200 psf
Data Points: X (ft), Cohesion (psf)
Data Point: (-225, 900)
Data Point: (-120, 900)
Data Point: (-80, 1,000)
Data Point: (0, 1,200)
Data Point: (140, 1,000)
Data Point: (200, 900)
Data Point: (275, 900)

Unit Weight Functions

CH (NG to -5)

Model: Spline Data Point Function
Function: Unit Weight vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 118 pcf
Data Points: X (ft), Unit Weight (pcf)
Data Point: (-225, 80)
Data Point: (-120, 80)
Data Point: (-80, 100)
Data Point: (0, 118)
Data Point: (140, 100)
Data Point: (200, 80)
Data Point: (275, 80)

CH (-5 to -15)

Model: Spline Data Point Function
Function: Unit Weight vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 83 pcf
Data Points: X (ft), Unit Weight (pcf)
Data Point: (-225, 80)
Data Point: (-120, 80)
Data Point: (-80, 80)
Data Point: (0, 83)
Data Point: (140, 80)
Data Point: (200, 80)
Data Point: (275, 80)

CH (-15 to -20)

Model: Spline Data Point Function
Function: Unit Weight vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 99 pcf
Data Points: X (ft), Unit Weight (pcf)
Data Point: (-225, 97)
Data Point: (-120, 97)
Data Point: (-80, 102)
Data Point: (0, 99)
Data Point: (140, 102)
Data Point: (200, 97)
Data Point: (275, 97)

CH (-20 to -32)

Model: Spline Data Point Function
Function: Unit Weight vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 106 pcf
Data Points: X (ft), Unit Weight (pcf)
Data Point: (-225, 106)
Data Point: (-120, 106)
Data Point: (-80, 102)
Data Point: (0, 106)
Data Point: (140, 102)
Data Point: (200, 106)

Data Point: (275, 106)

CH (-32 to -40)

Model: Spline Data Point Function
Function: Unit Weight vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 102 pcf
Data Points: X (ft), Unit Weight (pcf)
Data Point: (-225, 99)
Data Point: (-120, 99)
Data Point: (-80, 104)
Data Point: (0, 102)
Data Point: (140, 104)
Data Point: (200, 99)
Data Point: (275, 99)

CH (-40 to -52)

Model: Spline Data Point Function
Function: Unit Weight vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 100 pcf
Data Points: X (ft), Unit Weight (pcf)
Data Point: (-225, 99)
Data Point: (-120, 99)
Data Point: (-80, 98)
Data Point: (0, 100)
Data Point: (140, 98)
Data Point: (200, 99)
Data Point: (275, 99)

CH (-52 to -70)

Model: Spline Data Point Function
Function: Unit Weight vs. X
Curve Fit to Data: 100 %
Segment Curvature: 0 %
Y-Intercept: 120 pcf
Data Points: X (ft), Unit Weight (pcf)
Data Point: (-225, 123)
Data Point: (-120, 123)
Data Point: (-80, 122)
Data Point: (0, 120)
Data Point: (140, 122)
Data Point: (200, 123)
Data Point: (275, 123)

Spatial Functions

CH (-15 to -20)

Model: Linear Interpolation
Limit Range By: Data Values
Data Points: X (ft), Y (ft), Cohesion (psf)
Data Point: (-225, -15, 125)
Data Point: (-120, -15, 125)
Data Point: (-80, -15, 140)
Data Point: (0, -15, 225)

Data Point: (140, -15, 140)
Data Point: (200, -15, 125)
Data Point: (275, -15, 125)
Data Point: (-225, -20, 125)
Data Point: (-120, -20, 125)
Data Point: (-80, -20, 182)
Data Point: (0, -20, 225)
Data Point: (140, -20, 182)
Data Point: (200, -20, 125)
Data Point: (275, -20, 125)

CH (-20 to -32)

Model: Linear Interpolation
Limit Range By: Data Values
Data Points: X (ft), Y (ft), Cohesion (psf)
Data Point: (-225, -20, 125)
Data Point: (-120, -20, 125)
Data Point: (-80, -20, 182)
Data Point: (0, -20, 225)
Data Point: (140, -20, 182)
Data Point: (200, -20, 125)
Data Point: (275, -20, 125)
Data Point: (-225, -32, 200)
Data Point: (-120, -32, 200)
Data Point: (-80, -32, 282)
Data Point: (0, -32, 337)
Data Point: (140, -32, 282)
Data Point: (200, -32, 200)
Data Point: (275, -32, 200)

CH (-32 to -40)

Model: Linear Interpolation
Limit Range By: Data Values
Data Points: X (ft), Y (ft), Cohesion (psf)
Data Point: (-225, -32, 251)
Data Point: (-120, -32, 251)
Data Point: (-80, -32, 282)
Data Point: (0, -32, 337)
Data Point: (140, -32, 282)
Data Point: (200, -32, 251)
Data Point: (275, -32, 251)
Data Point: (-225, -40, 315)
Data Point: (-120, -40, 315)
Data Point: (-80, -40, 350)
Data Point: (0, -40, 409)
Data Point: (140, -40, 350)
Data Point: (200, -40, 315)
Data Point: (275, -40, 315)

CH (-40 to -52)

Model: Linear Interpolation
Limit Range By: Data Values
Data Points: X (ft), Y (ft), Cohesion (psf)
Data Point: (-225, -40, 315)
Data Point: (-120, -40, 315)
Data Point: (-80, -40, 350)
Data Point: (0, -40, 409)
Data Point: (140, -40, 350)
Data Point: (200, -40, 315)

Data Point: (275, -40, 315)
Data Point: (-225, -52, 412)
Data Point: (-120, -52, 412)
Data Point: (-80, -52, 450)
Data Point: (0, -52, 520)
Data Point: (140, -52, 450)
Data Point: (200, -52, 412)
Data Point: (275, -52, 412)

Points

	X	Y
Point 1	-225 ft	-70 ft
Point 2	275 ft	-70 ft
Point 3	-225 ft	-52 ft
Point 4	275 ft	-52 ft
Point 5	-225 ft	-40 ft
Point 6	275 ft	-40 ft
Point 7	-225 ft	-32 ft
Point 8	275 ft	-32 ft
Point 9	-225 ft	-20 ft
Point 10	275 ft	-20 ft
Point 11	-225 ft	-15 ft
Point 12	275 ft	-15 ft
Point 13	-225 ft	-5 ft
Point 14	275 ft	-5 ft
Point 15	-6 ft	7 ft
Point 16	-6 ft	5 ft
Point 17	-6 ft	2 ft
Point 18	-11 ft	2 ft
Point 19	6 ft	2 ft
Point 20	6 ft	5 ft
Point 21	6 ft	7 ft
Point 22	11 ft	2 ft
Point 23	-225 ft	0 ft
Point 24	-200 ft	-0.3 ft
Point 25	-175.5 ft	0.4 ft
Point 26	-149.8 ft	0.8 ft
Point 27	-128.7 ft	1.3 ft
Point 28	-112.8 ft	1.9 ft
Point 29	-97.7 ft	2 ft
Point 30	-79 ft	2.3 ft
Point 31	-60 ft	2.8 ft
Point 32	-39.9 ft	3 ft
Point 33	-30 ft	3.3 ft
Point 34	-20 ft	3.6 ft
Point 35	23.9 ft	6.3 ft
Point 36	40 ft	5.7 ft
Point 37	71.5 ft	5.1 ft
Point 38	100 ft	4.5 ft
Point 39	120.1 ft	3.4 ft
Point 40	175 ft	2.5 ft

Point 41	191.4 ft	2.9 ft
Point 42	225.6 ft	3.1 ft
Point 43	275 ft	3.4 ft
Point 44	-17.9 ft	4.3 ft

Regions

	Material	Points	Area
Region 1	CH (-52 to -70)	1,3,4,2	9,000 ft²
Region 2	CH (-40 to -52)	3,5,6,4	6,000 ft²
Region 3	CH (-32 to -40)	5,7,8,6	4,000 ft²
Region 4	CH (-20 to -32)	7,9,10,8	6,000 ft²
Region 5	CH (-15 to -20)	9,11,12,10	2,500 ft²
Region 6	CH (-5 to -15)	11,13,14,12	5,000 ft²
Region 7	CH (NG to -5)	13,23,24,25,26,27,28,29,30,31,32,33,34,44,18,17,19,22,35,36,37,38,39,40,41,42,43,14	3,882.4 ft²
Region 8	COMPACTED FILL	44,15,16,17,18	35.5 ft²
Region 9	COMPACTED FILL	19,20,21,35,22	55.5 ft²

Slip Results

Slip Surfaces Analysed: 1948 of 3850 converged

Current Slip Surface

Slip Surface: 1,223
Factor of Safety: 1.65
Volume: 3,499.3845 ft³
Weight: 333,101.91 lbf
Resisting Moment: 1,222,353.4 lbf·ft
Activating Moment: 741,132.9 lbf·ft
Resisting Force: 31,783.487 lbf
Activating Force: 19,344.728 lbf
Slip Rank: 1 of 3,850 slip surfaces
Exit: (176.02841, 2.5250832) ft
Entry: (-24.466019, 3.4660194) ft
Radius: 73.067621 ft
Center: (75.784509, 3.7012535) ft

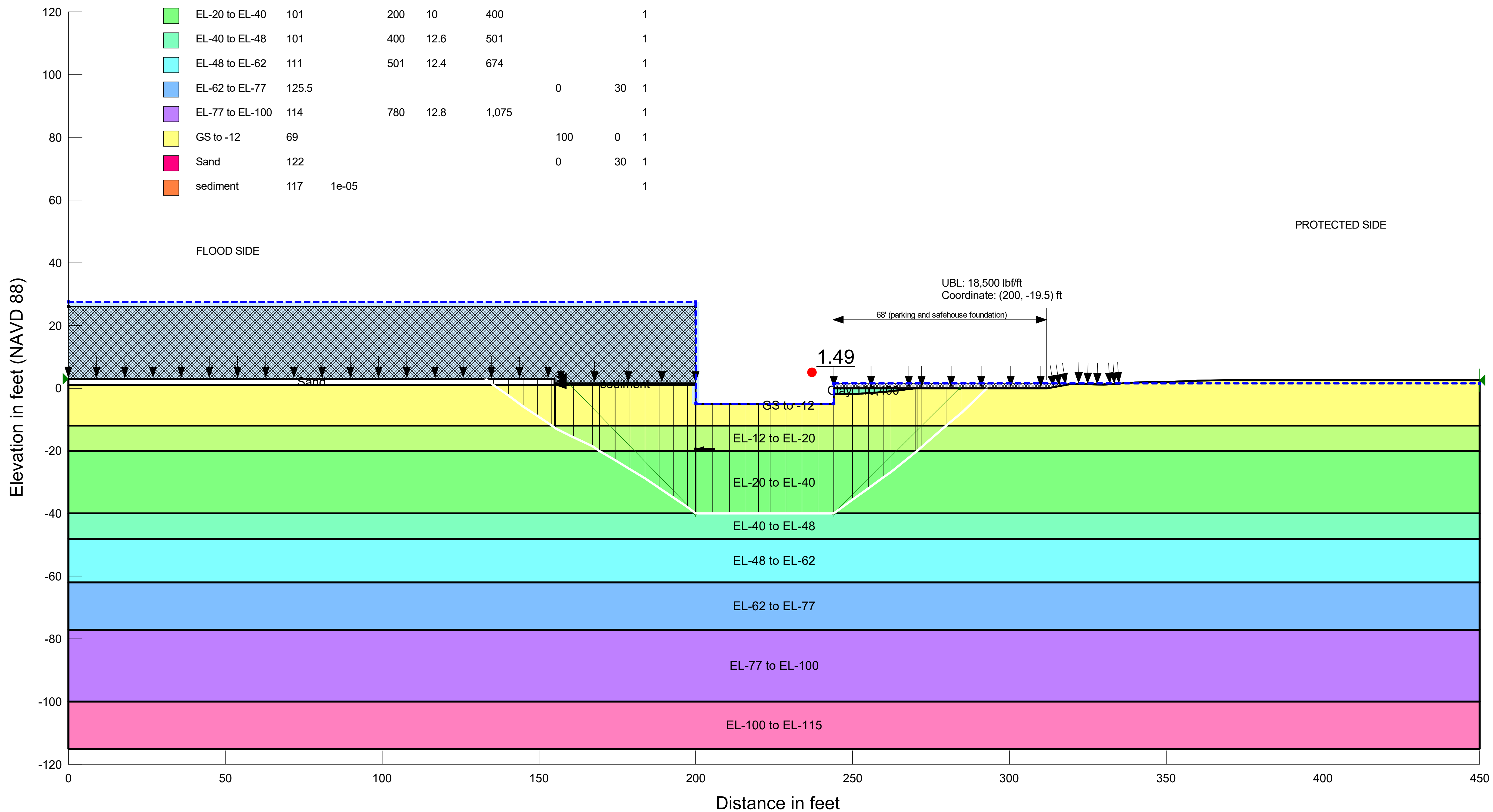
Slip Slices

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Base Material
Slice 1	-22.23301 ft	1.2330097 ft	1,046.2602 psf	884.93147 psf	-0 psf	426.36529 psf	0 psf	CH (NG to -5)
Slice 2	-18.95 ft	-2.05 ft	1,251.12 psf	1,257.1472 psf	0 psf	433.54688 psf	0 psf	CH (NG to -5)
Slice				1,510.5901		437.92188		CH (NG

3	-16.95 ft	-4.05 ft	1,375.92 psf	psf	0 psf	psf	0 psf	to -5)
Slice 4	-13.5 ft	-7.5 ft	1,591.2 psf	2,026.6714 psf	0 psf	148.3125 psf	0 psf	CH (-5 to -15)
Slice 5	-8.55 ft	-12.45 ft	1,900.08 psf	2,488.8701 psf	0 psf	148.93125 psf	0 psf	CH (-5 to -15)
Slice 6	-6.0656029 ft	-14.934397 ft	1,711.6855 psf	2,390.9595 psf	0 psf	149.2418 psf	0 psf	CH (-5 to -15)
Slice 7	-6.0156029 ft	-14.984397 ft	1,215.6055 psf	2,065.3149 psf	0 psf	149.24805 psf	0 psf	CH (-5 to -15)
Slice 8	-3 ft	-15 ft	1,060.8 psf	1,653.0166 psf	0 psf	149.625 psf	0 psf	CH (-5 to -15)
Slice 9	3 ft	-15 ft	1,060.8 psf	1,655.5268 psf	0 psf	149.78571 psf	0 psf	CH (-5 to -15)
Slice 10	8.5 ft	-15 ft	1,366.1143 psf	2,213.1477 psf	0 psf	149.39286 psf	0 psf	CH (-5 to -15)
Slice 11	15.5 ft	-15 ft	1,347.3943 psf	2,175.3684 psf	0 psf	148.89286 psf	0 psf	CH (-5 to -15)
Slice 12	21.95 ft	-15 ft	1,331.1012 psf	2,138.301 psf	0 psf	148.43214 psf	0 psf	CH (-5 to -15)
Slice 13	27.925 ft	-15 ft	1,318.0518 psf	2,102.5191 psf	0 psf	148.00536 psf	0 psf	CH (-5 to -15)
Slice 14	35.975 ft	-15 ft	1,300.4706 psf	2,055.2305 psf	0 psf	147.43036 psf	0 psf	CH (-5 to -15)
Slice 15	43.15 ft	-15 ft	1,287.936 psf	2,020.0591 psf	0 psf	146.91786 psf	0 psf	CH (-5 to -15)
Slice 16	49.45 ft	-15 ft	1,280.448 psf	1,996.685 psf	0 psf	146.46786 psf	0 psf	CH (-5 to -15)
Slice 17	55.75 ft	-15 ft	1,272.96 psf	1,973.5053 psf	0 psf	146.01786 psf	0 psf	CH (-5 to -15)
Slice 18	62.05 ft	-15 ft	1,265.472 psf	1,950.5201 psf	0 psf	145.56786 psf	0 psf	CH (-5 to -15)
Slice 19	68.35 ft	-15 ft	1,257.984 psf	1,927.7292 psf	0 psf	145.11786 psf	0 psf	CH (-5 to -15)
Slice 20	75.0625 ft	-15 ft	1,249.56 psf	1,902.886 psf	0 psf	144.63839 psf	0 psf	CH (-5 to -15)
Slice 21	82.1875 ft	-15 ft	1,240.2 psf	1,876.0509 psf	0 psf	144.12946 psf	0 psf	CH (-5 to -15)
Slice 22	89.3125 ft	-15 ft	1,230.84 psf	1,849.4906 psf	0 psf	143.62054 psf	0 psf	CH (-5 to -15)
Slice 23	96.4375 ft	-15 ft	1,221.48 psf	1,823.2052 psf	0 psf	143.11161 psf	0 psf	CH (-5 to -15)
Slice 24	103.35 ft	-15 ft	1,205.36 psf	1,786.154 psf	0 psf	142.61786 psf	0 psf	CH (-5 to -15)
Slice 25	110.05 ft	-15 ft	1,182.48 psf	1,738.6049 psf	0 psf	142.13929 psf	0 psf	CH (-5 to -15)
Slice 26	116.75 ft	-15 ft	1,159.6 psf	1,691.6875 psf	0 psf	141.66071 psf	0 psf	CH (-5 to -15)
Slice 27	123.19 ft	-15 ft	1,144.9991 psf	1,659.2871 psf	0 psf	141.20071 psf	0 psf	CH (-5 to -15)
Slice 28	129.37 ft	-15 ft	1,138.6772 psf	1,641.0506 psf	0 psf	140.75929 psf	0 psf	CH (-5 to -15)
Slice 29	135.55 ft	-15 ft	1,132.3554 psf	1,622.9751 psf	0 psf	140.31786 psf	0 psf	CH (-5 to -15)
Slice 30	141.73 ft	-15 ft	1,126.0336 psf	1,602.5616 psf	0 psf	138.84667 psf	0 psf	CH (-5 to -15)

Slice 31	147.91 ft	-15 ft	1,119.7117 psf	1,576.0451 psf	0 psf	134.72667 psf	0 psf	CH (-5 to -15)
Slice 32	154.57037 ft	-12.5 ft	956.89851 psf	1,434.661 psf	0 psf	130.28642 psf	0 psf	CH (-5 to -15)
Slice 33	161.71111 ft	-7.5 ft	637.59388 psf	993.30734 psf	0 psf	125.52593 psf	0 psf	CH (-5 to -15)
Slice 34	170.14074 ft	-1.5975095 ft	260.65538 psf	474.36105 psf	0 psf	199.53087 psf	0 psf	CH (NG to -5)
Slice 35	175.4963 ft	2.1524905 ft	21.684595 psf	114.48822 psf	0 psf	181.67902 psf	0 psf	CH (NG to -5)
Slice 36	176.0105 ft	2.5125416 ft	-0.78259698 psf	82.38105 psf	0 psf	179.965 psf	0 psf	CH (NG to -5)

Color	Name	Unit Weight (pcf)	Cohesion (psf)	C-Top of Layer (psf)	C-Rate of Change ((lbf/ft²)/ft)	C-Maximum (psf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Clay 110,400	110					400	0	1
	EL-100 to EL-115	114		1,075	11.9	1,254			1
	EL-12 to EL-20	101		100	12.5	200			1
	EL-20 to EL-40	101		200	10	400			1
	EL-40 to EL-48	101		400	12.6	501			1
	EL-48 to EL-62	111		501	12.4	674			1
	EL-62 to EL-77	125.5					0	30	1
	EL-77 to EL-100	114		780	12.8	1,075			1
	GS to -12	69					100	0	1
	Sand	122					0	30	1
	sediment	117	1e-05						1



Directory: G:\F&MHOME\QuachB\LPV-WBV GRR levee lifts\FLD floodwall stability\GIWW\
File Name: GIWW_Twall (N1-N2)_EWL_6in sediment.gsz
SubFile: EL -40 Fully Specified w/ UBL

LPV-WBV GRR
GIWW T-WALL, N1 & N2 SECTIONS

TOW EL -40 FULLY-SPECIFIED WITH UBL

EL -40 Fully Specified w/ UBL

File Information

File Version: 10.00
Created By: Rebecca Scherer
Last Edited By: Quach, Bich N CIV USARMY CEMVN (US)
Revision Number: 633
Date: 06/03/2020
Time: 01:35:28 PM
Tool Version: 10.0.0.17401
File Name: GIWW_Twall (N1-N2)_EWL_6in sediment.gsz
Directory: G:\F&MHOME\QuachB\LPV-WBV GRR levee lifts\FLD floodwall stability\GIWW\
Last Solved Date: 06/03/2020
Last Solved Time: 01:45:22 PM

Project Settings

Unit System: U.S. Customary Units

Analysis Settings

EL -40 Fully Specified w/ UBL

- Kind: SLOPE/W
- Method: Spencer
- Settings
  - PWP Conditions from: Piezometric Line
    - Apply Phreatic Correction: No
    - Use Staged Rapid Drawdown: No
  - Unit Weight of Water: 62.4 pcf
- Slip Surface
  - Direction of movement: Left to Right
  - Use Passive Mode: No
  - Slip Surface Option: Fully-Specified
  - Critical slip surfaces saved: 1
  - Optimize Critical Slip Surface Location: Yes
  - Optimizations Settings
    - Maximum Iterations: 10,000
    - Convergence Tolerance: 1e-07
    - Starting Points: 8
    - Ending Points: 16
    - Complete Passes per Insertion: 1
    - Driving Side Maximum Convex Angle: 5 °
    - Resisting Side Maximum Convex Angle: 1 °
  - Tension Crack Option: (none)
- Distribution
  - F of S Calculation Option: Constant
- Advanced

Geometry Settings
Minimum Slip Surface Depth: 0.1 ft
Number of Slices: 30
Factor of Safety Convergence Settings
Maximum Number of Iterations: 100
Tolerable difference in F of S: 0.01
Solution Settings
Search Method: Root Finder
Tolerable difference between starting and converged F of S: 3
Maximum iterations to calculate converged lambda: 20
Max Absolute Lambda: 2

Materials

GS to -12

Model: Mohr-Coulomb
Unit Weight: 69 pcf
Cohesion': 100 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

EL-12 to EL-20

Model: S=f(depth)
Unit Weight: 101 pcf
C-Top of Layer: 100 psf
C-Rate of Change: 12.5 (lbf/ft^2)/ft
C-Maximum: 200 psf
Pore Water Pressure
Piezometric Line: 1

EL-20 to EL-40

Model: S=f(depth)
Unit Weight: 101 pcf
C-Top of Layer: 200 psf
C-Rate of Change: 10 (lbf/ft^2)/ft
C-Maximum: 400 psf
Pore Water Pressure
Piezometric Line: 1

EL-40 to EL-48

Model: S=f(depth)
Unit Weight: 101 pcf
C-Top of Layer: 400 psf
C-Rate of Change: 12.6 (lbf/ft^2)/ft
C-Maximum: 501 psf
Pore Water Pressure
Piezometric Line: 1

EL-48 to EL-62

Model: S=f(depth)
Unit Weight: 111 pcf
C-Top of Layer: 501 psf
C-Rate of Change: 12.4 (lbf/ft²)/ft
C-Maximum: 674 psf
Pore Water Pressure
Piezometric Line: 1

EL-62 to EL-77

Model: Mohr-Coulomb
Unit Weight: 125.5 pcf
Cohesion': 0 psf
Phi': 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

EL-77 to EL-100

Model: S=f(depth)
Unit Weight: 114 pcf
C-Top of Layer: 780 psf
C-Rate of Change: 12.8 (lbf/ft²)/ft
C-Maximum: 1,075 psf
Pore Water Pressure
Piezometric Line: 1

EL-100 to EL-115

Model: S=f(depth)
Unit Weight: 114 pcf
C-Top of Layer: 1,075 psf
C-Rate of Change: 11.9 (lbf/ft²)/ft
C-Maximum: 1,254 psf
Pore Water Pressure
Piezometric Line: 1

Clay 110,400

Model: Mohr-Coulomb
Unit Weight: 110 pcf
Cohesion': 400 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Sand

Model: Mohr-Coulomb
Unit Weight: 122 pcf
Cohesion': 0 psf
Phi': 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

sediment

Model: Undrained (Phi=0)
Unit Weight: 117 pcf
Cohesion: 1e-05 psf
Pore Water Pressure
Piezometric Line: 1

Fully Specified Slip Surfaces

Fully Specified Slip Surface 1

	X	Y
	159 ft	2 ft
	200 ft	-40 ft
	244 ft	-40 ft
	284 ft	0 ft

Slip Surface Limits

Left Coordinate: (0, 3) ft
Right Coordinate: (450, 2.6) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X	Y
Coordinate 1	0 ft	27.5 ft
Coordinate 2	200 ft	27.5 ft
Coordinate 3	200.1 ft	-5 ft
Coordinate 4	244.01 ft	-5 ft
Coordinate 5	244.01 ft	1.5 ft
Coordinate 6	450 ft	1.5 ft

Point Loads

Point Load 1

Coordinate: (200, -19.5) ft
Magnitude: 18,500 lbf
Direction: 0 °

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): 0.6 pcf
Direction: Normal

Coordinates

	X	Y
	0 ft	26 ft
	199.99 ft	26 ft

Surcharge Load 2

Surcharge (Unit Weight): 0.6 pcf
Direction: Normal

Coordinates

	X	Y
	244.001 ft	1.5 ft
	335 ft	1.5 ft

Points

	X	Y
Point 1	0 ft	-12 ft
Point 2	0 ft	-20 ft
Point 3	0 ft	-40 ft
Point 4	0 ft	-48 ft
Point 5	0 ft	-62 ft
Point 6	0 ft	-77 ft
Point 7	0 ft	-100 ft
Point 8	0 ft	-115 ft
Point 9	450 ft	-12 ft
Point 10	450 ft	-20 ft
Point 11	450 ft	-40 ft
Point 12	450 ft	-48 ft
Point 13	450 ft	-62 ft
Point 14	450 ft	-77 ft
Point 15	450 ft	-100 ft
Point 16	450 ft	-115 ft
Point 17	200 ft	-5 ft
Point 18	244 ft	-5 ft
Point 19	244 ft	-2 ft
Point 20	0 ft	1 ft
Point 21	450 ft	2.6 ft
Point 22	200 ft	1 ft
Point 23	250 ft	-2 ft
Point 24	260 ft	-1.2 ft

Point 25	270 ft	0 ft
Point 26	320 ft	1.4 ft
Point 27	330 ft	1.1 ft
Point 28	340 ft	1.8 ft
Point 29	350 ft	2 ft
Point 30	370 ft	2.6 ft
Point 31	360 ft	2.4 ft
Point 32	155 ft	3 ft
Point 33	155 ft	1 ft
Point 34	0 ft	3 ft
Point 35	244 ft	0 ft
Point 36	312 ft	0 ft
Point 37	200 ft	1.5 ft
Point 38	155 ft	1.5 ft

Regions

	Material	Points	Area
Region 1	EL-100 to EL-115	7,15,16,8	6,750 ft^2
Region 2	EL-77 to EL-100	6,14,15,7	10,350 ft^2
Region 3	EL-62 to EL-77	5,13,14,6	6,750 ft^2
Region 4	EL-48 to EL-62	4,12,13,5	6,300 ft^2
Region 5	EL-40 to EL-48	3,11,12,4	3,600 ft^2
Region 6	EL-20 to EL-40	2,10,11,3	9,000 ft^2
Region 7	EL-12 to EL-20	1,9,10,2	3,600 ft^2
Region 8	GS to -12	20,33,22,17,18,19,23,24,25,36,26,27,28,29,31,30,21,9,1	5,652.6 ft^2
Region 9	Sand	20,34,32,38,33	310 ft^2
Region 10	Clay 110,400	19,35,25,24,23	34 ft^2
Region 11	sediment	33,38,37,22	22.5 ft^2

Slip Results

Slip Surfaces Analysed: 2 of 2 converged

Current Slip Surface

Slip Surface: 2
Factor of Safety: 1.49
Volume: 3,954.106 ft^3
Weight: 352,765.43 lbf
Resisting Moment: 2,119,754.5 lbf·ft
Activating Moment: 1,426,917.1 lbf·ft
Resisting Force: 41,572.346 lbf
Activating Force: 28,005.021 lbf
Slip Rank: 1 of 2 slip surfaces
Exit: (292.92646, 0) ft
Entry: (132.89808, 3) ft

Radius: 67.956596 ft
Center: (221.7576, 1.875) ft

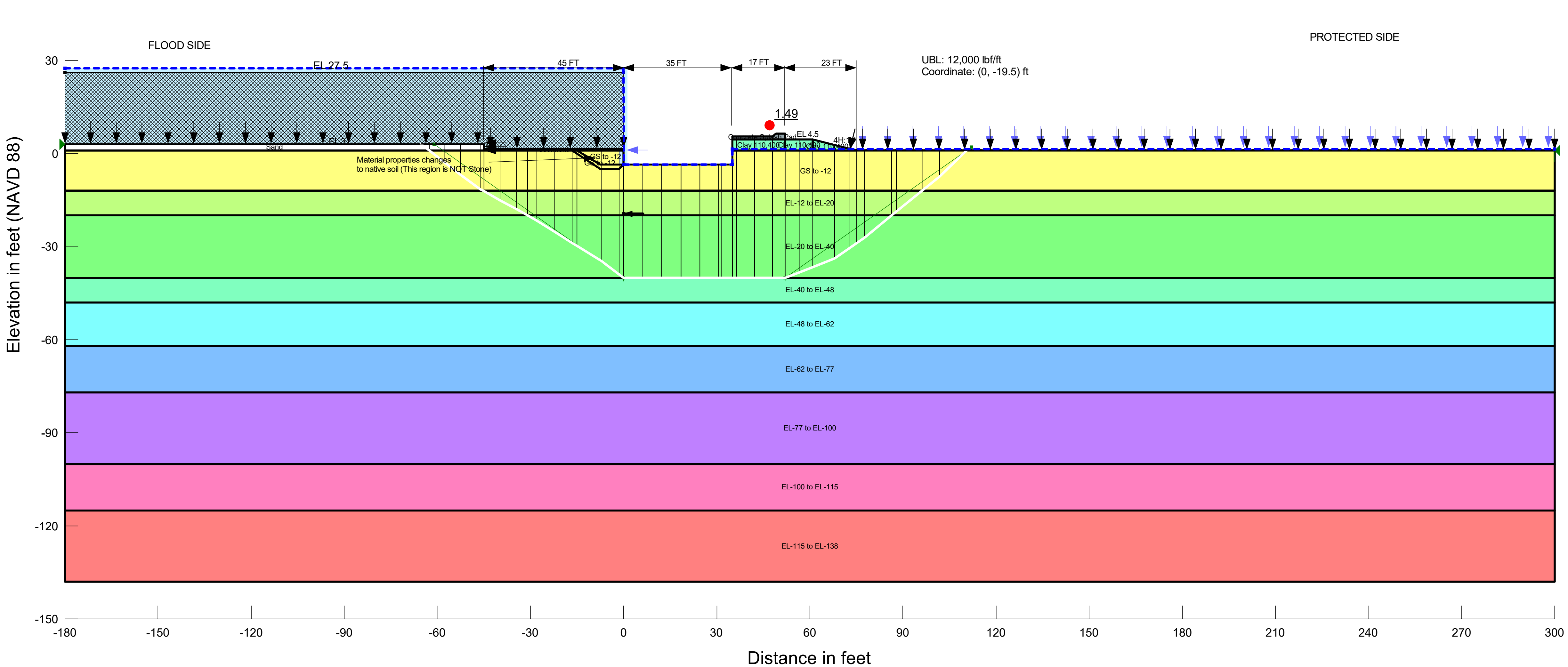
Slip Slices

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Base Material
Slice 1	134.25862 ft	2 ft	1,591.2 psf	1,625.6631 psf	19.89727 psf	0 psf	0 psf	Sand
Slice 2	137.94667 ft	-0.7107125 ft	1,760.3485 psf	1,823.8729 psf	0 psf	100 psf	0 psf	GS to -12
Slice 3	142.60167 ft	-4.1321375 ft	1,973.8454 psf	2,055.7524 psf	0 psf	100 psf	0 psf	GS to -12
Slice 4	147.23616 ft	-7.3821375 ft	2,176.6454 psf	2,284.2328 psf	0 psf	100 psf	0 psf	GS to -12
Slice 5	151.85013 ft	-10.460712 ft	2,368.7485 psf	2,493.2191 psf	0 psf	100 psf	0 psf	GS to -12
Slice 6	154.57856 ft	-12.2812 ft	2,482.3469 psf	2,692.7366 psf	0 psf	103.515 psf	0 psf	EL-12 to EL-20
Slice 7	155.15972 ft	-12.66897 ft	2,506.5437 psf	2,571.1044 psf	0 psf	108.36213 psf	0 psf	EL-12 to EL-20
Slice 8	158.22612 ft	-14.20985 ft	2,602.6946 psf	2,742.2453 psf	0 psf	127.62313 psf	0 psf	EL-12 to EL-20
Slice 9	164.03949 ft	-17.07847 ft	2,781.6965 psf	3,017.3334 psf	0 psf	163.48087 psf	0 psf	EL-12 to EL-20
Slice 10	168.17594 ft	-19.25639 ft	2,917.5987 psf	3,203.4318 psf	0 psf	190.70487 psf	0 psf	EL-12 to EL-20
Slice 11	171.80609 ft	-21.451448 ft	3,054.5704 psf	3,412.7331 psf	0 psf	214.51448 psf	0 psf	EL-20 to EL-40
Slice 12	176.60685 ft	-24.354345 ft	3,235.7111 psf	3,690.4719 psf	0 psf	243.54345 psf	0 psf	EL-20 to EL-40
Slice 13	181.40761 ft	-27.257242 ft	3,416.8519 psf	3,968.2107 psf	0 psf	272.57242 psf	0 psf	EL-20 to EL-40
Slice 14	186.05859 ft	-30.230265 ft	3,602.3685 psf	4,231.0346 psf	0 psf	302.30265 psf	0 psf	EL-20 to EL-40
Slice 15	190.55981 ft	-33.273415 ft	3,792.2611 psf	4,520.2524 psf	0 psf	332.73415 psf	0 psf	EL-20 to EL-40
Slice 16	195.06101 ft	-36.316565 ft	3,982.1537 psf	4,809.4703 psf	0 psf	363.16565 psf	0 psf	EL-20 to EL-40
Slice	198.65081	-38.915049	4,144.2991	5,007.9435	0 psf	389.15049	0 psf	EL-20 to

17	ft	ft	psf	psf		psf		EL-40
Slice 18	199.995 ft	-39.995979 ft	4,211.7491 psf	78,446.901 psf	0 psf	399.95979 psf	0 psf	EL-20 to EL-40
Slice 19	200.05 ft	-40 ft	3,198 psf	4,331.6223 psf	0 psf	400 psf	0 psf	EL-20 to EL-40
Slice 20	202.76537 ft	-40 ft	2,184 psf	3,317.6223 psf	0 psf	400 psf	0 psf	EL-20 to EL-40
Slice 21	208.09609 ft	-40 ft	2,184 psf	3,317.6223 psf	0 psf	400 psf	0 psf	EL-20 to EL-40
Slice 22	213.42683 ft	-40 ft	2,184 psf	3,317.6223 psf	0 psf	400 psf	0 psf	EL-20 to EL-40
Slice 23	218.01942 ft	-40 ft	2,184 psf	3,317.6223 psf	0 psf	400 psf	0 psf	EL-20 to EL-40
Slice 24	221.80113 ft	-40 ft	2,184 psf	3,317.6223 psf	0 psf	400 psf	0 psf	EL-20 to EL-40
Slice 25	226.19868 ft	-40 ft	2,184 psf	3,317.6223 psf	0 psf	400 psf	0 psf	EL-20 to EL-40
Slice 26	231.28477 ft	-40 ft	2,184 psf	3,317.6223 psf	0 psf	400 psf	0 psf	EL-20 to EL-40
Slice 27	236.37086 ft	-40 ft	2,184 psf	3,317.6223 psf	0 psf	400 psf	0 psf	EL-20 to EL-40
Slice 28	241.45695 ft	-40 ft	2,184 psf	3,317.6223 psf	0 psf	400 psf	0 psf	EL-20 to EL-40
Slice 29	244.0005 ft	-39.999636 ft	2,183.9773 psf	4,012.4907 psf	0 psf	399.99636 psf	0 psf	EL-20 to EL-40
Slice 30	244.0055 ft	-39.995993 ft	2,183.75 psf	4,013.0138 psf	0 psf	399.95993 psf	0 psf	EL-20 to EL-40
Slice 31	247.005 ft	-37.810866 ft	2,452.998 psf	3,872.3279 psf	0 psf	378.10866 psf	0 psf	EL-20 to EL-40
Slice 32	252.5 ft	-33.807773 ft	2,203.2051 psf	3,431.6391 psf	0 psf	338.07773 psf	0 psf	EL-20 to EL-40
Slice 33	257.5 ft	-30.165287 ft	1,975.9139 psf	3,021.5464 psf	0 psf	301.65287 psf	0 psf	EL-20 to EL-40
Slice 34	261.12197 ft	-27.526692 ft	1,811.2656 psf	2,722.6041 psf	0 psf	275.26692 psf	0 psf	EL-20 to EL-40
Slice 35	266.12197 ft	-23.576013 ft	1,564.7432 psf	2,288.2658 psf	0 psf	235.76013 psf	0 psf	EL-20 to EL-40
Slice 36	270.27395 ft	-20.221343 ft	1,355.4118 psf	1,903.9372 psf	0 psf	202.21343 psf	0 psf	EL-20 to EL-40
Slice 37	271.23737 ft	-19.44293 ft	1,306.8388 psf	1,818.48 psf	0 psf	193.03662 psf	0 psf	EL-12 to EL-20

Slice 38	275.91678 ft	-15.443575 ft	1,057.2791 psf	1,385.0734 psf	0 psf	143.04469 psf	0 psf	EL-12 to EL-20
Slice 39	282.41595 ft	-9.833515 ft	707.21134 psf	850.85586 psf	0 psf	100 psf	0 psf	GS to -12
Slice 40	288.92583 ft	-3.83287 ft	332.77109 psf	435.30679 psf	0 psf	100 psf	0 psf	GS to -12

Color	Name	Unit Weight (pcf)	Cohesion (psf)	C-Top of Layer (psf)	C-Rate of Change ((lbf/ft²)/ft)	C-Maximum (psf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Clay 110,400	110					400	0	1
	Concrete Splash Pad	145					20,000	0	1
	EL-100 to EL-115	114		1,075	11.9	1,254			1
	EL-115 to EL-138	108		1,093	10	1,323			1
	EL-12 to EL-20	101		150	10.3	212			1
	EL-20 to EL-40	101		212	10.3	418			1
	EL-40 to EL-48	101		418	10.3	500			1
	EL-48 to EL-62	111		500	10.3	644			1
	EL-62 to EL-77	125.5					0	30	1
	EL-77 to EL-100	114		780	12.8	1,075			1
	GS to -12	69					150	0	1
	Sand	122					0	30	1
	sediment	117	1e-05						1



Directory: G:\F&MHOME\QuachB\LPV-WBV GRR levee lifts\FLD floodwall stability\GIWW\
File Name: GIWW_Twall (N3 to N10)_EWL_6in sediment.gsz
SubFile: EWL-EL-40 fully specified

LPV-WBV GRR
GIWW T-WALL, N3 TO N10 SECTIONS

TOW EL -40 FULLY-SPECIFIED WITH UBL

EWL-EL-40 fully specified

File Information

- File Version: 10.00
- Created By: Rebecca Scherer
- Last Edited By: Quach, Bich N CIV USARMY CEMVN (US)
- Revision Number: 478
- Date: 06/04/2020
- Time: 01:06:37 PM
- Tool Version: 10.0.0.17401
- File Name: GIWW_Twall (N3 to N10)_EWL_6in sediment.gsz
- Directory: G:\F&MHOME\QuachB\LPV-WBV GRR levee lifts\FLD floodwall stability\GIWW\
- Last Solved Date: 06/04/2020
- Last Solved Time: 01:07:10 PM

Project Settings

- Unit System: U.S. Customary Units

Analysis Settings

EWL-EL-40 fully specified

- Kind: SLOPE/W
- Method: Spencer
- Settings
  - PWP Conditions from: Piezometric Line
    - Apply Phreatic Correction: No
    - Use Staged Rapid Drawdown: No
  - Unit Weight of Water: 62.4 pcf
- Slip Surface
  - Direction of movement: Left to Right
  - Use Passive Mode: No
  - Slip Surface Option: Fully-Specified
  - Critical slip surfaces saved: 1
  - Optimize Critical Slip Surface Location: Yes
  - Optimizations Settings
    - Maximum Iterations: 4,000
    - Convergence Tolerance: 1e-07
    - Starting Points: 8
    - Ending Points: 16
    - Complete Passes per Insertion: 1
    - Driving Side Maximum Convex Angle: 5 °
    - Resisting Side Maximum Convex Angle: 1 °
  - Tension Crack Option: (none)
- Distribution
  - F of S Calculation Option: Constant
- Advanced

Geometry Settings
  Minimum Slip Surface Depth: 0.1 ft
  Number of Slices: 30
Factor of Safety Convergence Settings
  Maximum Number of Iterations: 100
  Tolerable difference in F of S: 0.01
Solution Settings
  Search Method: Root Finder
  Tolerable difference between starting and converged F of S: 3
  Maximum iterations to calculate converged lambda: 20
  Max Absolute Lambda: 2

Materials

GS to -12

Model: Mohr-Coulomb
Unit Weight: 69 pcf
Cohesion': 150 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
  Piezometric Line: 1

EL-12 to EL-20

Model: S=f(depth)
Unit Weight: 101 pcf
C-Top of Layer: 150 psf
C-Rate of Change: 10.3 (lbf/ft^2)/ft
C-Maximum: 212 psf
Pore Water Pressure
  Piezometric Line: 1

EL-20 to EL-40

Model: S=f(depth)
Unit Weight: 101 pcf
C-Top of Layer: 212 psf
C-Rate of Change: 10.3 (lbf/ft^2)/ft
C-Maximum: 418 psf
Pore Water Pressure
  Piezometric Line: 1

EL-40 to EL-48

Model: S=f(depth)
Unit Weight: 101 pcf
C-Top of Layer: 418 psf
C-Rate of Change: 10.3 (lbf/ft^2)/ft
C-Maximum: 500 psf
Pore Water Pressure
  Piezometric Line: 1

EL-48 to EL-62

Model: S=f(depth)

Unit Weight: 111 pcf
C-Top of Layer: 500 psf
C-Rate of Change: 10.3 (lbf/ft²)/ft
C-Maximum: 644 psf
Pore Water Pressure
Piezometric Line: 1

EL-62 to EL-77

Model: Mohr-Coulomb
Unit Weight: 125.5 pcf
Cohesion': 0 psf
Phi': 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

EL-77 to EL-100

Model: S=f(depth)
Unit Weight: 114 pcf
C-Top of Layer: 780 psf
C-Rate of Change: 12.8 (lbf/ft²)/ft
C-Maximum: 1,075 psf
Pore Water Pressure
Piezometric Line: 1

EL-100 to EL-115

Model: S=f(depth)
Unit Weight: 114 pcf
C-Top of Layer: 1,075 psf
C-Rate of Change: 11.9 (lbf/ft²)/ft
C-Maximum: 1,254 psf
Pore Water Pressure
Piezometric Line: 1

EL-115 to EL-138

Model: S=f(depth)
Unit Weight: 108 pcf
C-Top of Layer: 1,093 psf
C-Rate of Change: 10 (lbf/ft²)/ft
C-Maximum: 1,323 psf
Pore Water Pressure
Piezometric Line: 1

Concrete Splash Pad

Model: Mohr-Coulomb
Unit Weight: 145 pcf
Cohesion': 20,000 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Clay 110,400

Model: Mohr-Coulomb
Unit Weight: 110 pcf
Cohesion': 400 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Sand

Model: Mohr-Coulomb
Unit Weight: 122 pcf
Cohesion': 0 psf
Phi': 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

sediment

Model: Undrained (Phi=0)
Unit Weight: 117 pcf
Cohesion: 1e-05 psf
Pore Water Pressure
Piezometric Line: 1

Fully Specified Slip Surfaces

Fully Specified Slip Surface 1

	X	Y
	-61 ft	3 ft
	0 ft	-40 ft
	52 ft	-40 ft
	112 ft	2 ft

Slip Surface Limits

Left Coordinate: (-180, 3) ft
Right Coordinate: (300, 1) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X	Y
Coordinate 1	-180 ft	27.5 ft
Coordinate 2	0 ft	27.5 ft
Coordinate 3	0.1 ft	-3.5 ft
Coordinate 4	35 ft	-3.5 ft

Coordinate 5	35 ft	1.5 ft
Coordinate 6	300 ft	1.5 ft

Point Loads

Point Load 1

Coordinate: (0, -19.5) ft
Magnitude: 12,000 lbf
Direction: 0 °

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): 1.6 pcf
Direction: Normal

Coordinates

	X	Y
	-180 ft	26 ft
	-0.001 ft	26 ft

Surcharge Load 2

Surcharge (Unit Weight): 1.6 pcf
Direction: Normal

Coordinates

	X	Y
	73 ft	1.5 ft
	300 ft	1.5 ft

Points

	X	Y
Point 1	-180 ft	1 ft
Point 2	-180 ft	-12 ft
Point 3	-180 ft	-20 ft
Point 4	-180 ft	-40 ft
Point 5	-180 ft	-48 ft
Point 6	-180 ft	-62 ft
Point 7	-180 ft	-77 ft
Point 8	-180 ft	-100 ft
Point 9	-180 ft	-115 ft
Point 10	-180 ft	-138 ft
Point 11	300 ft	1 ft
Point 12	300 ft	-12 ft

Point 13	300 ft	-20 ft
Point 14	300 ft	-40 ft
Point 15	300 ft	-48 ft
Point 16	300 ft	-62 ft
Point 17	300 ft	-77 ft
Point 18	300 ft	-100 ft
Point 19	300 ft	-115 ft
Point 20	300 ft	-138 ft
Point 21	35 ft	-3.5 ft
Point 22	0 ft	-3.5 ft
Point 23	0 ft	1 ft
Point 24	-1.5 ft	-5 ft
Point 25	-7.5 ft	-5 ft
Point 26	-16.5 ft	1 ft
Point 27	-15 ft	1 ft
Point 28	-7.5 ft	-3.5 ft
Point 29	35 ft	1 ft
Point 30	35 ft	4.5 ft
Point 31	52 ft	4.5 ft
Point 32	61 ft	4.5 ft
Point 33	75 ft	1 ft
Point 34	52 ft	1 ft
Point 35	61 ft	1 ft
Point 36	35 ft	5.5 ft
Point 37	52 ft	6.5 ft
Point 38	49 ft	6.5 ft
Point 39	48 ft	5.5 ft
Point 40	-45 ft	1 ft
Point 41	-180 ft	3 ft
Point 42	-45 ft	3 ft
Point 43	0 ft	1.5 ft
Point 44	-45 ft	1.5 ft

Regions

	Material	Points	Area
Region 1	GS to -12	27,26,25,24,22,28	20.25 ft^2
Region 2	GS to -12	27,23,22,28	50.625 ft^2
Region 3	EL-115 to EL-138	10,20,19,9	11,040 ft^2
Region 4	EL-100 to EL-115	8,18,19,9	7,200 ft^2
Region 5	EL-77 to EL-100	7,17,18,8	11,040 ft^2
Region 6	EL-62 to EL-77	6,16,17,7	7,200 ft^2
Region 7	EL-48 to EL-62	5,15,16,6	6,720 ft^2
Region 8	EL-40 to EL-48	4,14,15,5	3,840 ft^2
Region 9	EL-20 to EL-40	3,13,14,4	9,600 ft^2
Region 10	EL-12 to EL-20	2,12,13,3	3,840 ft^2

Region 11	GS to -12	1,40,26,25,24,22,21,29,34,35,33,11,12,2	6,011.6 ft²
Region 12	Clay 110,400	30,31,34,29	59.5 ft²
Region 13	Clay 110,400	31,32,35,34	31.5 ft²
Region 14	Clay 110,400	32,35,33	24.5 ft²
Region 15	Concrete Splash Pad	36,39,38,37,31,30	20.5 ft²
Region 16	Sand	41,42,44,40,1	270 ft²
Region 17	sediment	40,44,43,23,27,26	22.5 ft²

Slip Results

Slip Surfaces Analysed: 2 of 2 converged

Current Slip Surface

Slip Surface: 2
Factor of Safety: 1.49
Volume: 4,864.1333 ft³
Weight: 433,742.75 lbf
Resisting Moment: 2,854,236.7 lbf·ft
Activating Moment: 1,910,749.6 lbf·ft
Resisting Force: 52,156.922 lbf
Activating Force: 35,009.789 lbf
Slip Rank: 1 of 2 slip surfaces
Exit: (110.57869, 1) ft
Entry: (-65.180666, 3) ft
Radius: 73.098779 ft
Center: (24.8032, 3.5) ft

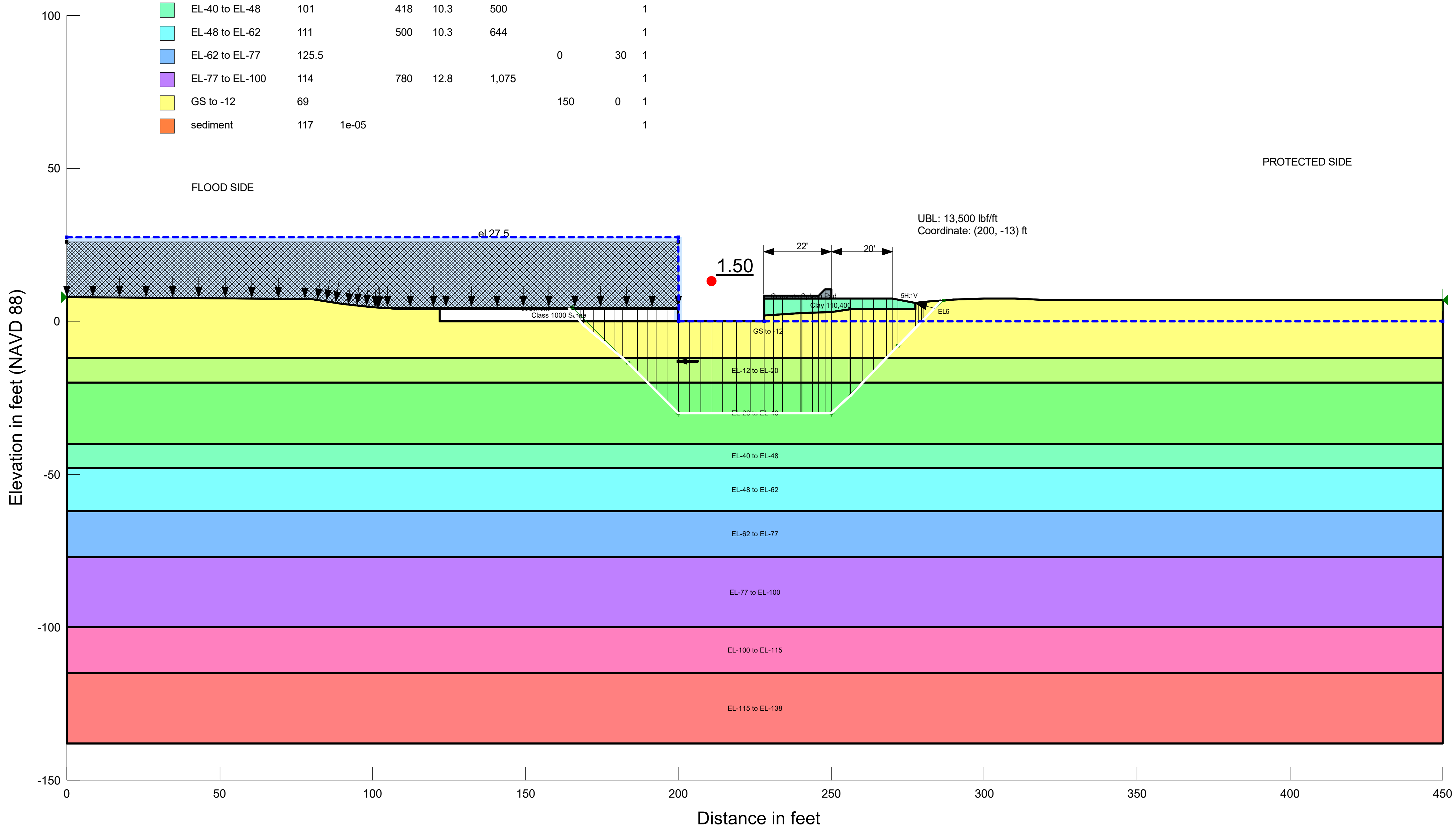
Slip Slices

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Base Material
Slice 1	-63.900922 ft	2 ft	1,591.2 psf	1,633.5392 psf	24.444528 psf	0 psf	0 psf	Sand
Slice 2	-60.105036 ft	-0.96613 ft	1,776.2865 psf	1,823.7505 psf	0 psf	150 psf	0 psf	GS to -12
Slice 3	-55.072752 ft	-4.89839 ft	2,021.6595 psf	2,088.2951 psf	0 psf	150 psf	0 psf	GS to -12
Slice 4	-49.34421 ft	-9.17897 ft	2,288.7677 psf	2,386.8573 psf	0 psf	150 psf	0 psf	GS to -12
Slice 5	-45.67528 ft	-11.74671 ft	2,448.9947 psf	2,589.8517 psf	0 psf	150 psf	0 psf	GS to -12
Slice 6	-45.109375 ft	-12.060683 ft	2,468.5866 psf	2,969.3106 psf	0 psf	150.62503 psf	0 psf	EL-12 to EL-20
Slice 7	-42.389072	-13.569949	2,562.7648 psf	2,669.3268 psf	0 psf	166.17048 psf	0 psf	EL-12 to EL-20

	ft	ft						
Slice 8	-37.167217 ft	-16.467116 ft	2,743.5481 psf	2,946.524 psf	0 psf	196.0113 psf	0 psf	EL-12 to EL-20
Slice 9	-32.700745 ft	-18.95785 ft	2,898.9698 psf	3,186.4867 psf	0 psf	212 psf	0 psf	EL-12 to EL-20
Slice 10	-29.363755 ft	-20.83204 ft	3,015.9193 psf	3,369.3923 psf	0 psf	220.57001 psf	0 psf	EL-20 to EL-40
Slice 11	-25.036732 ft	-23.453622 ft	3,179.506 psf	3,601.3617 psf	0 psf	247.57231 psf	0 psf	EL-20 to EL-40
Slice 12	-19.345578 ft	-27.032706 ft	3,402.8409 psf	3,941.2072 psf	0 psf	284.43687 psf	0 psf	EL-20 to EL-40
Slice 13	-15.75 ft	-29.293912 ft	3,543.9401 psf	4,155.916 psf	0 psf	307.7273 psf	0 psf	EL-20 to EL-40
Slice 14	-11.13019 ft	-32.199243 ft	3,725.2328 psf	4,431.7866 psf	0 psf	337.6522 psf	0 psf	EL-20 to EL-40
Slice 15	-4.38019 ft	-36.762033 ft	4,009.9508 psf	4,820.2565 psf	0 psf	384.64894 psf	0 psf	EL-20 to EL-40
Slice 16	-0.7505 ft	-39.445208 ft	4,177.381 psf	5,072.15 psf	0 psf	412.28564 psf	0 psf	EL-20 to EL-40
Slice 17	-0.0005 ft	-39.99963 ft	4,211.9769 psf	674,220.47 psf	0 psf	417.99619 psf	0 psf	EL-20 to EL-40
Slice 18	0.05 ft	-40 ft	3,244.8 psf	4,390.8824 psf	0 psf	418 psf	0 psf	EL-20 to EL-40
Slice 19	3.163236 ft	-40 ft	2,277.6 psf	3,423.6824 psf	0 psf	418 psf	0 psf	EL-20 to EL-40
Slice 20	9.289708 ft	-40 ft	2,277.6 psf	3,423.6824 psf	0 psf	418 psf	0 psf	EL-20 to EL-40
Slice 21	15.41618 ft	-40 ft	2,277.6 psf	3,423.6824 psf	0 psf	418 psf	0 psf	EL-20 to EL-40
Slice 22	21.542652 ft	-40 ft	2,277.6 psf	3,423.6824 psf	0 psf	418 psf	0 psf	EL-20 to EL-40
Slice 23	27.669124 ft	-40 ft	2,277.6 psf	3,423.6824 psf	0 psf	418 psf	0 psf	EL-20 to EL-40
Slice 24	31.203625 ft	-40 ft	2,277.6 psf	3,423.6824 psf	0 psf	418 psf	0 psf	EL-20 to EL-40
Slice 25	33.337445 ft	-40 ft	2,277.6 psf	3,423.6824 psf	0 psf	418 psf	0 psf	EL-20 to EL-40
Slice 26	35.727445 ft	-40 ft	2,589.6 psf	4,264.1824 psf	0 psf	418 psf	0 psf	EL-20 to EL-40
Slice 27	39.341167 ft	-40 ft	2,589.6 psf	4,264.1824 psf	0 psf	418 psf	0 psf	EL-20 to EL-40
Slice	45.113723			4,264.1824				EL-20 to

28	ft	-40 ft	2,589.6 psf	psf	0 psf	418 psf	0 psf	EL-40
Slice 29	48.5 ft	-40 ft	2,589.6 psf	4,336.6824 psf	0 psf	418 psf	0 psf	EL-20 to EL-40
Slice 30	50.5 ft	-40 ft	2,589.6 psf	4,409.1824 psf	0 psf	418 psf	0 psf	EL-20 to EL-40
Slice 31	54.25 ft	-39.132214 ft	2,535.4502 psf	4,189.4736 psf	0 psf	409.06181 psf	0 psf	EL-20 to EL-40
Slice 32	58.75 ft	-37.396642 ft	2,427.1505 psf	4,006.8838 psf	0 psf	391.18542 psf	0 psf	EL-20 to EL-40
Slice 33	64.46983 ft	-35.190603 ft	2,289.4936 psf	3,678.1557 psf	0 psf	368.46321 psf	0 psf	EL-20 to EL-40
Slice 34	70.46983 ft	-32.092161 ft	2,096.1508 psf	3,289.3829 psf	0 psf	336.54925 psf	0 psf	EL-20 to EL-40
Slice 35	74 ft	-29.636291 ft	1,942.9046 psf	2,940.138 psf	0 psf	311.2538 psf	0 psf	EL-20 to EL-40
Slice 36	76.29906 ft	-28.03688 ft	1,843.1013 psf	2,754.7354 psf	0 psf	294.77987 psf	0 psf	EL-20 to EL-40
Slice 37	81.98759 ft	-23.566575 ft	1,564.1543 psf	2,298.655 psf	0 psf	248.73572 psf	0 psf	EL-20 to EL-40
Slice 38	87.16193 ft	-19.36227 ft	1,301.8056 psf	1,841.1245 psf	0 psf	212 psf	0 psf	EL-12 to EL-20
Slice 39	92.076363 ft	-15.36227 ft	1,052.2056 psf	1,410.5065 psf	0 psf	184.63138 psf	0 psf	EL-12 to EL-20
Slice 40	99.004843 ft	-9.721135 ft	700.19882 psf	879.95166 psf	0 psf	150 psf	0 psf	GS to -12
Slice 41	106.19122 ft	-3.221135 ft	294.59882 psf	436.51648 psf	0 psf	150 psf	0 psf	GS to -12

Color	Name	Unit Weight (pcf)	Cohesion (psf)	C-Top of Layer (psf)	C-Rate of Change ((lbf/ft²)/ft)	C-Maximum (psf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Class 1000 Stone	160					0	40	1
	Clay 110,400	110					400	0	1
	Concrete Splash Pad	145					20,000	0	1
	EL-100 to EL-115	114		1,075	11.9	1,254			1
	EL-115 to EL-138	108		1,093	10	1,323			1
	EL-12 to EL-20	101		150	10.3	212			1
	EL-20 to EL-40	101		212	10.3	418			1
	EL-40 to EL-48	101		418	10.3	500			1
	EL-48 to EL-62	111		500	10.3	644			1
	EL-62 to EL-77	125.5					0	30	1
	EL-77 to EL-100	114		780	12.8	1,075			1
	GS to -12	69					150	0	1
	sediment	117	1e-05						1



Directory: G:\F&MHOME\QuachB\LPV-WBV GRR levee lifts\FLD floodwall stability\GIWW\
File Name: GIWW_Twall (N11)_EWL_6in sediment.gsz
SubFile: Fully Specified el-30 w/ubl

LPV-WBV-GRR
GIWW T-WALL, N11 SECTION

TOW EL -30 FULLY-SPECIFIED WITH UBL

Fully Specified el-30 w/ubl

File Information

File Version: 10.00
Created By: Rebecca Scherer
Last Edited By: Quach, Bich N CIV USARMY CEMVN (US)
Revision Number: 577
Date: 06/05/2020
Time: 04:30:53 PM
Tool Version: 10.0.0.17401
File Name: GIWW_Twall (N11)_EWL_6in sediment.gsz
Directory: G:\F&MHOME\QuachB\LPV-WBV GRR levee lifts\FLD floodwall stability\GIWW\
Last Solved Date: 09/21/2020
Last Solved Time: 02:17:18 PM

Project Settings

Unit System: U.S. Customary Units

Analysis Settings

Fully Specified el-30 w/ubl

Kind: SLOPE/W
Method: Spencer
Settings
- PWP Conditions from: Piezometric Line
  - Apply Phreatic Correction: No
  - Use Staged Rapid Drawdown: No
- Unit Weight of Water: 62.4 pcf

Slip Surface
- Direction of movement: Left to Right
- Use Passive Mode: Yes
- Slip Surface Option: Fully-Specified
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes
- Optimizations Settings
  - Maximum Iterations: 10,000
  - Convergence Tolerance: 1e-07
  - Starting Points: 8
  - Ending Points: 16
  - Complete Passes per Insertion: 1
  - Driving Side Maximum Convex Angle: 5 °
  - Resisting Side Maximum Convex Angle: 1 °
- Tension Crack Option: (none)

Distribution
- F of S Calculation Option: Constant

Advanced
- Geometry Settings
  - Minimum Slip Surface Depth: 0.1 ft

Number of Slices: 30
Factor of Safety Convergence Settings
Maximum Number of Iterations: 100
Tolerable difference in F of S: 0.01
Solution Settings
Search Method: Root Finder
Tolerable difference between starting and converged F of S: 3
Maximum iterations to calculate converged lambda: 20
Max Absolute Lambda: 2

Materials

GS to -12

Model: Mohr-Coulomb
Unit Weight: 69 pcf
Cohesion': 150 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

EL-12 to EL-20

Model: S=f(depth)
Unit Weight: 101 pcf
C-Top of Layer: 150 psf
C-Rate of Change: 10.3 (lbf/ft^2)/ft
C-Maximum: 212 psf
Pore Water Pressure
Piezometric Line: 1

EL-20 to EL-40

Model: S=f(depth)
Unit Weight: 101 pcf
C-Top of Layer: 212 psf
C-Rate of Change: 10.3 (lbf/ft^2)/ft
C-Maximum: 418 psf
Pore Water Pressure
Piezometric Line: 1

EL-40 to EL-48

Model: S=f(depth)
Unit Weight: 101 pcf
C-Top of Layer: 418 psf
C-Rate of Change: 10.3 (lbf/ft^2)/ft
C-Maximum: 500 psf
Pore Water Pressure
Piezometric Line: 1

EL-48 to EL-62

Model: S=f(depth)
Unit Weight: 111 pcf
C-Top of Layer: 500 psf
C-Rate of Change: 10.3 (lbf/ft^2)/ft

C-Maximum: 644 psf
Pore Water Pressure
Piezometric Line: 1

EL-62 to EL-77

Model: Mohr-Coulomb
Unit Weight: 125.5 pcf
Cohesion': 0 psf
Phi': 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

EL-77 to EL-100

Model: S=f(depth)
Unit Weight: 114 pcf
C-Top of Layer: 780 psf
C-Rate of Change: 12.8 (lbf/ft^2)/ft
C-Maximum: 1,075 psf
Pore Water Pressure
Piezometric Line: 1

EL-100 to EL-115

Model: S=f(depth)
Unit Weight: 114 pcf
C-Top of Layer: 1,075 psf
C-Rate of Change: 11.9 (lbf/ft^2)/ft
C-Maximum: 1,254 psf
Pore Water Pressure
Piezometric Line: 1

EL-115 to EL-138

Model: S=f(depth)
Unit Weight: 108 pcf
C-Top of Layer: 1,093 psf
C-Rate of Change: 10 (lbf/ft^2)/ft
C-Maximum: 1,323 psf
Pore Water Pressure
Piezometric Line: 1

Concrete Splash Pad

Model: Mohr-Coulomb
Unit Weight: 145 pcf
Cohesion': 20,000 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Clay 110,400

Model: Mohr-Coulomb
Unit Weight: 110 pcf
Cohesion': 400 psf
Phi': 0 °
Phi-B: 0 °

Pore Water Pressure
Piezometric Line: 1

Class 1000 Stone

Model: Mohr-Coulomb
Unit Weight: 160 pcf
Cohesion': 0 psf
Phi': 40 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

sediment

Model: Undrained (Phi=0)
Unit Weight: 117 pcf
Cohesion: 1e-05 psf
Pore Water Pressure
Piezometric Line: 1

Fully Specified Slip Surfaces

Fully Specified Slip Surface 1

	X	Y
	165.23417 ft	4.65046 ft
	183.47267 ft	-13.46169 ft
	200 ft	-30 ft
	250 ft	-30 ft
	271.8185 ft	-8 ft
	286.9 ft	6.9 ft

Slip Surface Limits

Left Coordinate: (0, 8) ft
Right Coordinate: (450, 7) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X	Y
Coordinate 1	0 ft	27.5 ft
Coordinate 2	200 ft	27.5 ft
Coordinate 3	200.1 ft	0 ft
Coordinate 4	228 ft	0 ft
Coordinate 5	450 ft	0 ft

Point Loads

Point Load 1

Coordinate: (200, -13) ft
Magnitude: 13,500 lbf
Direction: 0 °

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): 0.6 pcf
Direction: Normal

Coordinates

	X	Y
	0 ft	26 ft
	199.99 ft	26 ft

Points

	X	Y
Point 1	0 ft	0 ft
Point 2	0 ft	-12 ft
Point 3	0 ft	-20 ft
Point 4	0 ft	-40 ft
Point 5	0 ft	-48 ft
Point 6	0 ft	-62 ft
Point 7	0 ft	-77 ft
Point 8	0 ft	-100 ft
Point 9	0 ft	-115 ft
Point 10	0 ft	-138 ft
Point 11	450 ft	0 ft
Point 12	450 ft	-12 ft
Point 13	450 ft	-20 ft
Point 14	450 ft	-40 ft
Point 15	450 ft	-48 ft
Point 16	450 ft	-62 ft
Point 17	450 ft	-77 ft
Point 18	450 ft	-100 ft
Point 19	450 ft	-115 ft
Point 20	450 ft	-138 ft
Point 21	80 ft	7.3 ft
Point 22	90 ft	5.7 ft
Point 23	100 ft	4.7 ft
Point 24	110 ft	4 ft

Point 25	122 ft	4 ft
Point 26	122 ft	0 ft
Point 27	200 ft	4 ft
Point 28	200 ft	0 ft
Point 29	228 ft	0 ft
Point 30	228 ft	2 ft
Point 31	228 ft	4 ft
Point 32	228 ft	7.5 ft
Point 33	228 ft	8.5 ft
Point 34	240 ft	2.8 ft
Point 35	250 ft	3 ft
Point 36	270 ft	7.5 ft
Point 37	250 ft	10.5 ft
Point 38	248 ft	10.5 ft
Point 39	0 ft	8 ft
Point 40	246 ft	8.5 ft
Point 41	250 ft	7.5 ft
Point 42	280 ft	6.4 ft
Point 43	290 ft	7.1 ft
Point 44	320 ft	7 ft
Point 45	360 ft	7 ft
Point 46	450 ft	7 ft
Point 47	256.3 ft	4 ft
Point 48	300 ft	7.5 ft
Point 49	310 ft	7.5 ft
Point 50	277.5 ft	4 ft
Point 51	270 ft	5.5 ft
Point 52	260 ft	4.6 ft
Point 53	277.5 ft	6 ft
Point 54	200 ft	4.5 ft
Point 55	122 ft	4.5 ft
Point 56	102.8 ft	4.5 ft

Regions

	Material	Points	Area
Region 1	EL-115 to EL-138	10,20,19,9	10,350 ft^2
Region 2	EL-100 to EL-115	8,18,19,9	6,750 ft^2
Region 3	EL-77 to EL-100	7,17,18,8	10,350 ft^2
Region 4	EL-62 to EL-77	6,16,17,7	6,750 ft^2
Region 5	EL-48 to EL-62	5,15,16,6	6,300 ft^2
Region 6	EL-40 to EL-48	4,14,15,5	3,600 ft^2

Region 7	EL-20 to EL-40	3,13,14,4	9,000 ft²
Region 8	EL-12 to EL-20	2,12,13,3	3,600 ft²
Region 9	GS to -12	1,39,21,22,23,56,24,25,26,28,29,30,34,35,47,50,53,42,43,48,49,44,45,46,11,12,2	7,598.6 ft²
Region 10	Class 1000 Stone	25,27,28,26	312 ft²
Region 11	Concrete Splash Pad	33,40,38,37,41,32	28 ft²
Region 12	Clay 110,400	30,31,32,41,36,53,50,47,35,34	200.97 ft²
Region 13	sediment	56,55,54,27,25,24	46.8 ft²

Slip Results

Slip Surfaces Analysed: 2 of 2 converged

Current Slip Surface

Slip Surface: 2
Factor of Safety: 1.50
Volume: 2,999.4383 ft³
Weight: 269,851.37 lbf
Resisting Moment: 1,431,939.5 lbf·ft
Activating Moment: 957,426.78 lbf·ft
Resisting Force: 29,267.316 lbf
Activating Force: 19,568.19 lbf
Slip Rank: 1 of 2 slip surfaces
Exit: (286.02523, 6.821766) ft
Entry: (164.04279, 4.5) ft
Radius: 53.152156 ft
Center: (226.09856, 7.4771296) ft

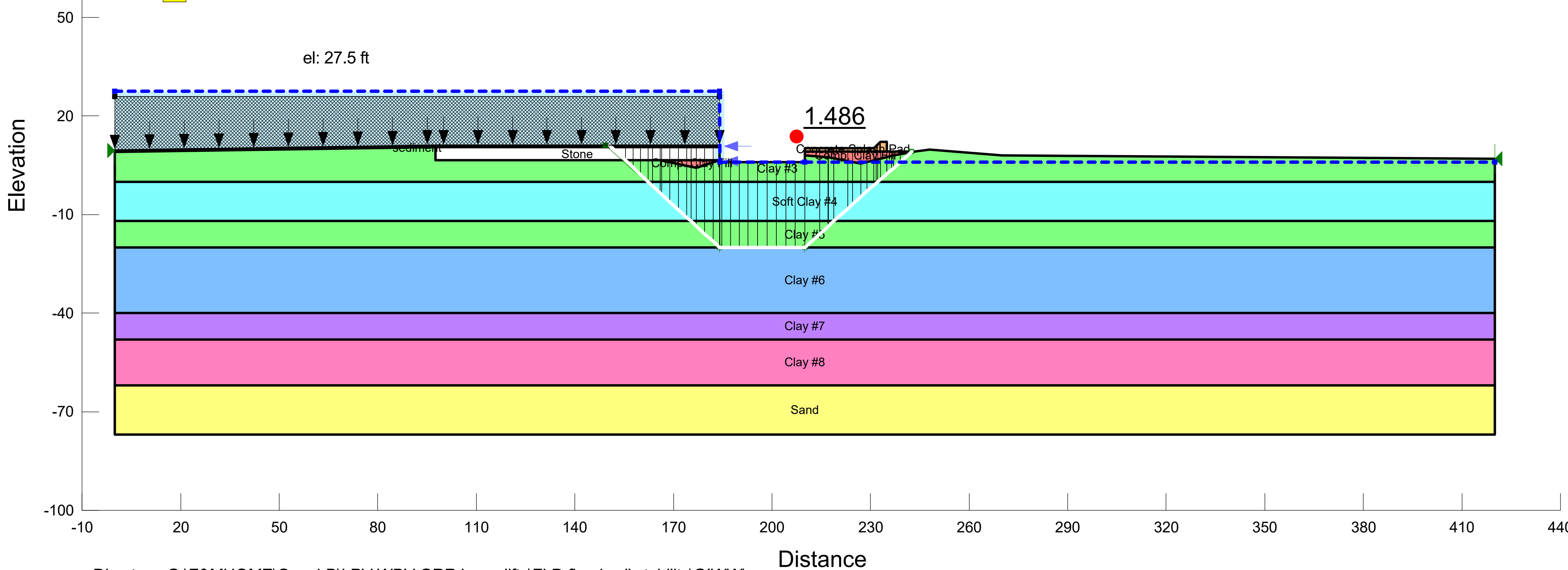
Slip Slices

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Base Material
Slice 1	164.25732 ft	4.25 ft	1,450.8 psf	1,440.0567 psf	0 psf	1e-05 psf	0 psf	sediment
Slice 2	166.18807 ft	2 ft	1,591.2 psf	1,707.9505 psf	97.965273 psf	0 psf	0 psf	Class 1000 Stone
Slice 3	168.42411 ft	-0.605765 ft	1,753.7997 psf	2,022.1057 psf	0 psf	150 psf	0 psf	GS to -12
Slice 4	170.66603 ft	-2.6465633 ft	1,881.1456 psf	2,207.4959 psf	0 psf	150 psf	0 psf	GS to -12
Slice 5	174.11022 ft	-5.51663 ft	2,060.2377 psf	2,401.9299 psf	0 psf	150 psf	0 psf	GS to -12

Slice 6	177.55441 ft	-8.3866967 ft	2,239.3299 psf	2,596.3639 psf	0 psf	150 psf	0 psf	GS to -12
Slice 7	180.53207 ft	-10.910865 ft	2,396.838 psf	2,761.9665 psf	0 psf	150 psf	0 psf	GS to -12
Slice 8	182.63015 ft	-12.730845 ft	2,510.4047 psf	2,903.9672 psf	0 psf	157.5277 psf	0 psf	EL-12 to EL-20
Slice 9	185.09351 ft	-15.096267 ft	2,658.0071 psf	3,098.6862 psf	0 psf	181.89156 psf	0 psf	EL-12 to EL-20
Slice 10	188.3352 ft	-18.365423 ft	2,862.0024 psf	3,402.336 psf	0 psf	212 psf	0 psf	EL-12 to EL-20
Slice 11	191.29047 ft	-21.345745 ft	3,047.9745 psf	3,687.8664 psf	0 psf	225.86117 psf	0 psf	EL-20 to EL-40
Slice 12	194.46618 ft	-24.51614 ft	3,245.8071 psf	3,984.5835 psf	0 psf	258.51624 psf	0 psf	EL-20 to EL-40
Slice 13	198.14873 ft	-28.16544 ft	3,473.5235 psf	4,321.5482 psf	0 psf	296.10403 psf	0 psf	EL-20 to EL-40
Slice 14	199.995 ft	-29.995045 ft	3,587.6908 psf	49,248.768 psf	0 psf	314.94896 psf	0 psf	EL-20 to EL-40
Slice 15	200.05 ft	-30 ft	2,730 psf	3,508.6665 psf	0 psf	315 psf	0 psf	EL-20 to EL-40
Slice 16	201.90709 ft	-30 ft	1,872 psf	2,650.6665 psf	0 psf	315 psf	0 psf	EL-20 to EL-40
Slice 17	205.52127 ft	-30 ft	1,872 psf	2,650.6665 psf	0 psf	315 psf	0 psf	EL-20 to EL-40
Slice 18	209.13545 ft	-30 ft	1,872 psf	2,650.6665 psf	0 psf	315 psf	0 psf	EL-20 to EL-40
Slice 19	212.74963 ft	-30 ft	1,872 psf	2,650.6665 psf	0 psf	315 psf	0 psf	EL-20 to EL-40
Slice 20	216.79727 ft	-30 ft	1,872 psf	2,650.6665 psf	0 psf	315 psf	0 psf	EL-20 to EL-40
Slice 21	221.27836 ft	-30 ft	1,872 psf	2,650.6665 psf	0 psf	315 psf	0 psf	EL-20 to EL-40
Slice 22	225.75945 ft	-30 ft	1,872 psf	2,650.6665 psf	0 psf	315 psf	0 psf	EL-20 to EL-40
Slice 23	229.53404 ft	-30 ft	1,872 psf	3,534.4735 psf	0 psf	315 psf	0 psf	EL-20 to EL-40
Slice 24	232.60213 ft	-30 ft	1,872 psf	3,526.0874 psf	0 psf	315 psf	0 psf	EL-20 to EL-40
Slice 25	237.06808 ft	-30 ft	1,872 psf	3,513.8804 psf	0 psf	315 psf	0 psf	EL-20 to EL-40
Slice 26	240.15927 ft	-30 ft	1,872 psf	3,505.7359 psf	0 psf	315 psf	0 psf	EL-20 to EL-40
Slice 27	242.07622 ft	-30 ft	1,872 psf	3,504.164 psf	0 psf	315 psf	0 psf	EL-20 to EL-40
Slice 28	244.91696 ft	-30 ft	1,872 psf	3,501.8346 psf	0 psf	315 psf	0 psf	EL-20 to EL-40
Slice 29	247 ft	-30 ft	1,872 psf	3,645.1265 psf	0 psf	315 psf	0 psf	EL-20 to EL-40
Slice 30	249 ft	-30 ft	1,872 psf	3,788.4865 psf	0 psf	315 psf	0 psf	EL-20 to EL-40
Slice 31	252.95624 ft	-27.322745 ft	1,704.9393 psf	3,302.1077 psf	0 psf	287.42427 psf	0 psf	EL-20 to EL-40

Slice 32	256.10624 ft	-24.443609 ft	1,525.2812 psf	2,998.8594 psf	0 psf	257.76917 psf	0 psf	EL-20 to EL-40
Slice 33	258.33555 ft	-22.120864 ft	1,380.3419 psf	2,740.0844 psf	0 psf	233.8449 psf	0 psf	EL-20 to EL-40
Slice 34	262.09258 ft	-18.20637 ft	1,136.0775 psf	2,319.5288 psf	0 psf	212 psf	0 psf	EL-12 to EL-20
Slice 35	265.91335 ft	-14.20637 ft	886.47749 psf	1,878.9681 psf	0 psf	172.72561 psf	0 psf	EL-12 to EL-20
Slice 36	269.00632 ft	-10.95563 ft	683.63132 psf	1,560.4082 psf	0 psf	150 psf	0 psf	GS to -12
Slice 37	270.90925 ft	-8.9556301 ft	558.83132 psf	1,398.6261 psf	0 psf	150 psf	0 psf	GS to -12
Slice 38	274.65925 ft	-5.11414 ft	319.12234 psf	1,038.3339 psf	0 psf	150 psf	0 psf	GS to -12
Slice 39	278.01072 ft	-1.70945 ft	106.66968 psf	655.91894 psf	0 psf	150 psf	0 psf	GS to -12
Slice 40	279.07896 ft	-0.59531 ft	37.147344 psf	595.33175 psf	0 psf	150 psf	0 psf	GS to -12
Slice 41	279.81824 ft	0.19407748 ft	-12.110435 psf	547.90017 psf	0 psf	150 psf	0 psf	GS to -12
Slice 42	283.01261 ft	3.6049605 ft	-224.94953 psf	323.78887 psf	0 psf	150 psf	0 psf	GS to -12

Color	Name	Unit Weight (pcf)	Cohesion (psf)	Cohesion Spatial Fn	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Clay #3	110			475	0	1
	Clay #5	101		Layer #5		0	1
	Clay #6	101		Layer #6		0	1
	Clay #7	101		Layer #7		0	1
	Clay #8	111		Layer #8		0	1
	Comp. Clay Fill	110			400	0	1
	Concrete Splash Pad	145			20,000	0	1
	Sand	125.5			0	30	1
	sediment	117	1e-05				1
	Soft Clay #4	69			293	0	1
	Stone	160			0	40	1



Directory: G:\F&MHOME\QuachB\LPV-WBV GRR levee lifts\FLD floodwall stability\GIWW\
File Name: GIWW_Twall (N12-N13)_EWL_6in sediment.gsz
Name: Fully Specified, el -20

LPV-WBV GRR
GIWW T-WALL, N-12 & N-13 SECTIONS

TOW EL. -20 FULLY-SPECIFIED

Fully Specified, el -20

File Information

File Version: 10.00
Created By: William W. Caver
Last Edited By: Quach, Bich N CIV USARMY CEMVN (US)
Revision Number: 56
Date: 06/05/2020
Time: 02:46:48 PM
Tool Version: 10.0.0.17401
File Name: GIWW_Twall (N12-N13)_EWL_6in sediment.gsz
Directory: G:\F&MHOME\QuachB\LPV-WBV GRR levee lifts\FLD floodwall stability\GIWW\
Last Solved Date: 06/05/2020
Last Solved Time: 02:47:28 PM

Project Settings

Unit System: U.S. Customary Units

Analysis Settings

Fully Specified, el -20

- Kind: SLOPE/W
- Method: Spencer
- Settings
  - PWP Conditions from: Piezometric Line
    - Apply Phreatic Correction: No
    - Use Staged Rapid Drawdown: No
  - Unit Weight of Water: 62.4 pcf
- Slip Surface
  - Direction of movement: Left to Right
  - Use Passive Mode: No
  - Slip Surface Option: Fully-Specified
  - Critical slip surfaces saved: 1
  - Optimize Critical Slip Surface Location: Yes
  - Optimizations Settings
    - Maximum Iterations: 5,000
    - Convergence Tolerance: 1e-07
    - Starting Points: 8
    - Ending Points: 16
    - Complete Passes per Insertion: 1
    - Driving Side Maximum Convex Angle: 5 °
    - Resisting Side Maximum Convex Angle: 1 °
  - Tension Crack Option: (none)
- Distribution
  - F of S Calculation Option: Constant
- Advanced
  - Geometry Settings

Minimum Slip Surface Depth: 0.1 ft
Number of Slices: 30
Factor of Safety Convergence Settings
Maximum Number of Iterations: 100
Tolerable difference in F of S: 0.01
Solution Settings
Search Method: Root Finder
Tolerable difference between starting and converged F of S: 3
Maximum iterations to calculate converged lambda: 20
Max Absolute Lambda: 2

Materials

Stone

Model: Mohr-Coulomb
Unit Weight: 160 pcf
Cohesion': 0 psf
Phi': 40 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Comp. Clay Fill

Model: Mohr-Coulomb
Unit Weight: 110 pcf
Cohesion': 400 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Clay #3

Model: Mohr-Coulomb
Unit Weight: 110 pcf
Cohesion': 475 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Soft Clay #4

Model: Mohr-Coulomb
Unit Weight: 69 pcf
Cohesion': 293 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Clay #5

Model: Spatial Mohr-Coulomb
Unit Weight: 101 pcf
Cohesion Spatial Fn: Layer #5

Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Clay #6
Model: Spatial Mohr-Coulomb
Unit Weight: 101 pcf
Cohesion Spatial Fn: Layer #6
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Clay #7
Model: Spatial Mohr-Coulomb
Unit Weight: 101 pcf
Cohesion Spatial Fn: Layer #7
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Clay #8
Model: Spatial Mohr-Coulomb
Unit Weight: 111 pcf
Cohesion Spatial Fn: Layer #8
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Sand
Model: Mohr-Coulomb
Unit Weight: 125.5 pcf
Cohesion': 0 psf
Phi': 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Concrete Splash Pad
Model: Mohr-Coulomb
Unit Weight: 145 pcf
Cohesion': 20,000 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

sediment
Model: Undrained (Phi=0)
Unit Weight: 117 pcf
Cohesion: 1e-05 psf

Pore Water Pressure
Piezometric Line: 1

Fully Specified Slip Surfaces

Fully Specified Slip Surface 1

	X	Y
	149.23055 ft	11.16033 ft
	184 ft	-20 ft
	210 ft	-20 ft
	242.43 ft	9.2 ft

Slip Surface Limits

Left Coordinate: (0, 9.5) ft
Right Coordinate: (420, 7) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X	Y
Coordinate 1	0 ft	27.5 ft
Coordinate 2	184 ft	27.5 ft
Coordinate 3	184.1 ft	6 ft
Coordinate 4	210 ft	6 ft
Coordinate 5	420 ft	6 ft

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): 0.6 pcf
Direction: Vertical

Coordinates

	X	Y
	0 ft	26 ft
	184 ft	26 ft

Spatial Functions

Layer #5

Model: Linear Interpolation
Limit Range By: Data Values

Data Points: X (ft), Y (ft), Cohesion (psf)
- Data Point: (0, -12, 293)
- Data Point: (0, -20, 351)
- Data Point: (500, -12, 293)
- Data Point: (500, -20, 351)

Layer #6
Model: Linear Interpolation
Limit Range By: Data Values
Data Points: X (ft), Y (ft), Cohesion (psf)
- Data Point: (0, -20, 351)
- Data Point: (0, -40, 544)
- Data Point: (500, -20, 351)
- Data Point: (500, -40, 544)

Layer #7
Model: Linear Interpolation
Limit Range By: Data Values
Data Points: X (ft), Y (ft), Cohesion (psf)
- Data Point: (0, -40, 544)
- Data Point: (0, -48, 621)
- Data Point: (500, -40, 544)
- Data Point: (500, -48, 621)

Layer #8
Model: Linear Interpolation
Limit Range By: Data Values
Data Points: X (ft), Y (ft), Cohesion (psf)
- Data Point: (0, -48, 621)
- Data Point: (0, -62, 756)
- Data Point: (500, -48, 621)
- Data Point: (500, -62, 756)

Points

	X	Y
Point 1	0 ft	9 ft
Point 2	97.5 ft	10.5 ft
Point 3	184 ft	10.5 ft
Point 4	184 ft	6.5 ft
Point 5	184 ft	6 ft
Point 6	210 ft	6 ft
Point 7	210 ft	8 ft
Point 8	210 ft	9.2 ft
Point 9	243.5 ft	9.2 ft
Point 10	248 ft	9.8 ft
Point 11	270 ft	8 ft
Point 12	420 ft	7 ft
Point 13	420 ft	0 ft
Point 14	420 ft	-12 ft
Point 15	420 ft	-20 ft

Point 16	420 ft	-40 ft
Point 17	420 ft	-48 ft
Point 18	420 ft	-62 ft
Point 19	420 ft	-77 ft
Point 20	237 ft	8 ft
Point 21	227 ft	5.5 ft
Point 22	217 ft	7.5 ft
Point 23	177 ft	4.2 ft
Point 24	166 ft	6.5 ft
Point 25	97.5 ft	6.5 ft
Point 26	0 ft	0 ft
Point 27	0 ft	-12 ft
Point 28	0 ft	-20 ft
Point 29	0 ft	-40 ft
Point 30	0 ft	-48 ft
Point 31	0 ft	-62 ft
Point 32	0 ft	-77 ft
Point 33	210 ft	10.2 ft
Point 34	231 ft	10.2 ft
Point 35	233 ft	12.2 ft
Point 36	235 ft	12.2 ft
Point 37	235.01 ft	9.2 ft
Point 38	184 ft	11 ft
Point 39	97.5 ft	11 ft
Point 40	0 ft	9.5 ft

Regions

	Material	Points	Area
Region 1	Stone	2,3,4,24,25	346 ft^2
Region 2	Comp. Clay Fill	4,23,24	20.7 ft^2
Region 3	Comp. Clay Fill	8,37,9,20,21,22,7	65.55 ft^2
Region 4	Clay #3	1,2,25,24,23,4,5,6,7,22,21,20,9,10,11,12,13,26	3,254.4 ft^2
Region 5	Soft Clay #4	26,13,14,27	5,040 ft^2
Region 6	Clay #5	27,14,15,28	3,360 ft^2
Region 7	Clay #6	28,15,16,29	8,400 ft^2
Region 8	Clay #7	29,16,17,30	3,360 ft^2
Region 9	Clay #8	30,17,18,31	5,880 ft^2
Region 10	Sand	31,18,19,32	6,300 ft^2
Region 11	Concrete Splash Pad	33,34,35,36,37,8	31.015 ft^2
Region 12	sediment	40,1,2,3,38,39	92 ft^2

Slip Results

Slip Surfaces Analysed: 2 of 2 converged

Current Slip Surface

Slip Surface: 2
Factor of Safety: 1.486
Volume: 1,700.7863 ft^3
Weight: 164,024.35 lbf
Resisting Moment: 1,244,084.1 lbf·ft
Activating Moment: 834,377.24 lbf·ft
Resisting Force: 31,200.135 lbf
Activating Force: 21,058.55 lbf
Slip Rank: 1 of 2 slip surfaces
Exit: (242.579, 9.2) ft
Entry: (150.60381, 11) ft
Radius: 41.160814 ft
Center: (195.94585, 11.45) ft

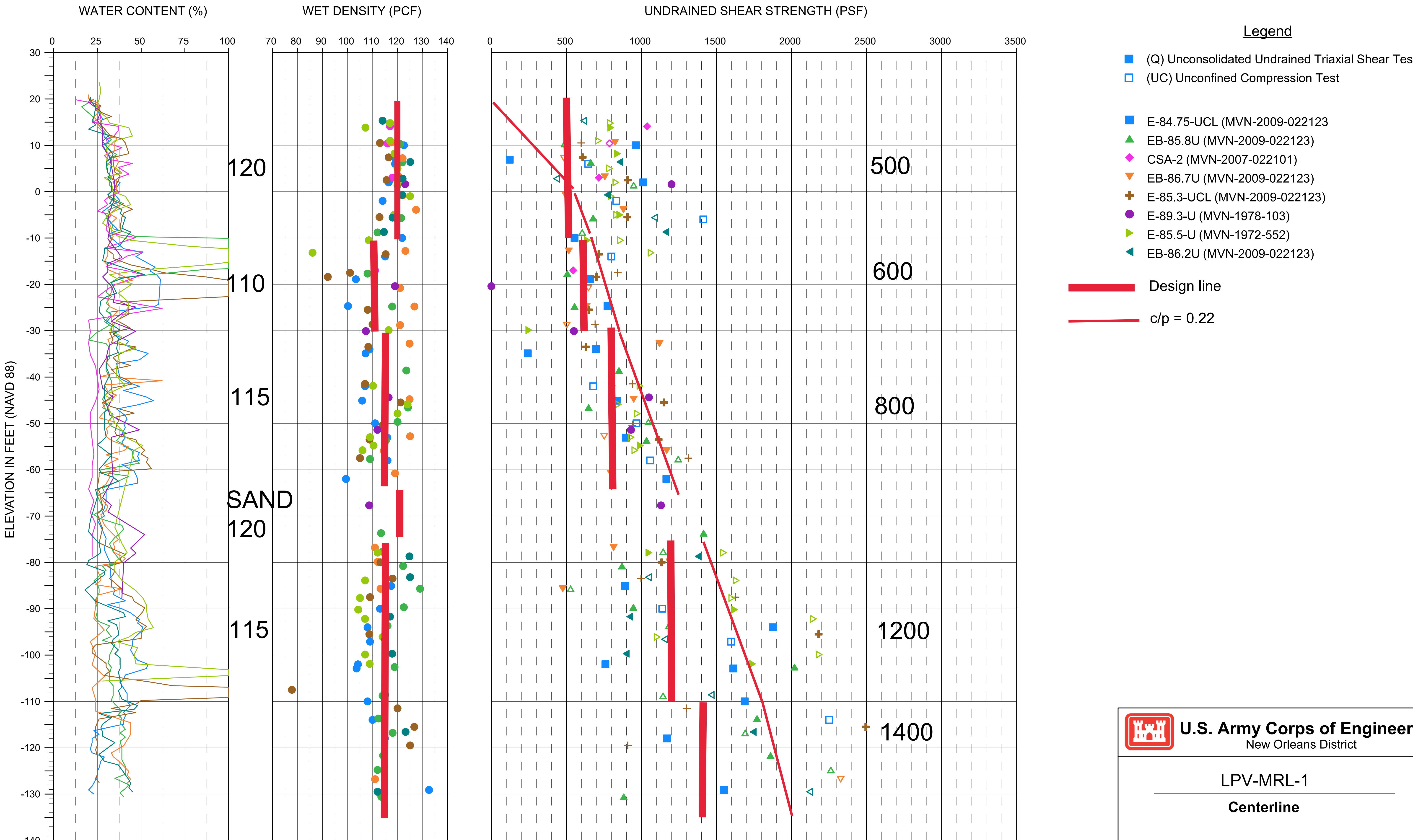
Slip Slices

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Base Material
Slice 1	150.87237 ft	10.75 ft	1,045.2 psf	1,061.859 psf	0 psf	1e-05 psf	0 psf	sediment
Slice 2	153.28941 ft	8.5 ft	1,185.6 psf	1,333.113 psf	123.77809 psf	0 psf	0 psf	Stone
Slice 3	156.56256 ft	5.45306 ft	1,375.7291 psf	1,550.0991 psf	0 psf	475 psf	0 psf	Clay #3
Slice 4	158.85093 ft	3.30459 ft	1,509.7936 psf	1,779.9883 psf	0 psf	475 psf	0 psf	Clay #3
Slice 5	161.17833 ft	1.10153 ft	1,647.2645 psf	2,020.9425 psf	0 psf	475 psf	0 psf	Clay #3
Slice 6	163.00348 ft	-0.62611 ft	1,755.0693 psf	2,298.055 psf	0 psf	293 psf	0 psf	Soft Clay #4
Slice 7	164.83247 ft	-2.361741 ft	1,863.3726 psf	2,416.349 psf	0 psf	293 psf	0 psf	Soft Clay #4
Slice 8	166.18014 ft	-3.642451 ft	1,943.2889 psf	2,504.212 psf	0 psf	293 psf	0 psf	Soft Clay #4
Slice 9	167.64319 ft	-4.9901967 ft	2,027.3883 psf	2,603.6565 psf	0 psf	293 psf	0 psf	Soft Clay #4
Slice 10	170.209 ft	-7.34331 ft	2,174.2225 psf	2,765.1239 psf	0 psf	293 psf	0 psf	Soft Clay #4
Slice 11	172.77482 ft	-9.6964233 ft	2,321.0568 psf	2,926.5912 psf	0 psf	293 psf	0 psf	Soft Clay #4
Slice 12	174.6761 ft	-11.43649 ft	2,429.637 psf	3,047.2301 psf	0 psf	293 psf	0 psf	Soft Clay #4
Slice 13	176.14723 ft	-12.777118 ft	2,513.2922 psf	3,160.5687 psf	0 psf	298.63411 psf	0 psf	Clay #5
Slice 14	178.26462 ft	-14.70667 ft	2,633.6962 psf	3,345.971 psf	0 psf	312.62336 psf	0 psf	Clay #5
Slice 15	180.79386 ft	-17.011537 ft	2,777.5199 psf	3,567.4358 psf	0 psf	329.33364 psf	0 psf	Clay #5
Slice	183.02924	-19.081985	2,906.7159	3,776.1347		344.34439		

16	ft	ft	psf	psf	0 psf	psf	0 psf	Clay #5
Slice 17	184.05 ft	-20 ft	2,293.2 psf	2,968.2263 psf	0 psf	351 psf	0 psf	Clay #5
Slice 18	184.39968 ft	-20 ft	1,622.4 psf	2,297.4263 psf	0 psf	351 psf	0 psf	Clay #5
Slice 19	186.03905 ft	-20 ft	1,622.4 psf	2,297.4263 psf	0 psf	351 psf	0 psf	Clay #5
Slice 20	188.71843 ft	-20 ft	1,622.4 psf	2,297.4263 psf	0 psf	351 psf	0 psf	Clay #5
Slice 21	191.39781 ft	-20 ft	1,622.4 psf	2,297.4263 psf	0 psf	351 psf	0 psf	Clay #5
Slice 22	194.17604 ft	-20 ft	1,622.4 psf	2,297.4263 psf	0 psf	351 psf	0 psf	Clay #5
Slice 23	197.05312 ft	-20 ft	1,622.4 psf	2,297.4263 psf	0 psf	351 psf	0 psf	Clay #5
Slice 24	199.93021 ft	-20 ft	1,622.4 psf	2,297.4263 psf	0 psf	351 psf	0 psf	Clay #5
Slice 25	202.80729 ft	-20 ft	1,622.4 psf	2,297.4263 psf	0 psf	351 psf	0 psf	Clay #5
Slice 26	205.68437 ft	-20 ft	1,622.4 psf	2,297.4263 psf	0 psf	351 psf	0 psf	Clay #5
Slice 27	208.56146 ft	-20 ft	1,622.4 psf	2,297.4263 psf	0 psf	351 psf	0 psf	Clay #5
Slice 28	212.25008 ft	-17.96151 ft	1,495.1982 psf	2,807.3892 psf	0 psf	336.22095 psf	0 psf	Clay #5
Slice 29	215.75008 ft	-14.782281 ft	1,296.8143 psf	2,471.8986 psf	0 psf	313.17154 psf	0 psf	Clay #5
Slice 30	217.07451 ft	-13.573541 ft	1,221.389 psf	2,343.7282 psf	0 psf	304.40817 psf	0 psf	Clay #5
Slice 31	217.97921 ft	-12.75277 ft	1,170.1728 psf	2,255.4323 psf	0 psf	298.45758 psf	0 psf	Clay #5
Slice 32	220.90135 ft	-10.10313 ft	1,004.8353 psf	2,044.0285 psf	0 psf	293 psf	0 psf	Soft Clay #4
Slice 33	223.74666 ft	-7.5357354 ft	844.62989 psf	1,862.4264 psf	0 psf	293 psf	0 psf	Soft Clay #4
Slice 34	225.75 ft	-5.7526319 ft	733.36423 psf	1,738.7249 psf	0 psf	293 psf	0 psf	Soft Clay #4
Slice 35	228 ft	-3.7499899 ft	608.39937 psf	1,599.7932 psf	0 psf	293 psf	0 psf	Soft Clay #4
Slice 36	230 ft	-1.9698637 ft	497.31949 psf	1,476.2982 psf	0 psf	293 psf	0 psf	Soft Clay #4
Slice 37	231.33569 ft	-0.78101529 ft	423.13535 psf	1,442.7618 psf	0 psf	293 psf	0 psf	Soft Clay #4
Slice 38	231.95173 ft	-0.241115 ft	389.44558 psf	1,488.9358 psf	0 psf	293 psf	0 psf	Soft Clay #4
Slice 39	232.61604 ft	0.33021759 ft	353.79442 psf	1,638.3881 psf	0 psf	475 psf	0 psf	Clay #3
Slice 40	234 ft	1.5204743 ft	279.5224 psf	1,562.7392 psf	0 psf	475 psf	0 psf	Clay #3
Slice	235.005 ft	2.3848136	225.58763	1,248.524	0 psf	475 psf	0 psf	Clay #3

41		ft	psf	psf				
Slice 42	235.70753 ft	2.9890169 ft	187.88534 psf	963.07369 psf	0 psf	475 psf	0 psf	Clay #3
Slice 43	236.70253 ft	3.8592706 ft	133.58151 psf	882.6728 psf	0 psf	475 psf	0 psf	Clay #3
Slice 44	238.029 ft	5.0648106 ft	58.355817 psf	749.3289 psf	0 psf	475 psf	0 psf	Clay #3
Slice 45	240.70111 ft	7.4933125 ft	-93.1827 psf	480.71408 psf	0 psf	475 psf	0 psf	Clay #3
Slice 46	242.46161 ft	9.0933125 ft	-193.0227 psf	257.64367 psf	0 psf	400 psf	0 psf	Comp. Clay Fill

Levee Stability Analyses



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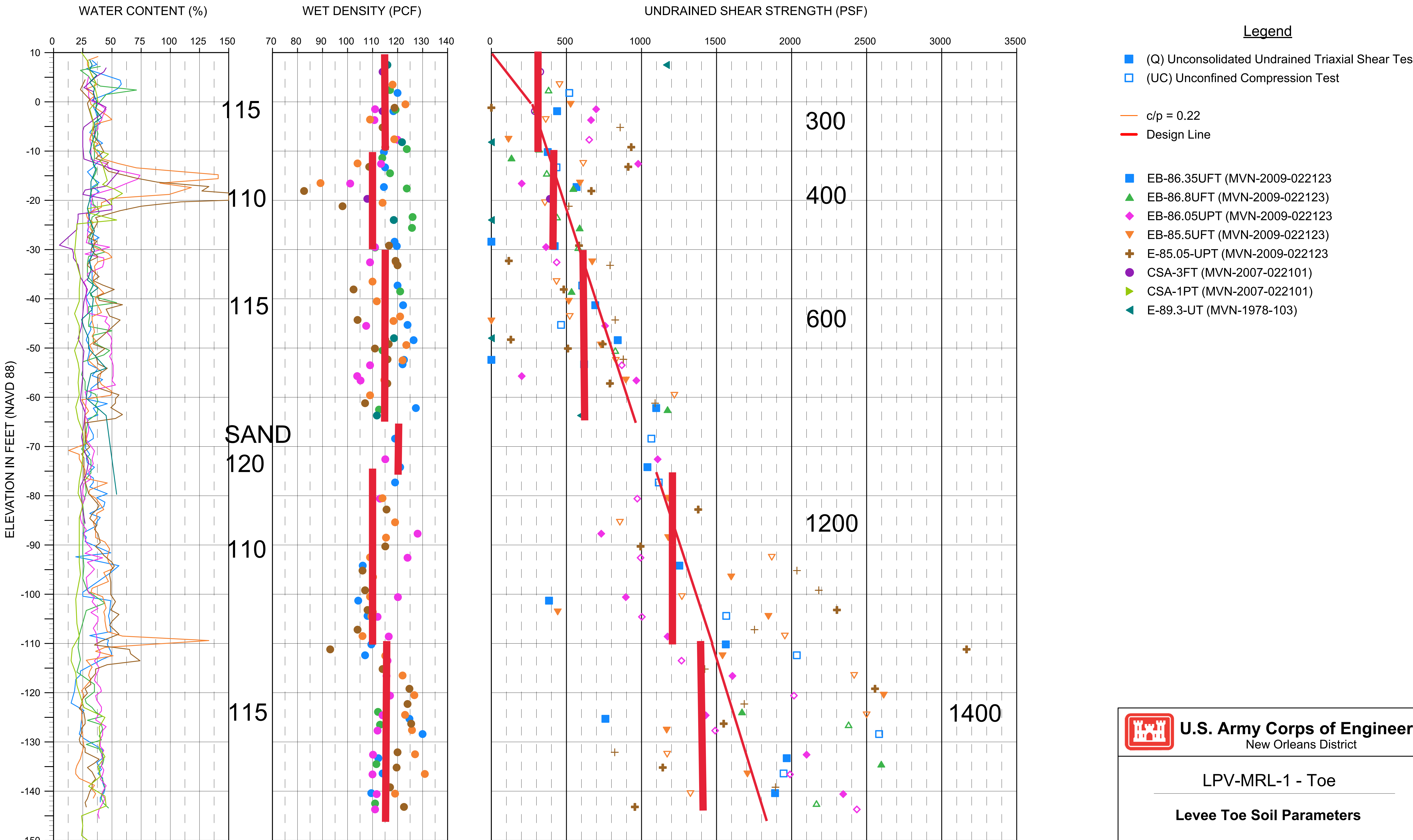
New Orleans District

LPV-MRL-1

Centerline

DRAWN.	CHECKED.	DATE.	SHEET.

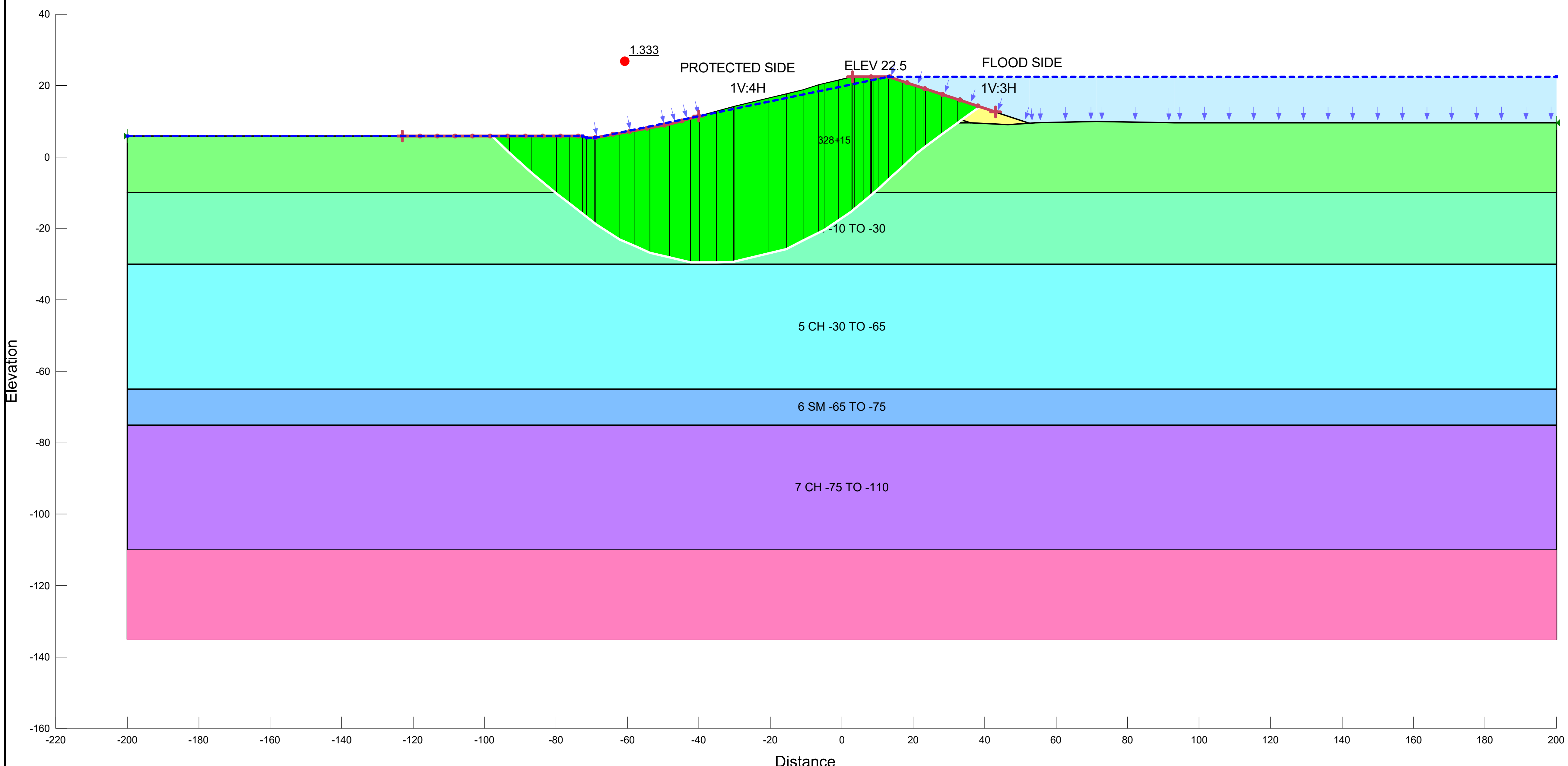


U.S. Army Corps of Engineers
New Orleans District

LPV-MRL-1 - Toe

Levee Toe Soil Parameters

DRAWN.	CHECKED.	DATE.	SHEET.
		22 June 2020	



Color	Name	Model	Weight Fn	Cohesion Fn	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-B (°)	Piezometric Line
	1 New levee	Mohr-Coulomb			115	600	0	0	1
	2 Levee	Mohr-Coulomb			115	600	0	0	1
	3 CH TO -10	Spatial Mohr-Coulomb	CH TO -10	CH TO -10			0	0	1
	4 CH -10 TO -30	Spatial Mohr-Coulomb		CH -10 TO -30	110		0	0	1
	5 CH -30 TO -65	Spatial Mohr-Coulomb		CH -30 TO -65	115		0	0	1
	6 SM -65 TO -75	Mohr-Coulomb			120	0	32	0	1
	7 CH -75 TO -110	Spatial Mohr-Coulomb	CH -75 TO -110			1,200	0	0	1
	8 CH -110 TO -135	Spatial Mohr-Coulomb			115	1,400	0	0	1

LPV-WBV GRR
LPV-MRL-1 RAISE AND FLOOD SIDE SHIFT

HWL ENTRY EXIT

HWL EE FS to PS

LPV-MRL-1 FS shift.gsz

08/13/2020 1:389.05512

2021

Lake Pontchartrain & Vicinity and West Bank & Vicinity Appendix C – Hydrology and Hydraulics

US Army Corps of Engineers®
New Orleans District

U.S. Army Corps of Engineers, New Orleans District

Non-Federal Sponsor: Coastal Protection and Restoration Authority Board of Louisiana

March 2021

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TABLE OF CONTENTS

LAKE PONTCHARTRAIN & VICINITY AND WEST BANK & VICINITY APPENDIX C – HYDROLOGY AND HYDRAULICS

1 GENERAL DESCRIPTION OF WORK

The purpose of this effort is to evaluate overtopping and interior flooding for hurricane and tropical storm surge events for the Greater New Orleans Hurricane and Storm Damage Risk Reduction System (HSDRRS) for with and without project scenarios. The HSDRRS is divided into two sub polders which are the Lake Pontchartrain and Vicinity (LPV) and the West Bank and Vicinity (WBV) projects. Additionally, portions of the HSDRRS are co-located with the Mississippi River Levees (MRL) project. Interior flooding estimates are produced for the 20YR, 50YR, 100YR, 200YR, 500YR and 1000YR surge events for existing conditions (year 2023) and future conditions (year 2073). Three future 2073 conditions are evaluated for low, medium and high relative sea level change (RSLC) projections. As described in the study authorization, one project alternatives is evaluated which is 100YR perimeter system. The 100YR HSDRRS ensures the expected overtopping rate at any given levee or floodwall segment is less than 0.1 cfs/ft with 90% confidence less than 0.01cfs/ft with 50% confidence for a 100YR surge and wave event. Interior flood risk varies tremendously by location and a 100YR perimeter system may not guarantee 100YR project performance at every location within the system. Furthermore, the 100YR perimeter system does not reduce the risk associated with rainfall flooding.

2 SOFTWARE

HEC-RAS 5.0.6. The latest version of the Hydraulic Engineering Center’s (CEIWR-HEC) River Analysis System (HEC-RAS) was used to model the inundation within the polders resulting from surge and wave overtopping events.

MATLAB R2017a. Matlab was used to automate the simulation of hundreds on RAS simulations, extract and plot model results, and run the ERDC water level statistics code.

ESRI ArcMap 10.2.2. GIS software was used to process lidar, levee and floodwall surveys, channel surveys, land coverage rasters.

3 LPV/WBV INTERIOR FLOODING ASSESSMENT

3.1 OVERVIEW

In previous studies, each sub-polder was modeled using storage areas, storage area connections, and 1D channels. There was little to no connectivity between sub-polder models, and so it was impossible to model the entire system properly with a single model. The 1D HEC-RAS modeling approach would not be recommended given the latest 2D (two-dimensional) advancements with HEC-RAS. Figure 1 displays an example of an older HEC-RAS 1D geometry for St. Bernard Parish. Information taken from the previous polder models includes the channel cross-sections (bathymetry) and some interior pump-station information.

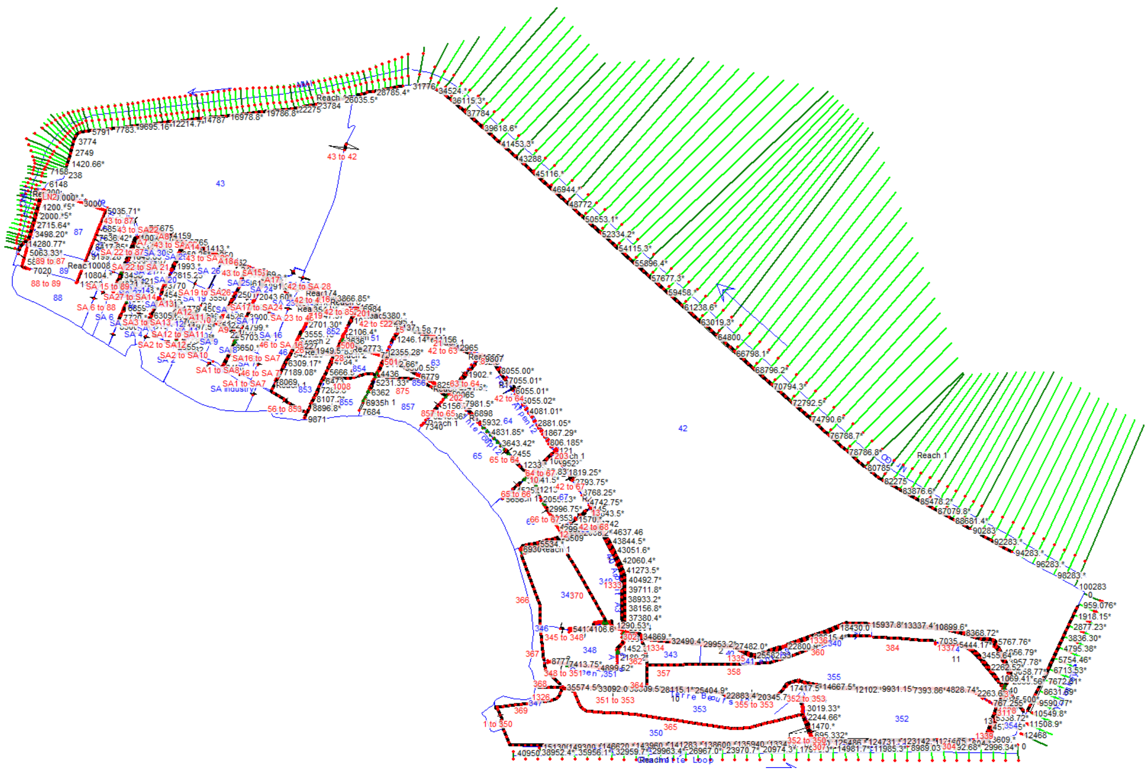

Figure 1. Example of polder model HEC RAS 1D geometry from post-Katrina study

3.2 HEC-RAS 2D MODEL DEVELOPMENT

A 2D hydrodynamic model was developed using the latest version of HEC-RAS. The HEC-RAS software has advanced considerably since previous studies of flooding of the polder interior. Given the drastic increase in capability of the newer version of HEC-RAS, an entirely new model geometry was developed using the best available data. Some input data from older models was incorporated into the latest HEC-RAS model, including a 1D/2D HEC-RAS model of the Orleans Metro Polder developed by Saint Paul District in 2018.

Separate 2D meshes were created for each sub polder. The LPV includes 2D meshes for St Charles, Orleans and Jefferson Parish east bank, the IHNC Corridor, New Orleans East, and St. Bernard Parish. The WBV includes 2D meshes for Waggaman, Gretna, Belle Chasse and Harvey/Algiers canals. All 2D meshes are connected using storage area connections with weir profiles assigned using the latest available levee/floodwall surveys. Figure 2 and Figure 3 display the HEC-RAS 2D computational domain for the entire HSDRRS. Figure 4 and Figure 5 display a zoomed portion of the RAS 2D computational domain in an areas located near Kenner, LA. The nominal mesh resolution is 700ft. The lower mesh resolution facilitates higher computational efficiency, while still providing realistic results for large scale overtopping and inundation events.

Figure 6 displays the Manning's n values applied to the HEC-RAS 2D mesh. Table 1 contains the Manning's n values applied to the HEC-RAS 2D mesh. The 2011 National Land Cover Database was used in this modeling effort. More information on this dataset is provided at http://www.mrlc.gov/. Manning's values were assigned to the various land coverage types in a manner consistent with other MVN H&H analyses.

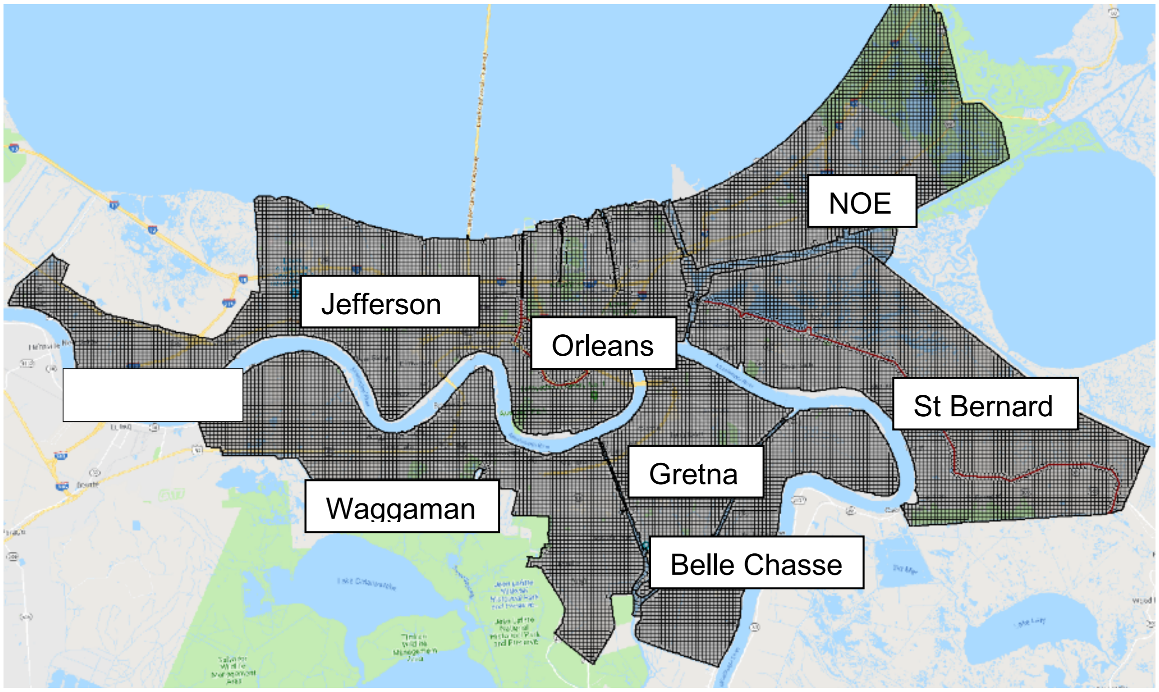

Figure 2. HEC-RAS computational mesh

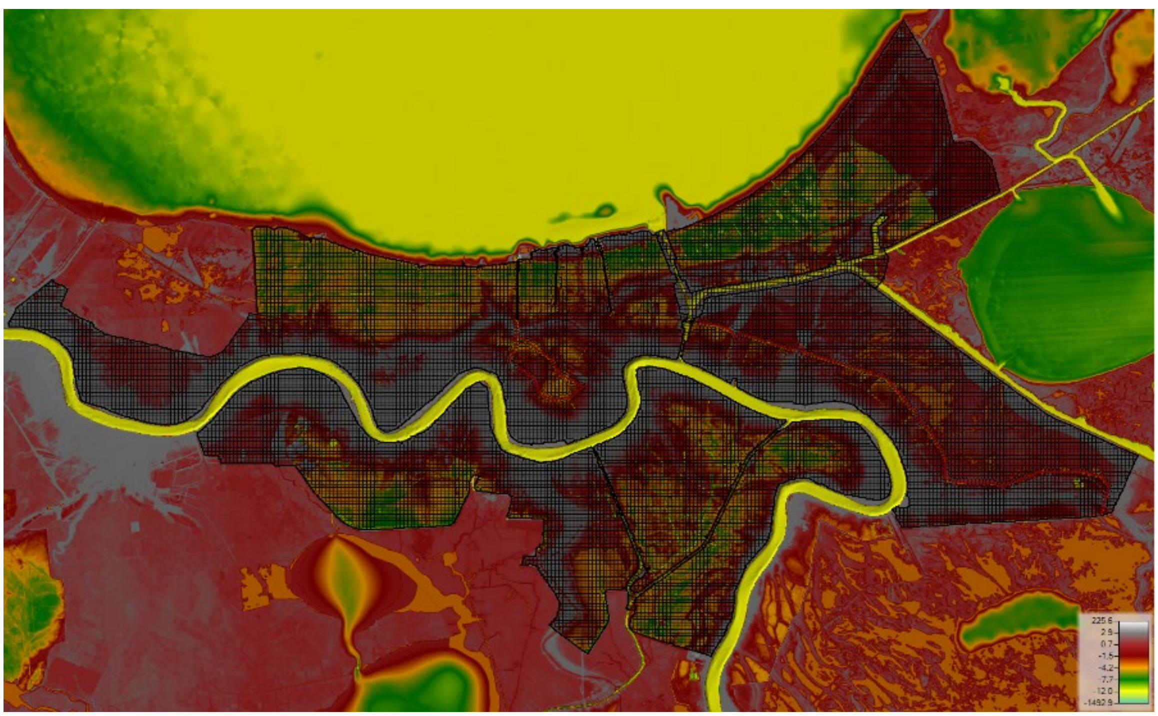

Figure 3. HEC-RAS computational mesh and terrain (ft. NAVD88)

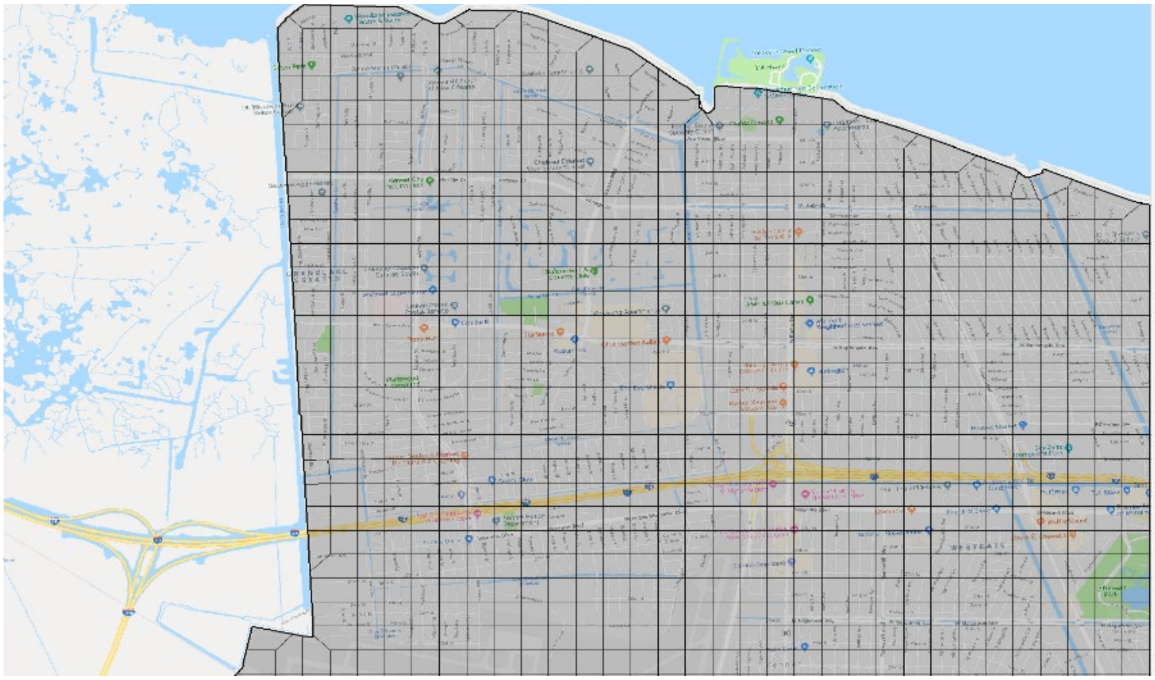

Figure 4. HEC-RAS computational mesh for HSDRRS interior near Kenner, LA

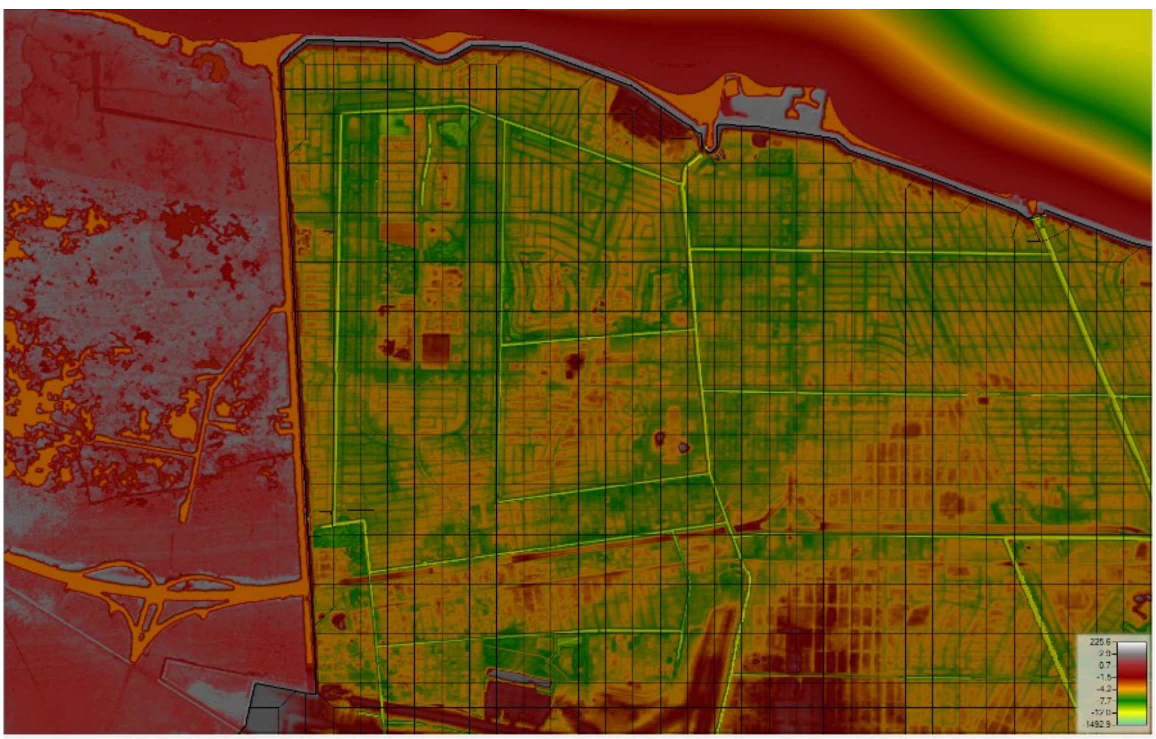

Figure 5. HEC-RAS computational mesh and terrain at HSDRRS interior near Kenner, LA (ft. NAVD88)

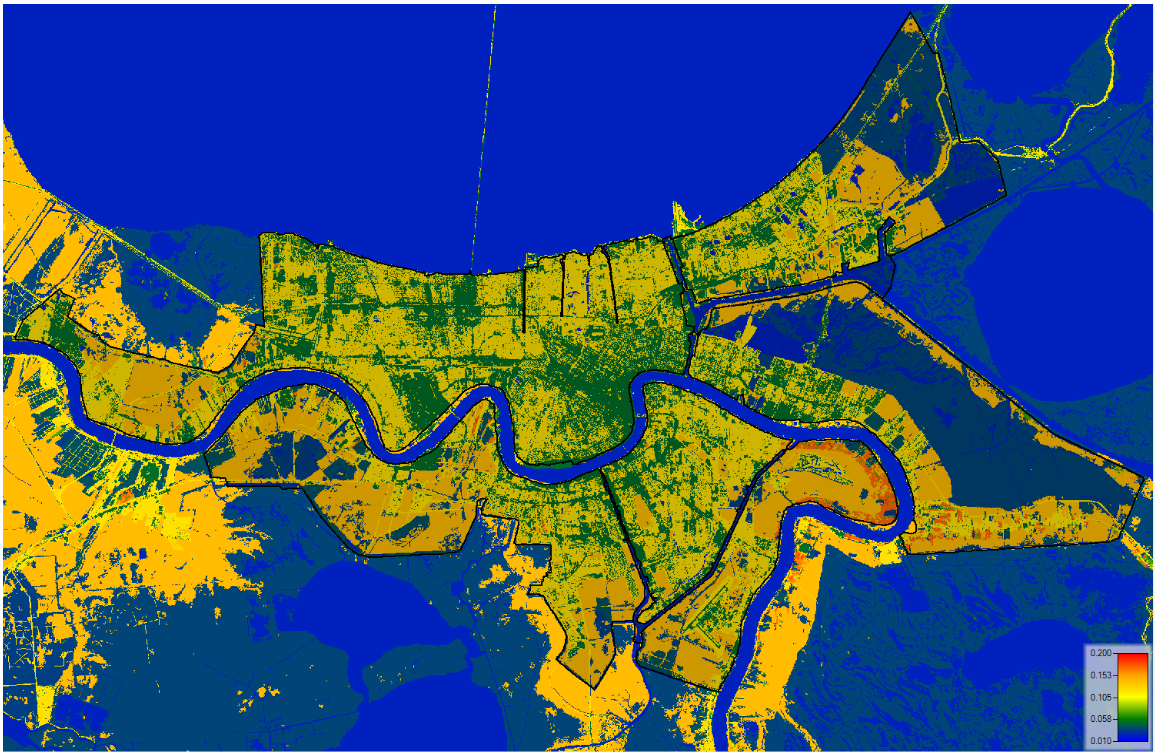

Figure 6. HEC-RAS Manning's n values

Table 1. Manning's n-values applied to HEC-RAS 2D model

value	description	n-value
11	Open Water	0.022
21	Developed, Open Space	0.12
22	Developed, Low Intensity	0.121
23	Developed, Medium Intensity	0.05
24	Developed, High Intensity	0.05
31	Barren Land	0.04
41	Deciduous Forest	0.16
42	Evergreen Forest	0.18
43	Mixed Forest	0.17
52	Shrub/Scrub	0.07
71	Grassland/Herbaceous	0.035
81	Pasture/Hay	0.033
82	Cultivated Crops	0.04
90	Woody Wetlands	0.14
95	Emergent Herbaceous Wetlands	0.035

3.3 HEC-RAS MODEL VALIDATION

The HEC-RAS 2D model was validated by simulating hurricane Katrina for the Orleans Metro and Jefferson Parish portion of the model geometry. During Katrina, interior floodwalls along the 17th Street Canal, London Canal and the western side of the IHNC were breached, allowing a tremendous volume to inundate the Jefferson Parish and Orleans Metro polder. Data from a separate HEC-RAS analysis conducted by Saint Paul District (MVP) was utilized in the latest simulation of Hurricane Katrina. The MVP model estimated the inflow into the polder by modeling the breaches using lateral structures with a specified breach width, invert and timing of failure. The MVP model setup produced realistic results of the inundation within the polder. All pump flow time-series, breach locations and widths, breach timing, observed high water marks, rainfall, and other model assumptions were consistent with information from the Interagency Performance Evaluation Taskforce (IPET) report. To validate the HEC-RAS 2D model used in the latest analysis, flows at each breach and pump location were extracted from the MVP model and applied at the boundary of the latest 2D mesh. Given that the boundary conditions are nearly equivalent, the latest simulation produced very similar results to the MVP model. The simulation shows that the latest 2D interior model produces realistic results when accurate inflows/outflows are applied at the model boundary.

Figure 7 displays a map with the Orleans Metro Polder divided into separate polygons. Each polygon contains observed high water mark data used in the validation of the model. Table 2 contains the comparison of observed and modeled high water mark data for the Orleans Metro Polder for Hurricane Katrina. Four separate model runs were compared. The first simulation is an early 1D model developed around the time of IPET using HEC-RAS 3.2. The second simulation is the MVP 1D/2D model developed in 2018 using HEC-RAS 4.0.2. The third simulation is the latest 2D polder model using HEC-RAS 5.0.7. The fourth simulation the latest 2D polder model without rainfall. The comparison of model to measurements shows that all simulations provide realistic water surface elevations and inundation extents. When rainfall is removed from the simulation, the water levels drop a few tenths of a foot in some areas, and drop by roughly 1ft in others. For the Katrina simulation, a single rainfall time-series was applied for the entire 2D mesh. It is unclear how realistic this assumption is given the wide spatial variability of rainfall during hurricanes. Despite totaling approximately 11.5 inches over a 24-hr period, removal of the rainfall does not significantly alter the validation of the model for this particular storm. For other storms, rainfall might be more significant. Figure 8 and Figure 9 display the maximum water surface elevation from the simulation of Hurricane Katrina for the 2018 MVP model and the latest 2020 HEC-RAS model. The comparison of model results shows very similar flood extents and elevations.

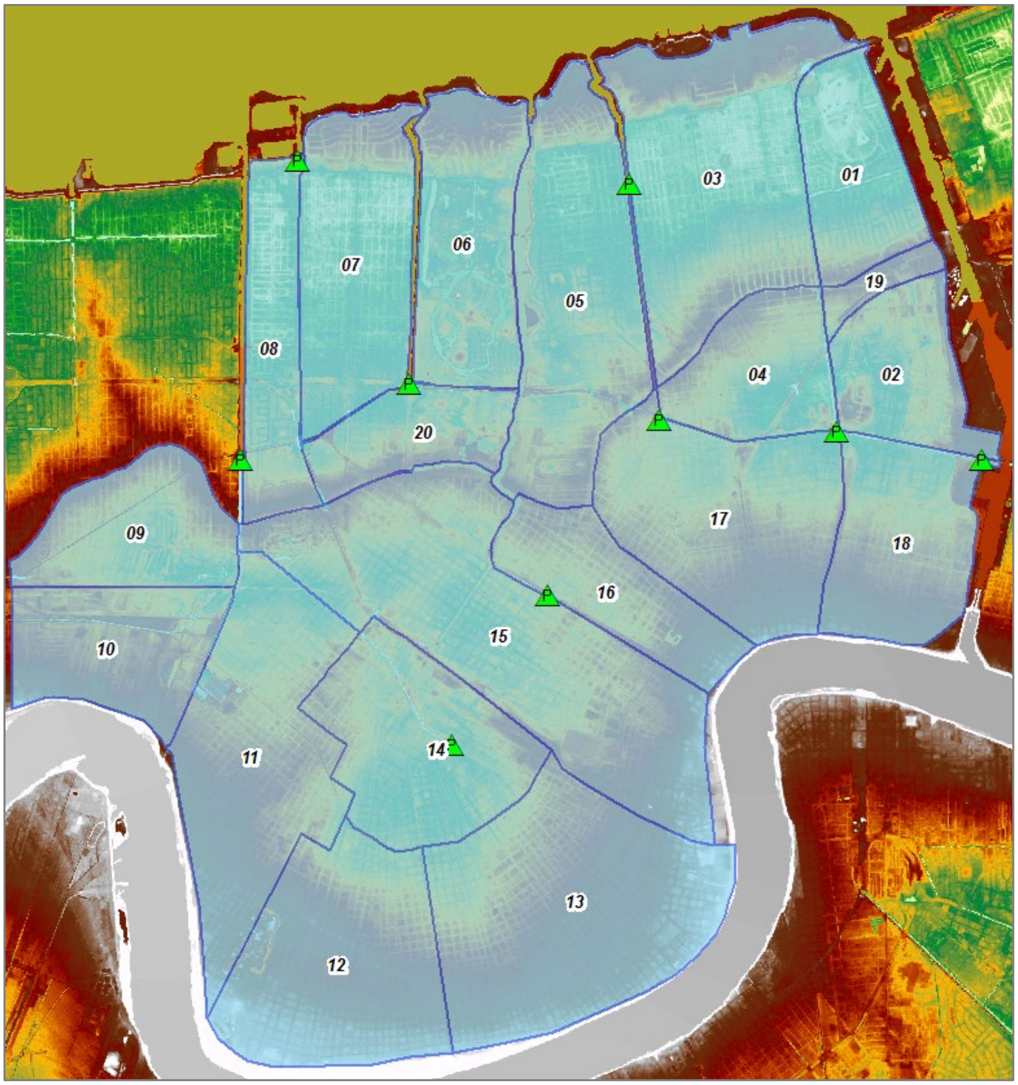

Figure 7. Orleans metro polder divisions used in high water mark comparison

Table 2. Comparison of observed and modeled high water mark data for Hurricane Katrina for Orleans Metro Polder

Storage Area	Measured High Water (ft, NAVD88)			HEC-RAS 3.2 Beta (1D Model) Calculated High Water (ft, NAVD88)	HEC-RAS 5.0.4 (1D/2D Model) Calculated High Water (ft, NAVD88)	HEC-RAS 5.0.7 (2D Model) Calculated High Water (ft, NAVD88)	HEC-RAS 5.0.7 (2D Model Without Rain) Calculated High Water (ft, NAVD88)
	# of HWM	Average	Range				
1	1	2.6	2.6	2.8	2.7	3.3	2.6
2	5	4.7	3.4 – 5.3	4.9	4.3 – 10.9	4.8	4.5
3	3	2.9	2.2 – 3.3	3.0	3.5	3.3	2.6
4	3	3.9	3.8 – 4.0	3.6	3.7 – 4.3	3.9	3.5
5	3	3.1	3.0 – 3.2	3.0	3.4	3.3	3.0
6	2	3.2	3.2 – 3.3	3.5	3.4	3.3	3.0
7	3	3.7	3.6 – 3.8	3.7	3.7	3.3	3.0
8	1	3.8	3.8	3.7	3.7 – 3.8	3.3	3.0
9	2	2.8	2.8	2.7	2.9	3.3	2.2
10	0			2.7	2.9	3.3	2.2
11	4	3.0	2.9 – 3.1	3.0	2.9	3.3	2.2
12	0			3.0	2.9	3.3	2.2
13	6	2.6	2.7 – 2.8	3.0	2.9	3.3	2.3
14	6	2.9	2.8 – 3.0	3.0	2.9	3.3	2.3
15	9	2.8	2.3 – 3.0	3.0	3.0	3.3	2.3
16	1	2.9	2.9	3.0	3.0	3.3	2.7
17	7	3.3	3.0 – 4.0	3.6	3.3 – 4.6	3.5	3.4
18	7	4.7	2.4 – 5.7	4.9	4.6 – 9.5	5.5	5.4
19	0			3.1	3.5 – 4.2	4.5	4.3
20	1	2.5	2.5	3.5	3.4	3	2.9

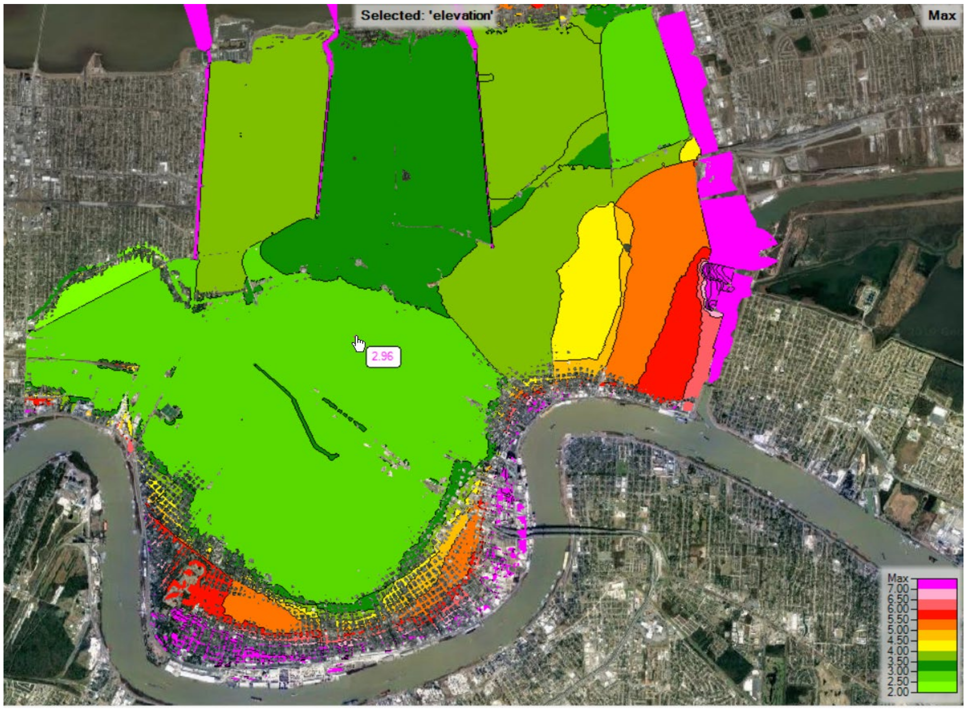

Figure 8. Hurricane Katrina maximum water surface elevation from 2018 MVP HEC-RAS 1D/2D model

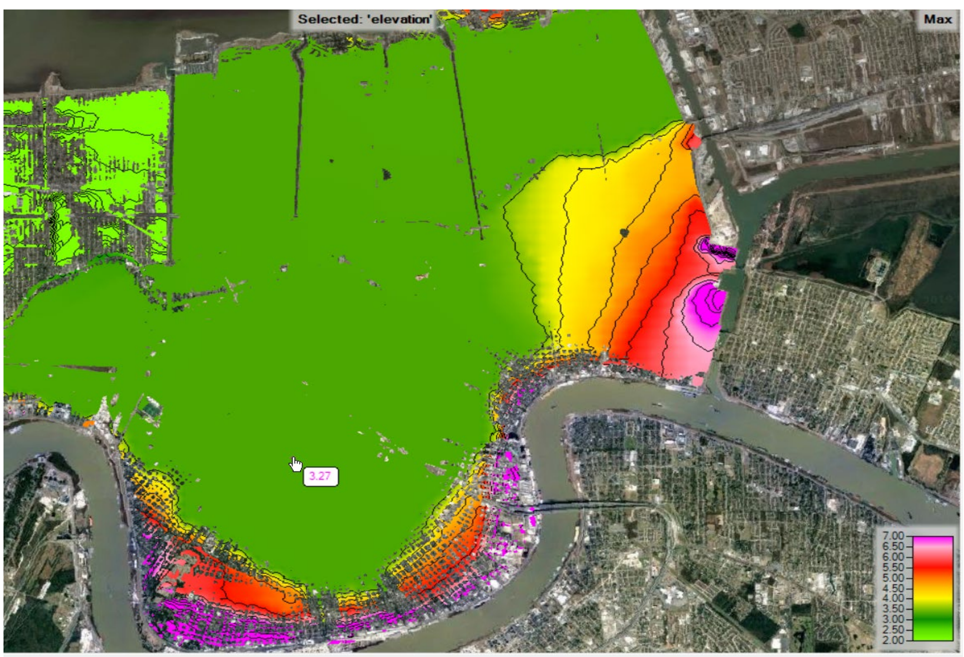

Figure 9. Hurricane Katrina maximum water surface elevation from 2020 MVN HEC-RAS 2D model

3.4 LEVEE SURVEYS, LIDAR, CHANNEL BATHYMETRY, PUMPS

The Corps collected comprehensive elevation surveys of all HSDRRS perimeter levees in 2019. No floodwalls were included in the latest survey. All floodwall elevations were assigned based on the NCC surveys. The perimeter levee and floodwalls are not incorporated into the HEC-RAS 2D geometry, but are instead used in overtopping calculations. Elevation profiles for the storage area connections, which allow polder to polder flow, were assigned based on the latest survey information.

RAS Terrain data was obtained from the USGS Northern Gulf Topo-Bathy dataset, which includes high resolution lidar of the HSDRRS interior. More information about USGS dataset can be found here: https://www.usgs.gov/land-resources/eros/coned. Channel bathymetry for all interior drainage canals was extracted from the post-Katrina era RAS1D polder models. Channel bathymetry and lidar were merged into a continuous terrain dataset in RAS Mapper.

Pump information including location and peak capacity was extracted from the Corps pump database located on the EGIS server. The pumps in the model are modeled as 2D area connections with outlet rating curves. The rating curve approach ensures the peak capacity of each pump is utilized in the simulations. The pumps are assigned mostly along the perimeter of the mesh and are set to discharge the water out of the system. Some pumps are set to discharge from one 2D area to another, such as those pumping into the IHNC corridor or into Harvey and Algiers canals. The rating curve approach to modeling pump-stations does not account for decreased pump flow during high head scenarios. The approach taken with the modeling allows somewhat more water to be removed from the system that would occur in reality during a surge overtopping event. Figure 10 displays the locations and total capacities (cfs) of pump-stations within the HSDRRS.

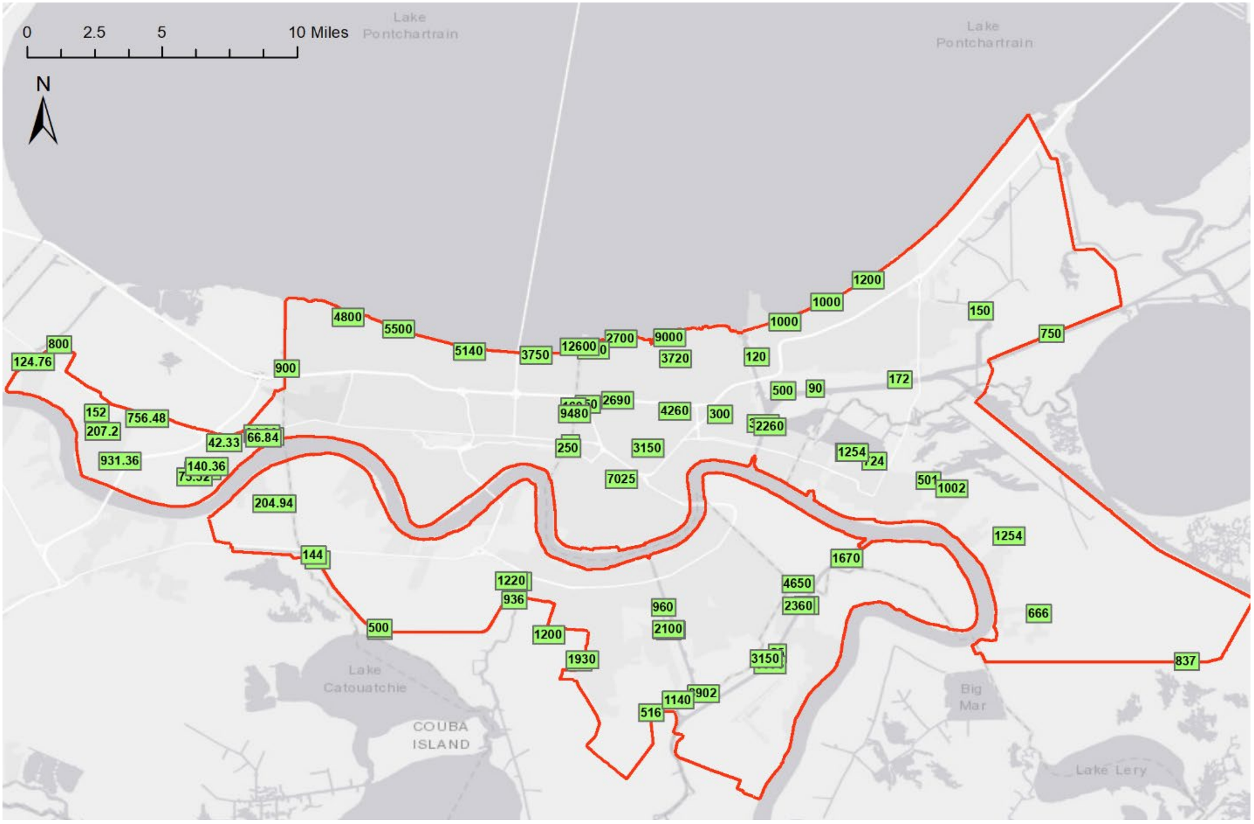

Figure 10. Major pump stations within HSDRRS

3.5 OVERTOPPING FLOW BOUNDARY CONDITIONS AND INITIAL CONDITIONS

Overtopping rates were calculated at the HSDRRS perimeter and applied as boundary conditions for the HEC-RAS 2D model. As part of the design of HSDRRS, the system was divided into 427 hydraulic design segments. Each segment has unique levee or floodwall geometry and hydraulic boundary conditions including still water elevation (swe), significant wave height (Hs) and mean wave period (Tm). The latest version of the design segment shapefile was extracted from EGIS for LPV/WBV as well as the co-located MRL. In total, 427 segments are processed with a series of Matlab scripts that calculate overtopping time-series at each location for all 152 synthetic storms.

ADCIRC Hydrographs for all 152 synthetic storms were extracted at each segment using a Matlab script. The ADCIRC surge hazard dataset used is from the 2017 CPRA master plan. The levee heights and alignments applied in the 2017 CPRA ADCIRC mesh provide a decent representation of the existing 2020 HSDRRS. Peak significant wave heights and wave periods were extracted at each design segment. The wave time-series data was not extracted from the CPRA ADCIRC+SWAN simulations. Instead, the surge elevation time-series were normalized to the peak wave values, producing an approximate wave time-series needed for the overtopping calculations. This assumption is conservative since it assumes the peak wave and surge will be coincidental. This assumption was also made by USACE in the post-Katrina surge hazard analysis. Additional inputs into the overtopping calculations include levee geometry parameters including wave berm elevation, levee slope and crest elevations. Levee and floodwall surveyed elevations were mapped to each of the 427 segment profiles.

Wave overtopping rates for levees were calculated using the equations 5.10 and 5.11 provided in Eurotop overtopping manual (Figure 11). Equation 5.17 was used for floodwalls. These equations represent the “mean-value” estimate of overtopping. More information about the Eurotop formulae can be found here: http://www.overtopping-manual.com/. A specialized Matlab function was written to estimate overtopping for levees or floodwalls and for surge and wave overtopping. If the surge elevation is less than the crest elevation, wave overtopping formuale are used. If the surge elevation is greater than the crest elevation, the Eurotop recommended weir equation is combined with the wave overtopping formulae, and the relative freeboard (Rc) value is set to 0. This approach is consistent with the guidance provided in the Eurotop manual. Overtopping rate time-series were calculated at each survey point along each of the 427 design segments. The resulting overtopping rates at each survey point are multiplied by the width between each point, then summed to produce a total flow for each segment. The overtopping time-series at each segment are then summed to the corresponding RAS 2D flow boundary. In total, 81 flow boundary conditions were assigned to the RAS 2D geometry.

$$\frac{q}{\sqrt{g \cdot H_{m0}^3}} = \frac{0.023}{\sqrt{\tan\alpha}} \gamma_b \cdot \xi_{m-1,0} \cdot \exp[-(2.7 \frac{R_c}{\xi_{m-1,0} \cdot H_{m0} \cdot \gamma_b \cdot \gamma_f \cdot \gamma_\beta \cdot \gamma_v})^{1.3}] \qquad 5.10$$

with a maximum of

$$\frac{q}{\sqrt{g \cdot H_{m0}^3}} = 0.09 \cdot \exp[-(1.5 \frac{R_c}{H_{m0} \cdot \gamma_f \cdot \gamma_\beta \cdot \gamma *})^{1.3}] \qquad 5.11$$

Figure 11. Eurotop wave overtopping formulae for levees

$$\frac{q}{\sqrt{g \cdot H_{m0}^3}} = 0.047 \cdot \exp[-(2.35 \frac{R_c}{H_{m0} \cdot \gamma_f \cdot \gamma_\beta})^{1.3}] \qquad 5.17$$

Figure 12. Eurotop wave overtopping formula for vertical wall

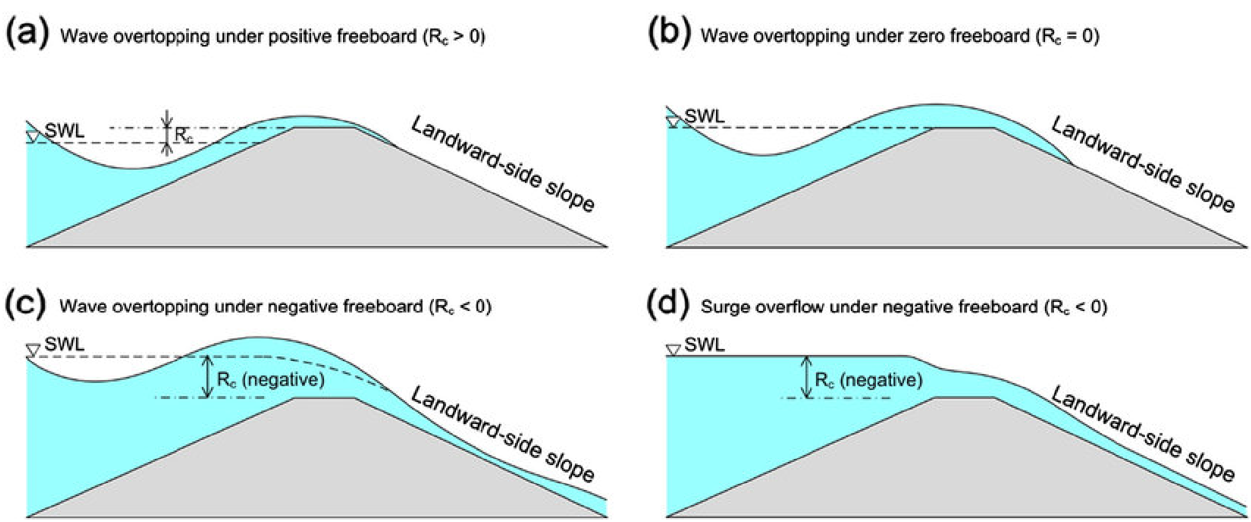

Figure 13 Wave overtopping for positive and negative free-board conditions.

Figure 14. HEC-RAS flow boundary segments (81 total segments

Figure 15 displays the levee and floodwall survey elevations for the entire HDSRRS perimeter taken from the 2019 levee survey and the NCC floodwall surveys. The LPV-HSDRRS is the continuous perimeter from Bonnet Carre Spillway to Caernarvon Diversion. For example purposes, Figure 15 also displays the peak surge and wave information along each profile for one of the synthetic storms (storm 027). The plot shows how the surge elevation is greater than the crest elevation in certain areas. For this particular storm, surge and wave overtopping occurs in several locations including St Charles Parish on the east bank, New Orleans East, and the co-located MRL. This plot was produced for all 152 synthetic storms.

Table 3 contains the starting water surface elevations assumed in the HEC-RAS modeling for different polders. The starting water surface elevations were assigned based on water surface elevations that were captured in the lidar surface. Initial water levels in the IHNC corridor and Harvey and Algiers canals were assigned based on the closure trigger levels for the IHNC surge barrier and the Western Closure Complex.

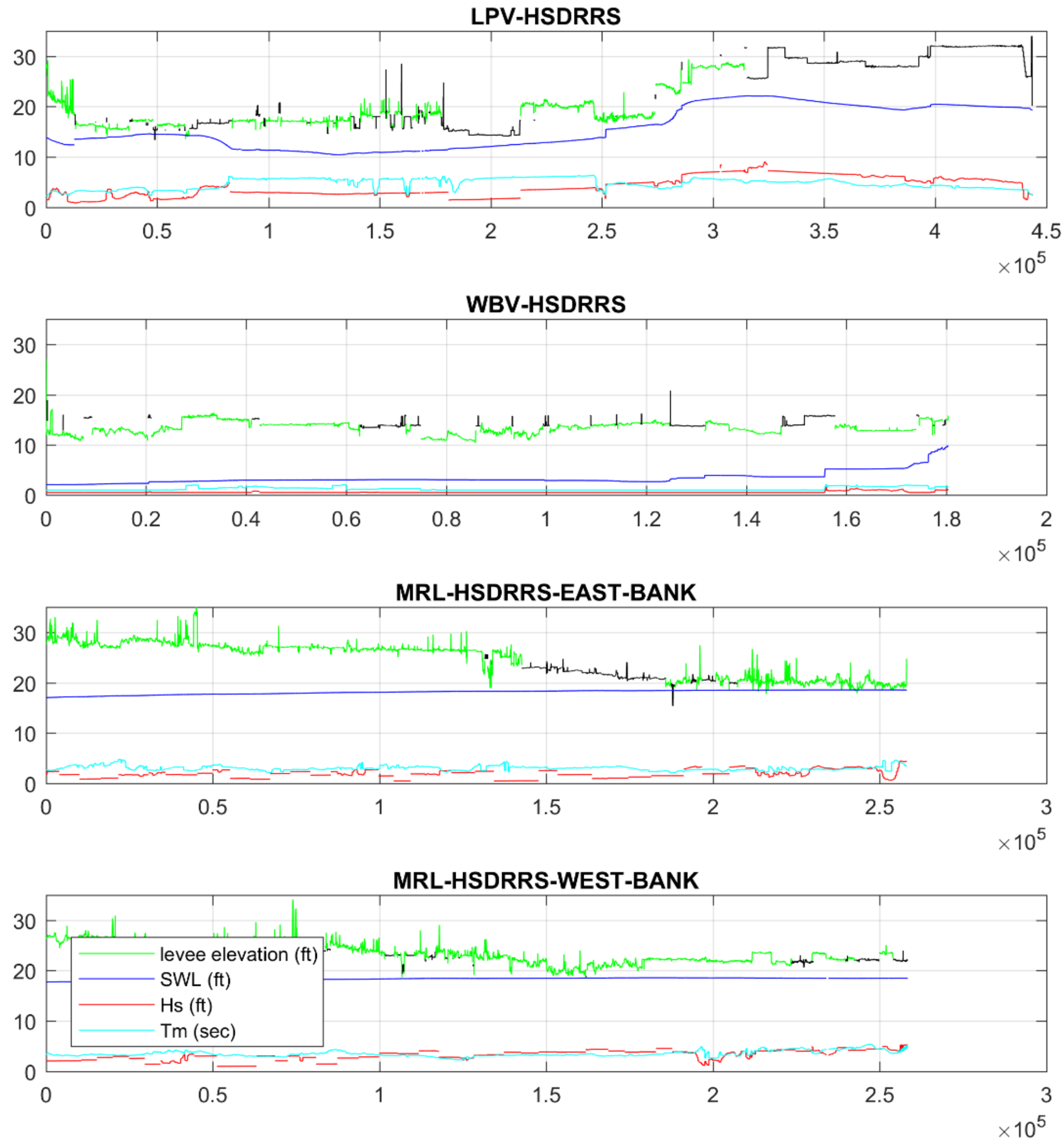

Figure 15. Levee and floodwall elevations, peak surge elevations and waves for synthetic storm 027

Table 3. Starting water surface elevations in HEC-RAS modeling.

Scenario	Starting Water Surface Elevation (ft. NAVD88)
St Charles, Jefferson, Orleans	-13.5
IHNC	3.0
New Orleans East	-15
Saint Bernard	-7
Waggaman	-10.9
Gretna	-10.9
Belle Chasse	-10.9
Harvey and Algiers Canals	2.5

3.6 HEC-RAS 2D SIMULATIONS OF 152 SYNTHETIC STORMS

HEC-RAS simulations were computed for all 152 JPM-OS synthetic storms. The storms cover a range of hypothetical tracks, forward speeds, intensities and sizes. Figure 16 displays the tracks for all 152 synthetic storms compared against a series of historically significant storms. The JPM-OS synthetic storms are basically an extension of the limited observed record. Figure 17 compares the wind-speeds of the synthetic storms compared against the historically significant storms. The synthetic storms are parametrically similar to actual storms in the record. All 152 storms must be simulated in order to estimate storm surge statistics.

As previously described, the overtopping time-series for each storm was applied to the RAS 2D polder model. To accomplish the task of running 152 synthetic storms, a specialized Matlab script was written to automate the process. The Matlab script overwrites and unsteady flow file with overtopping flow time-series at each boundary segment for a given storm, then runs the simulation and saves the results. Figure 18 displays the peak water surface elevation produced by synthetic storm 027. The figure shows overtopping in St. Charles Parish and portions of the co-located MRL, consistent with what is shown in Figure 15. The surge of this event at these locations is roughly equivalent to a 500YR return period.

The RAS simulation of one storm crashed. In this case, the overtopping flow rate was too extreme for the software to handle. A 100,000cfs limit was applied to the inflow hydrographs at each flow boundary, which resolved the stability problem.

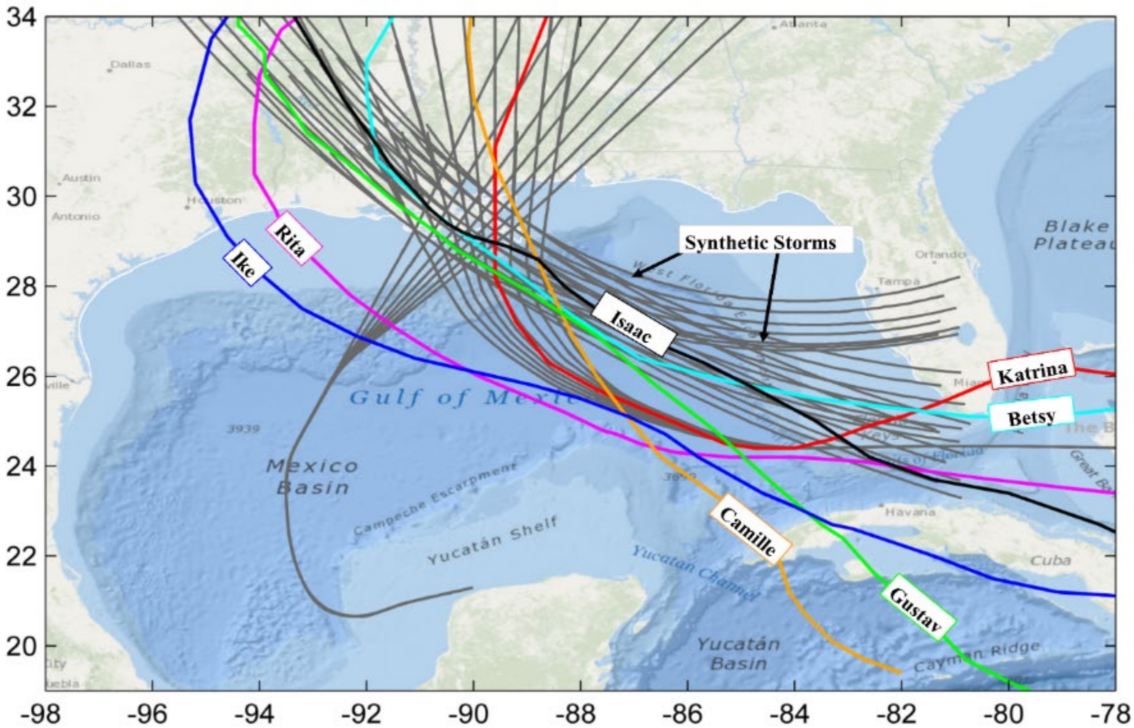

Figure 16. Storm tracks for JPM-OS synthetic events and historical storms of significance

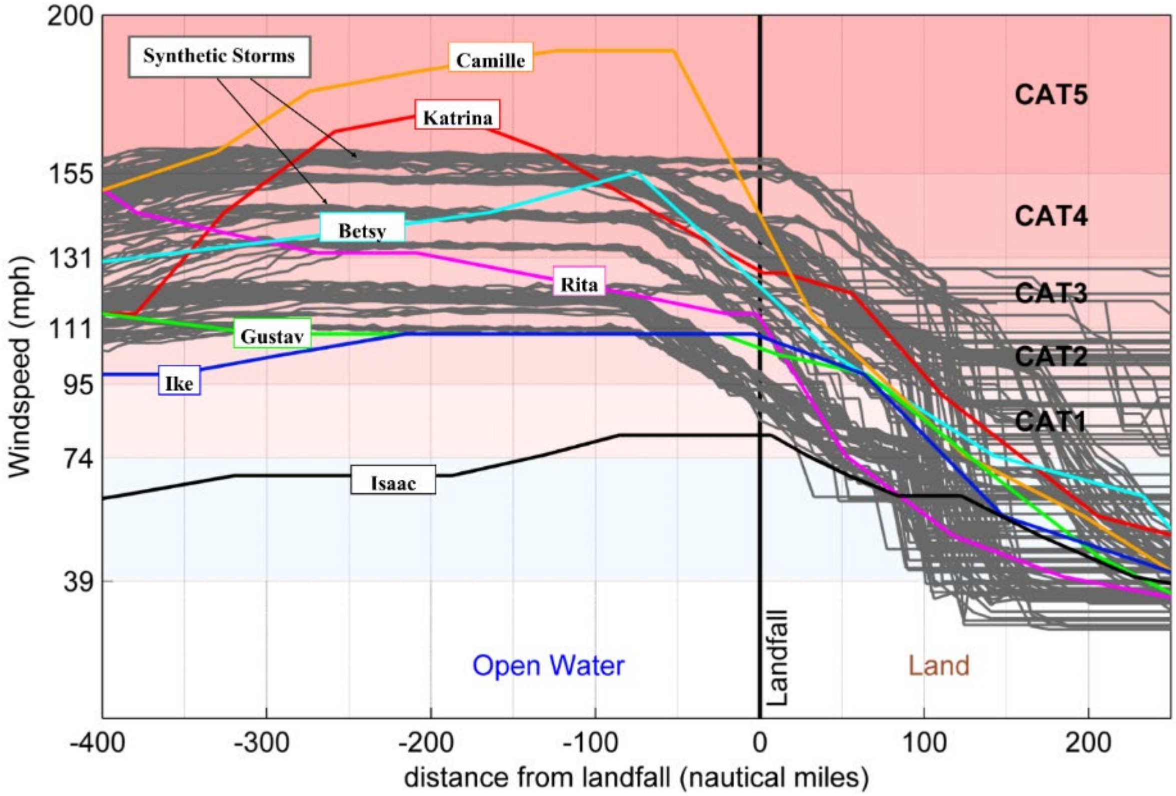

Figure 17. Storm wind-speeds for JPM-OS synthetic events and historical storms of significance

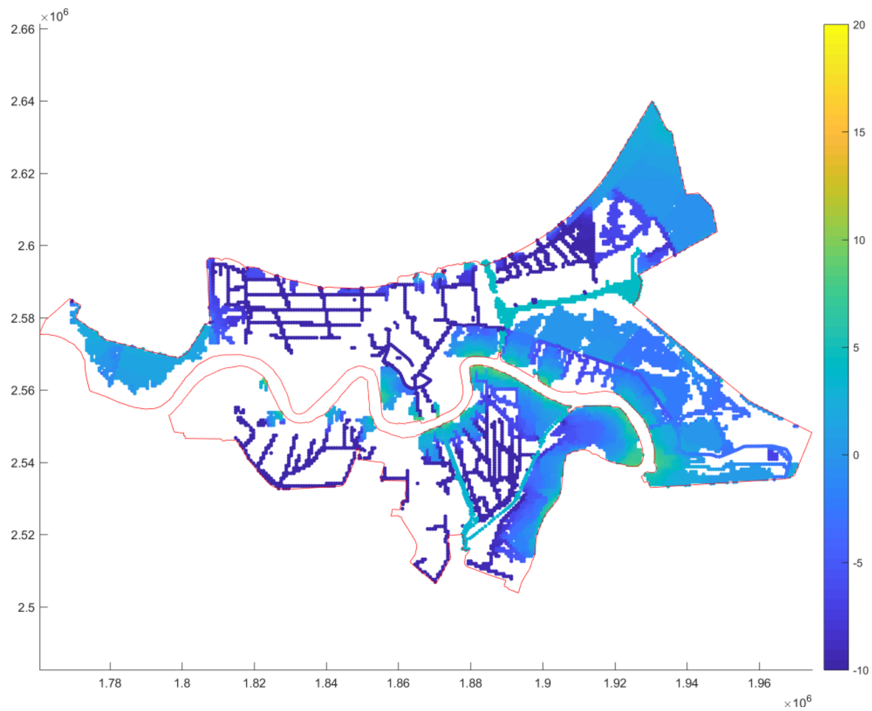

Figure 18. Peak water surface elevation (ft. NAVD88) for synthetic storm 027

3.7 INTERIOR WATER LEVEL STATISTICS

Once all 152 synthetic storms were evaluated, water level statistics could be completed using the latest JPM-OS code. The code was provided by ERDC's Coastal Hydraulics Lab. The code combines the meteorological probability and the peak surge elevation of all 152 storm events to estimate the 20YR, 50YR, 100YR, 200YR, 500YR and 1000YR surge elevations. Figure 19 displays the 100YR water surface profile for existing conditions. The model shows some overtopping in certain areas where there are known low spots relative to the 100YR required design including St. Charles Parish and portions of the co-located MRL. Figure 20 displays the 500YR water surface profile for existing conditions. The 500YR inundation is much more extensive than the 100YR. The water surface profile for each return period was provided to economics. Figure 21 and Figure 22 display the peak depth for the 100YR and 500YR frequencies for the 2023 without-project condition.

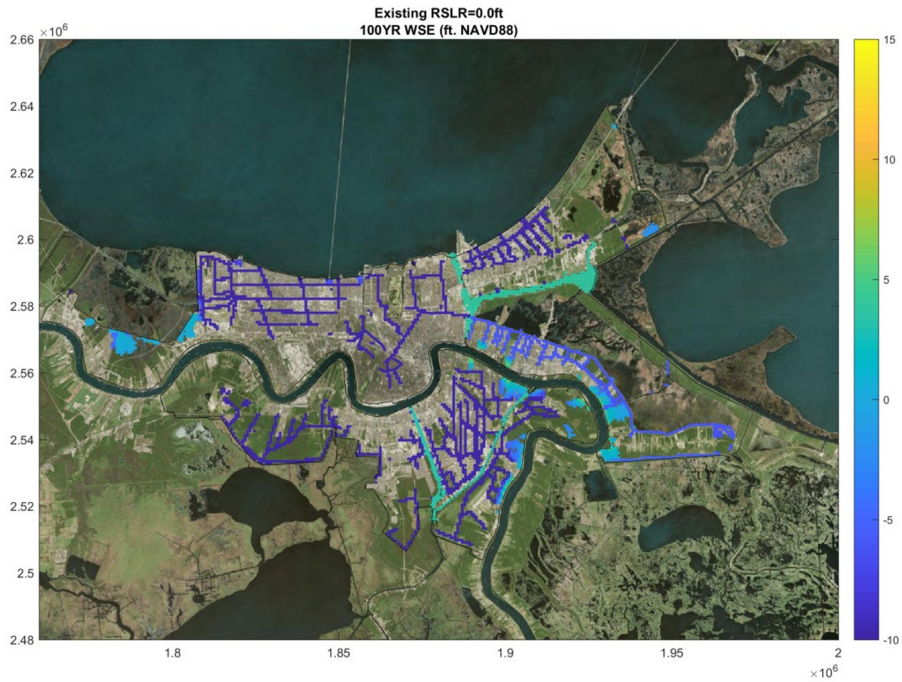

Figure 19. 100 year peak water surface elevation (ft. NAVD88) for existing 2023 conditions

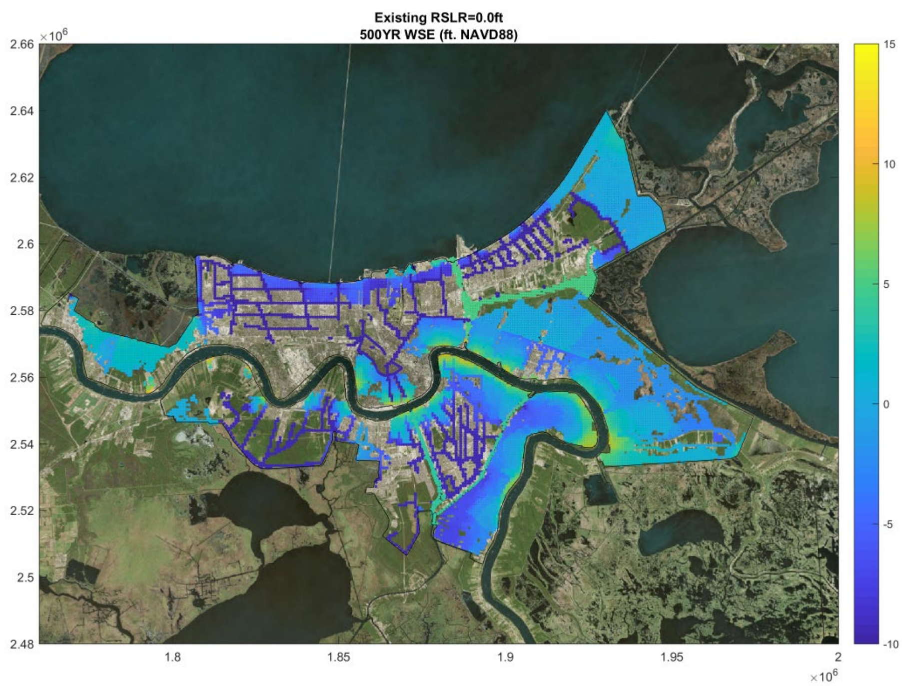

Figure 20. 500 year peak water surface elevation (ft. NAVD88) for existing 2023 conditions

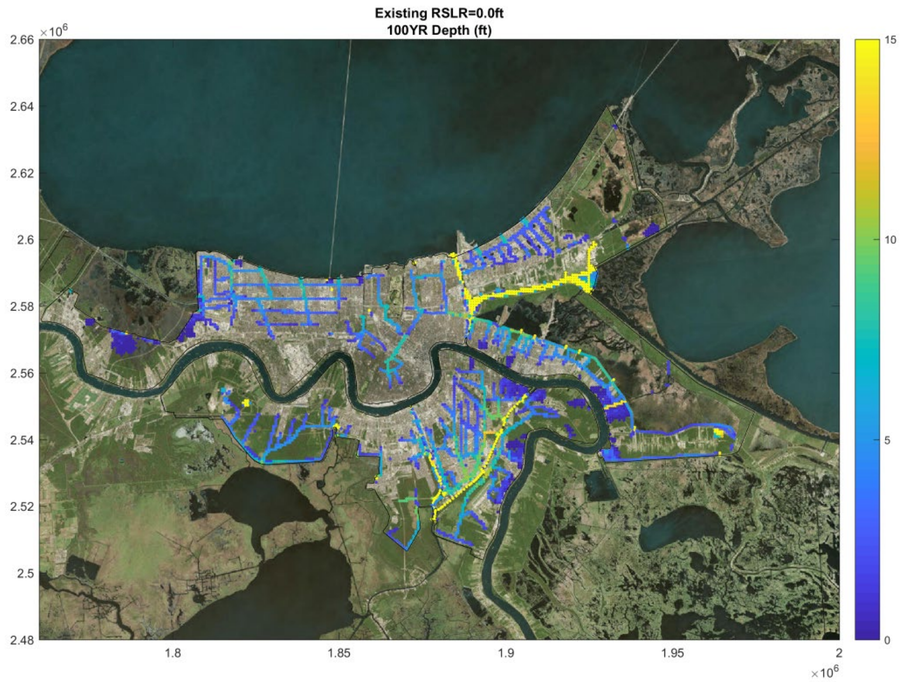

Figure 21. 100 year peak depth (ft.) for existing 2023 conditions

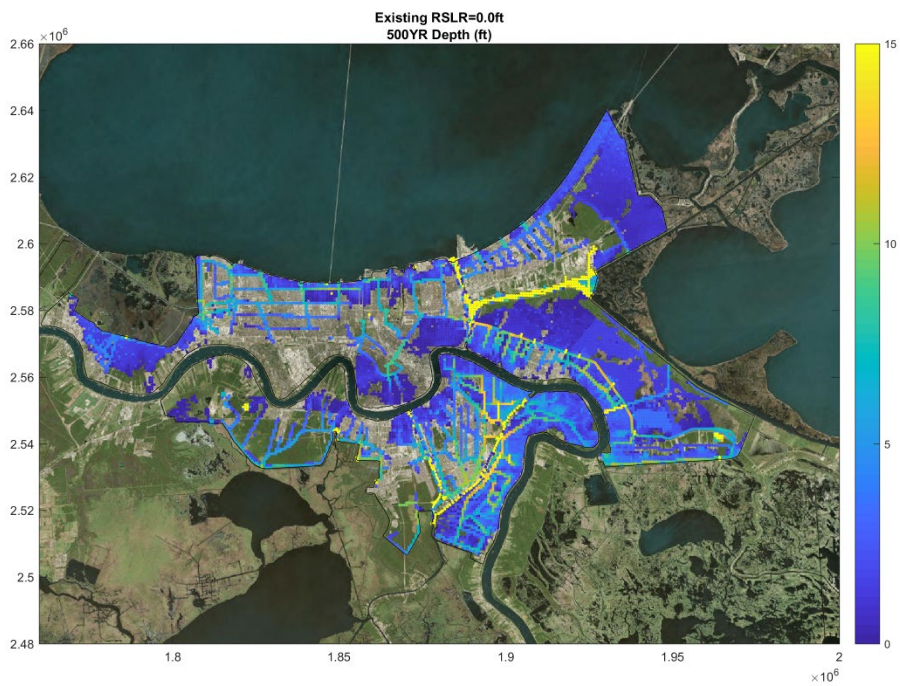

Figure 22. 500 year peak depth (ft.) for existing 2023 conditions

3.8 FUTURE CONDITIONS AND RELATIVE SEA LEVEL CHANGE

Three relative sea level change (RSLC) values were evaluated including 1.3, 1.8 and 3.4 ft. The Corps climate change website was used to determine the three RSLC amounts: http://corpsmapu.usace.army.mil/rccinfo/slc/slcc_nn_calc.html. The average RSLC projections at 7 nearby gages was used for the project evaluation. Table 4 contains the RSLC projections at the 7 gages. Low, intermediate and high RSLC projections assumed for the project evaluation are provided in Table 5 and Figure 23. The plot shows how the project performance of a system designed and built to intermediate RSLC conditions (1.8ft in 2073) would begin to decrease near 2053 for a high RSLC scenario or be extended to 2091 for the low RSLC projection. This uncertainty in project performance has been bracketed in Figure 23. Figure 24 displays the location of the 7 gages relative to HSDRRS.

Table 4. RSLC projections

Location	Rate of Ground Movement (mm/yr)	Subsidence over 50 Years (ft)	Projected RSLC from 2023 to 2073		
			Low (ft)	Int (ft)	High (Ft)
Lake Pontch West End (85625)	7.11	1.2	1.4	1.9	3.5
Rigolets (85700)	3	0.5	0.7	1.2	2.9
IHNC (76160)	8.77	1.4	1.7	2.2	3.8
Bayou Barataria (82750)	5.3	0.9	1.2	1.6	3.2
IHNC lock (01340)	5.1	0.8	1.1	1.6	3.2
MS River Carrolton (01300)	5.4	0.9	1.2	1.7	3.2
MRGO Shell Beach (85800)	8.5	1.4	1.7	2.2	3.7
average:	6.2	1.0	1.3	1.8	3.4

An evaluation was performed to estimate the performance of each project alternative up to and after year 2073, which is the ending year of the design evaluation. Corps policy demands an evaluation of major infrastructure for a time period of 100 years, which would be year 2123. The performance of the project through time depends on the RSLC projection (low/intermediate/high), the initial performance of each project alternative, and an understanding how the exterior stage-frequency changes through time for the various RSLC amounts. Figure 25 displays the estimated project performance through time for 500YR, 200YR and 100YR project alternatives at a portion of HSDRRS near the LPV Lakefront. Figure 26 displays the project performance through time for 500YR, 200YR and 100YR project alternative at a portion of HSDRRS near the WBV West Closure Complex. As described previously, the project begins to lose performance near 2053 for the high RSLC projections. For intermediate RSLC projections, the project begins to lose performance at 2073 (as designed). For low RSLC projections, the project performs adequately to 2091 and then begins to lose performance. A 200YR project alternative designed for intermediate RSLC conditions seems to guarantee 100YR performance up to roughly year 2070 for high RSLR conditions, which should be an added benefit of a 200YR project selection.

The 1% AEP project performance should not change through time for with-project conditions, assuming the project is fully funded, constructed and maintained. The goal of the project, as described in the authorization, is to maintain the project performance to the authorized level which is 1% AEP. As long as the levee lifts are frequent and include some overbuild and are based on the latest available surge hazard data, the project should be able to maintain 1% AEP though time, regardless of what RSLC is realized. The risk to the interior is only increasing if the system is not adaptively managed to keep up with RSLC based of the latest available surge hazard data. For without project conditions or for conditions where the RSLC is higher than intermediate projections and lifts did not accommodate the difference, the project performance would decrease, as shown in Figure 25 and Figure 26.

Table 5. USACE Relative Sea Level Change from 2023 to 2123. Average of 7 gages.

	Low	Int	High
2023	0.0	0.0	0.0
2028	0.1	0.2	0.3
2033	0.3	0.3	0.5
2038	0.4	0.5	0.8
2043	0.5	0.6	1.1
2048	0.6	0.8	1.4
2053	0.8	1.0	1.8
2058	0.9	1.2	2.2
2063	1.0	1.4	2.6
2068	1.2	1.6	3.0
2073	**1.3**	**1.8**	**3.4**
2078	1.4	2.0	3.8
2083	1.5	2.2	4.3
2088	1.7	2.4	4.7
2093	1.8	2.6	5.2
2098	1.9	2.8	5.7
2103	2.1	3.1	6.3
2108	2.2	3.3	6.9
2113	2.3	3.5	7.4
2118	2.4	3.8	8.0
2123	**2.6**	**4.0**	**8.6**

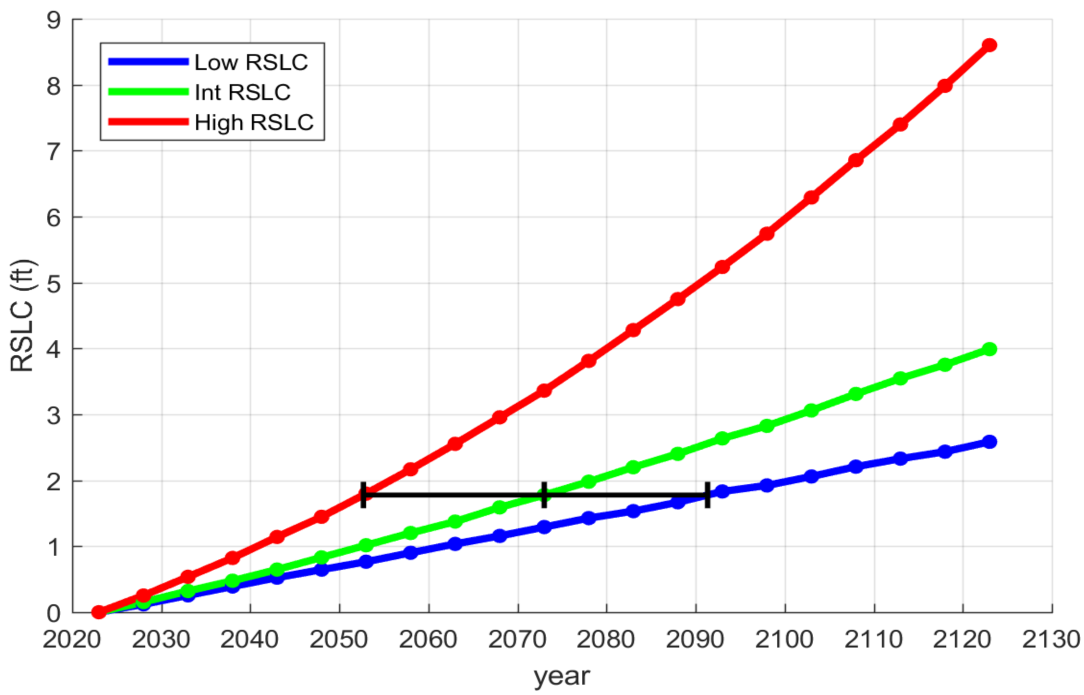

Figure 23. Low, intermediate and high relative sea level change projections from 2023 to 2123

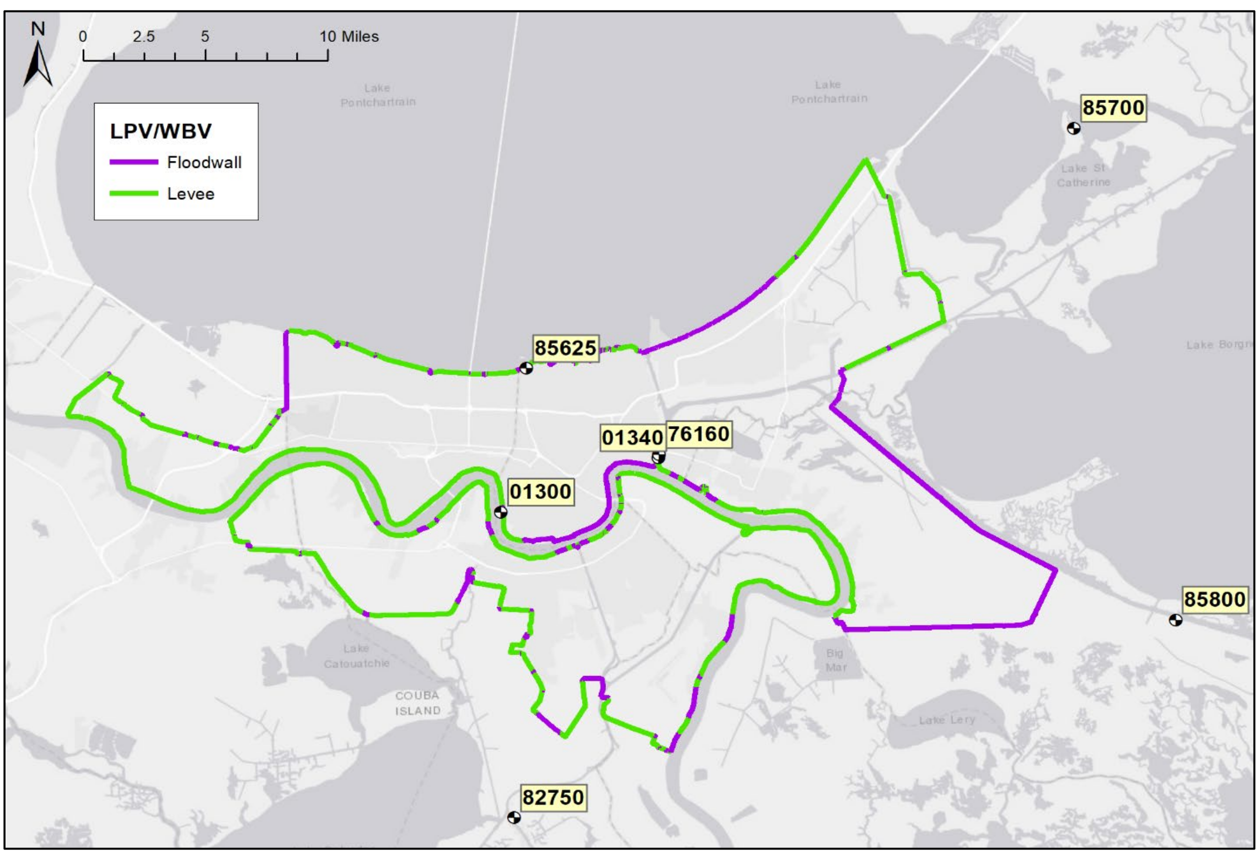

Figure 24. Location of water level gages used to determine RSLC projections

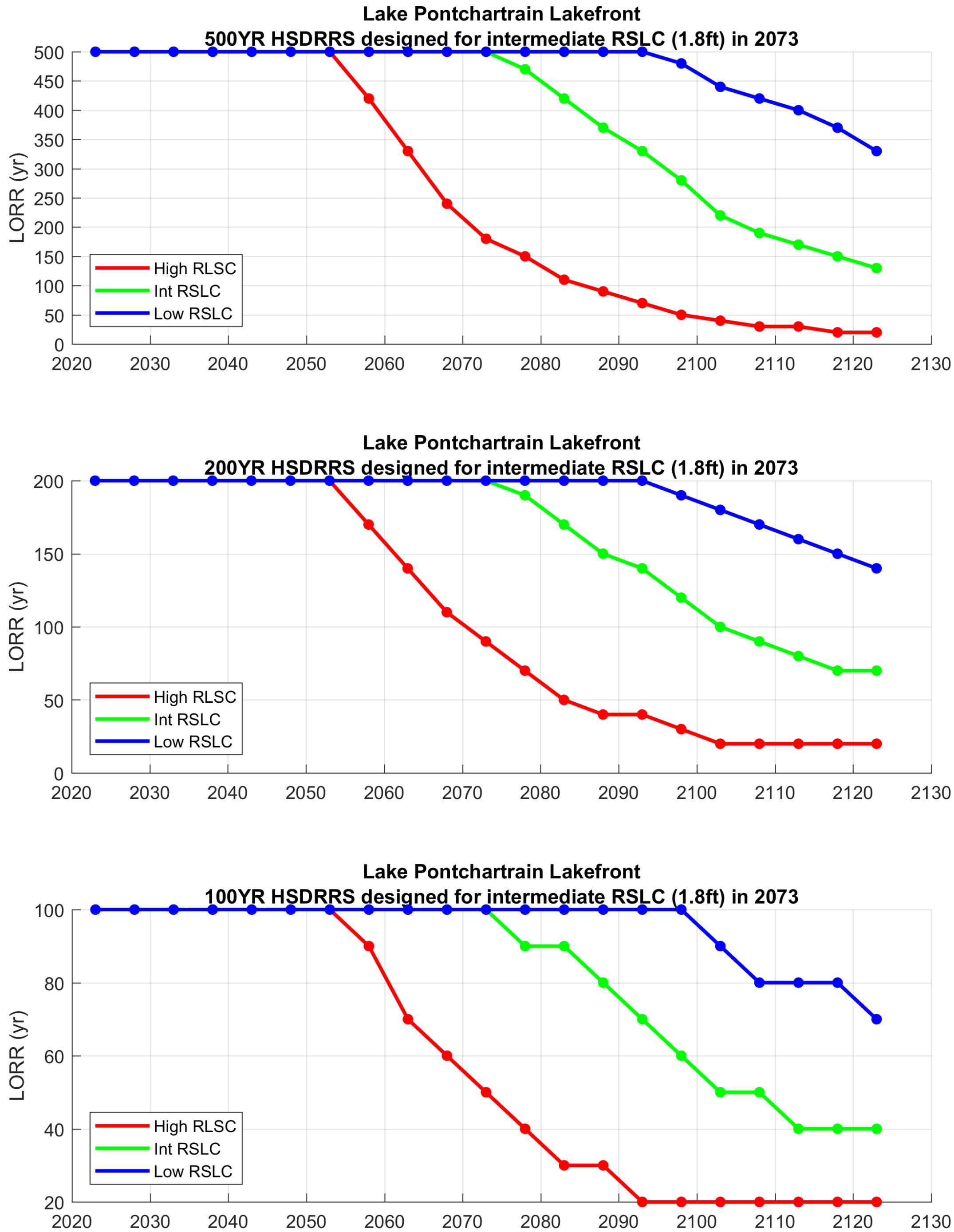

Figure 25. Project performance for 500YR, 200YR and 100YR project alternatives for 3 RSLC projections at a location along the LPV Lakefront

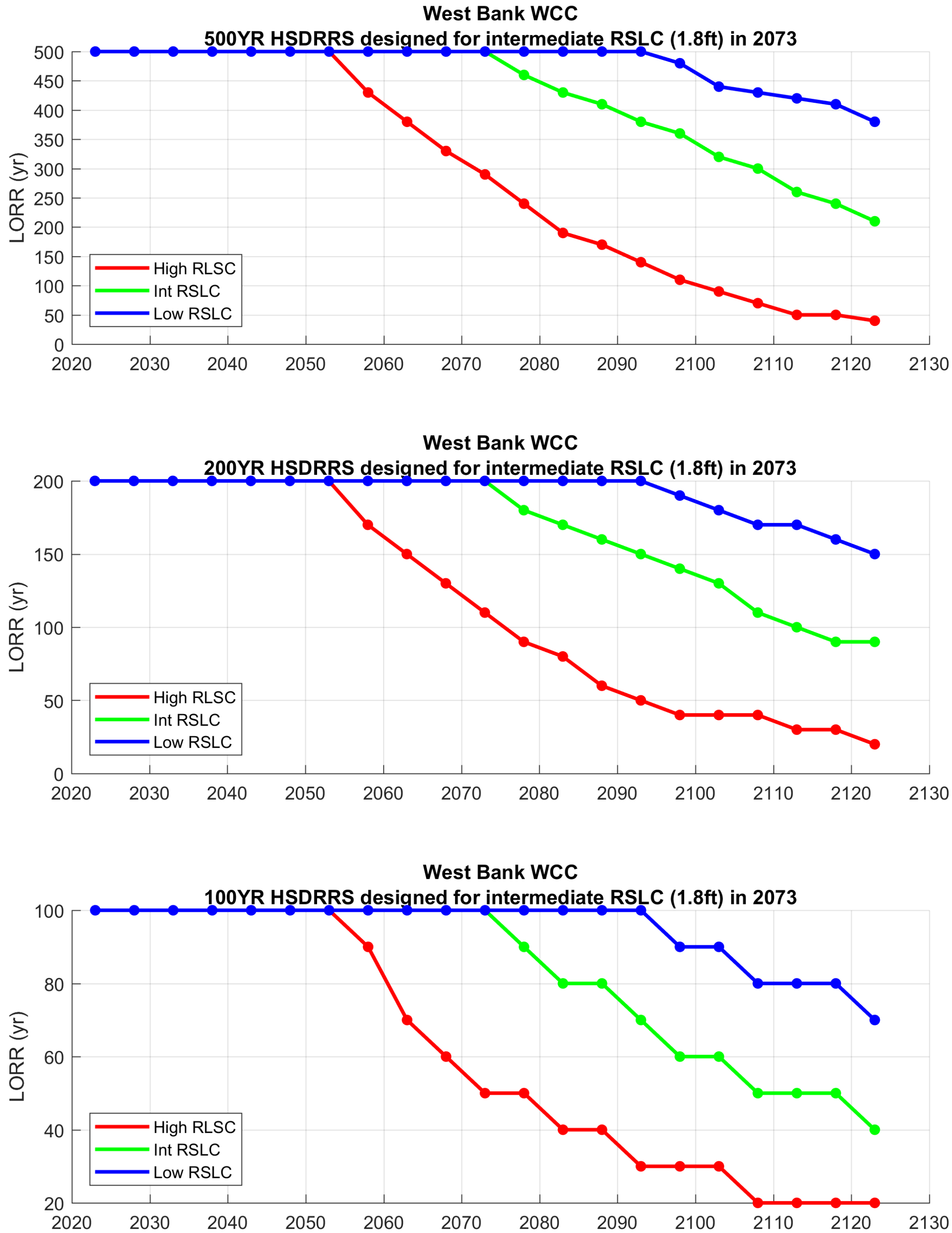

Figure 26. Project performance for 500YR, 200YR and 100YR project alternatives for 3 RSLC projections at a location on the West Bank

The overtopping calculations, RAS simulations and JPM-OS statistics were repeated for the 2073 future without-project condition for low, intermediate and high RSLC. CPRA conducted a full suite of 152 storms for the future condition. The amount of eustatic sea level rise assigned in the ADCIRC simulations was 1.5ft. The grid bathymetry was changed to reflect future conditions. Some portions of the grid were subsided and some accreted, as depicted in Figure 27. The subsidence varies by region, but around HSDRRS the amount was close to -0.5ft. For the purposes of this study, we assumed the CPRA future condition ADCIRC runs evaluated a total RSLC of approximately 2.0ft (1.5 eustatic + 0.5ft subsidence).

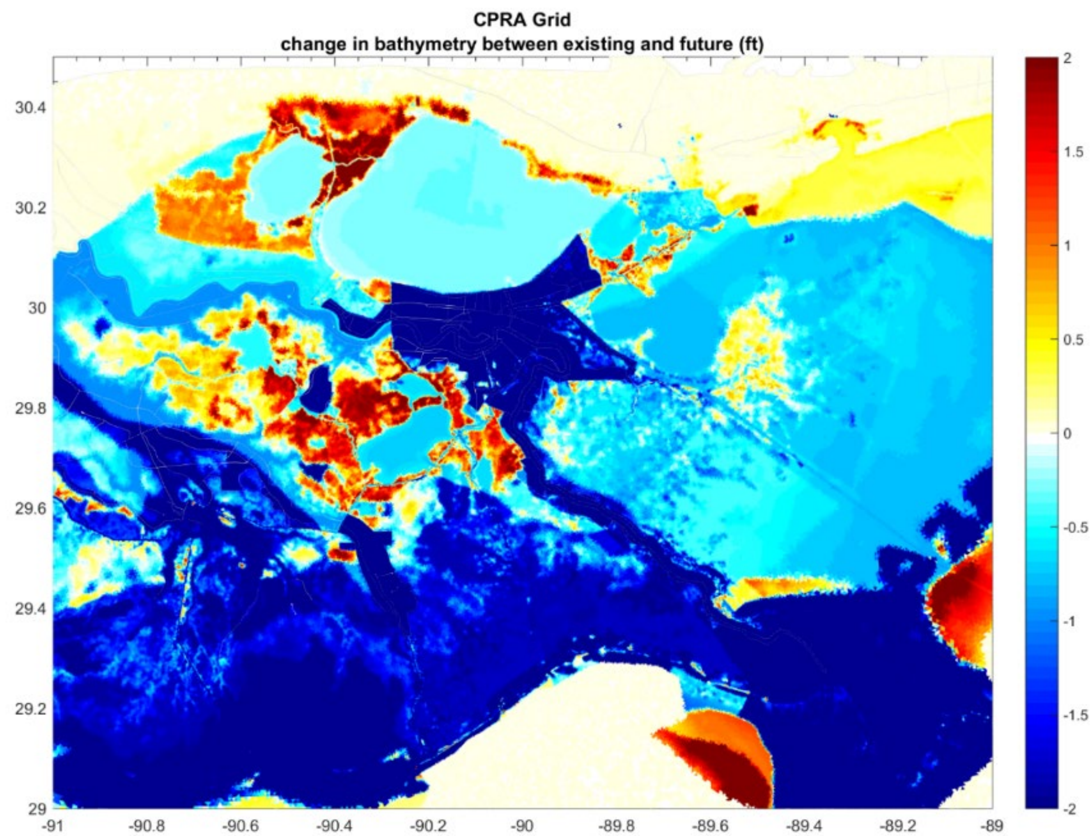

Figure 27. Change in bathymetry from existing to future conditions (CPRA mesh S13G60)

Surge and wave time-series for the future condition for the various RSLC conditions (1.3, 1.8 and 3.4) were developed using linear interpolation and extrapolation of the CPRA simulation results. CPRA conducted the full suite of 152 simulations with 0.0ft and 2.0 ft of RSLC. The confidence level for the interpolated surge and wave results (RSLC= 1.3 and 1.8ft) are higher than the extrapolated case (RSLC=3.4ft). The CPRA simulations provide the best representation of future conditions available due to the incorporation of spatially variable subsidence, land use changes, morphology and adjustments to bottom friction and canopy coefficients.

Future condition overtopping calculations also factor in levee settlement over the 50 year period of analysis. Levee settlement data was provided by the MVN Geotech branch. Levee settlement values vary by location. The worst case settlement projection is 5.4ft, but the average settlement values of all levees is 2.2ft. Figure 28 displays the projected levee settlement values provided by the MVN Geotechnical Engineering branch. No settlement was assumed for the floodwalls. The MR&T levees above the cross-over points are assumed to settle 0.5ft by 2073, although if the levee settles below the MR&T authorized grade, then it is assumed to be lifted to

MR&T authorized grade. In other words, the analysis assumes the MR&T levees are always built to at least authorized grade in the 2073 future conditions. Figure 29 displays an example of an existing and future condition levee showing the effects of local settlement, regional subsidence and eustatic sea level rise.

Figure 28. Projected levee settlement values by 2073. Levees are plotted as green line. Floodwalls are grey lines

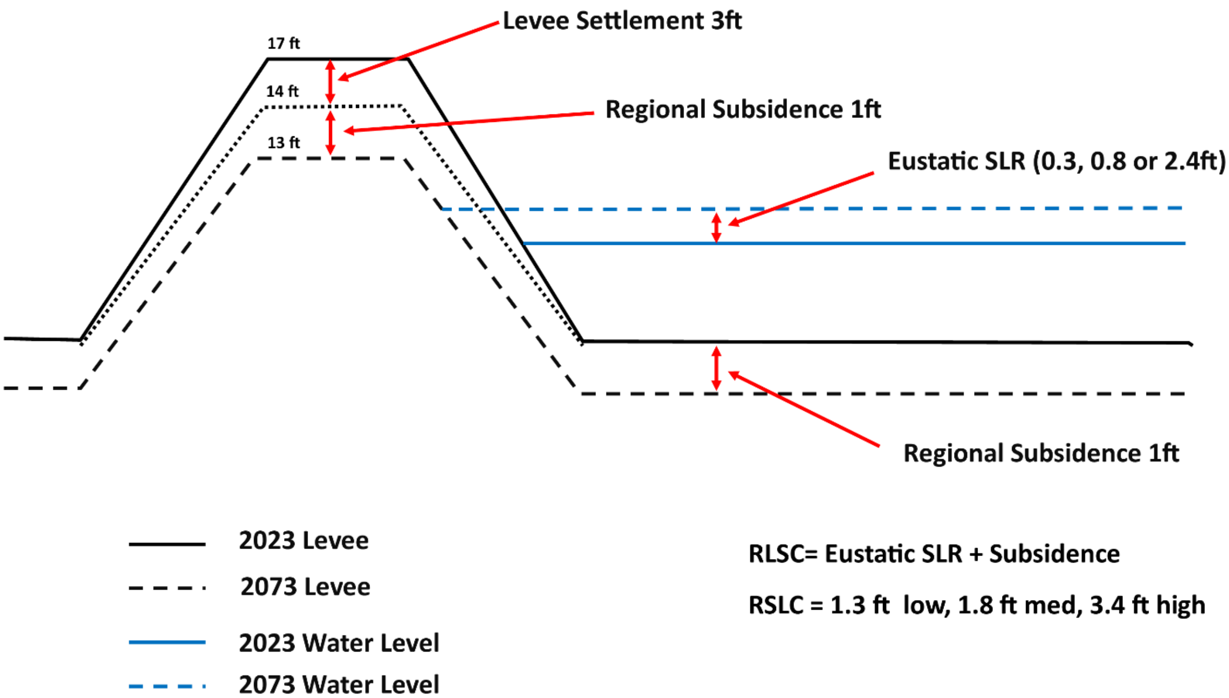

Figure 29. Example of settlement, subsidence and eustatic sea level rise.

3.9 FUTURE CONDITION OVERTOPPING AND INUNDATION

Levee settlement and RSLC result in greater overtopping volumes and more inundation in the HEC-RAS simulations of future without-project conditions. Figure 30 displays the resulting 100YR water surface elevation for the future without-project scenario assuming intermediate 1.8 ft RSLC. The resulting 100YR inundation is much greater in the future without-project scenario. Figure 31 displays the resulting 500YR water surface elevation for the future without-project scenario assuming intermediate 1.8 ft RSLC. All statistical water surfaces were provided to economics for evaluation. Figure 32 and Figure 33 display the 100YR and 500YR depths for 2073 intermediate RSLC conditions for without project conditions.

The modeling of synthetic storms estimates overtopping rate time-series at the IHNC Surge Barrier, Seabrook, and the IHNC lock. Statistical processing of modeled water-levels produces stage frequency data within the closed IHNC basin. Water levels for existing and future without-project conditions within the closed IHNC basin are provided in Table 6. The table includes raw RAS model output, and water levels accounting for the effects of rainfall, pumping and wind-setup. In the past, 90% water levels were assumed and they are also provided in the table. All of these added effects increase the expected water level within the basin. A previously assumed safe water level within the basin is 8.0ft NAVD88. If there are problems exceeding the safe water level, there are ways to mitigate, aside from raising barriers, such as adding a pump-station, expanding storage by establishing a conduit to the central wetlands, or accepting a higher level of risk within the basin. Another important observation is when Hurricane Gustav produced approximately 12ft NAVDD88 surge elevation within the basin (prior to barrier construction), and the interior floodwalls performed adequately, suggesting a higher safe water level may be possible. Since the interior IHNC basin is a sensitive area, it is important to provide a more detailed review the expected interior water levels for with and without project conditions during the PED phase of the project.

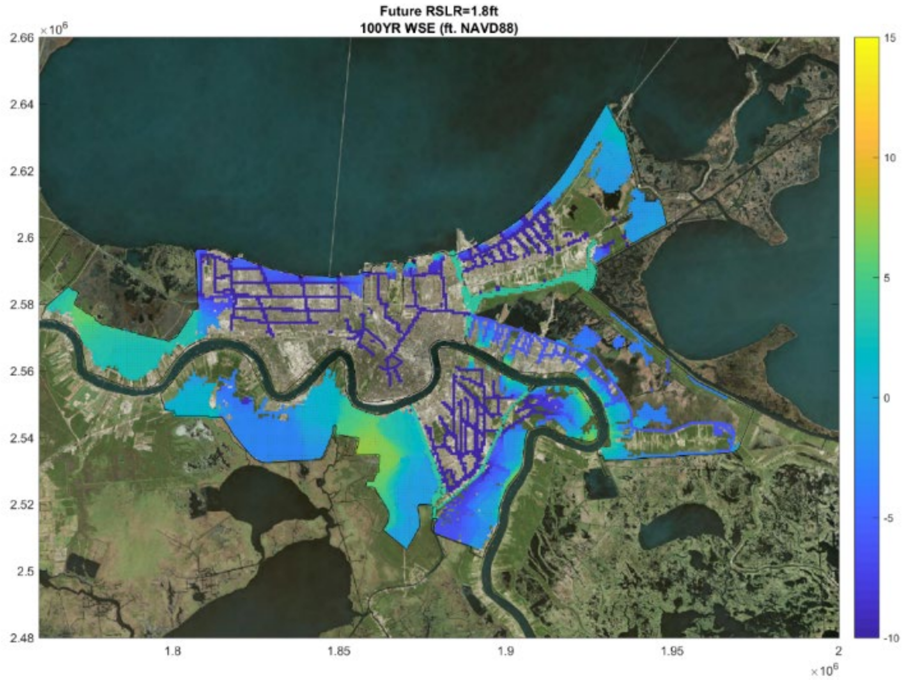

Figure 30. 100 year peak water surface elevation (ft. NAVD88) for future 2073 intermediate RSLC conditions – without project

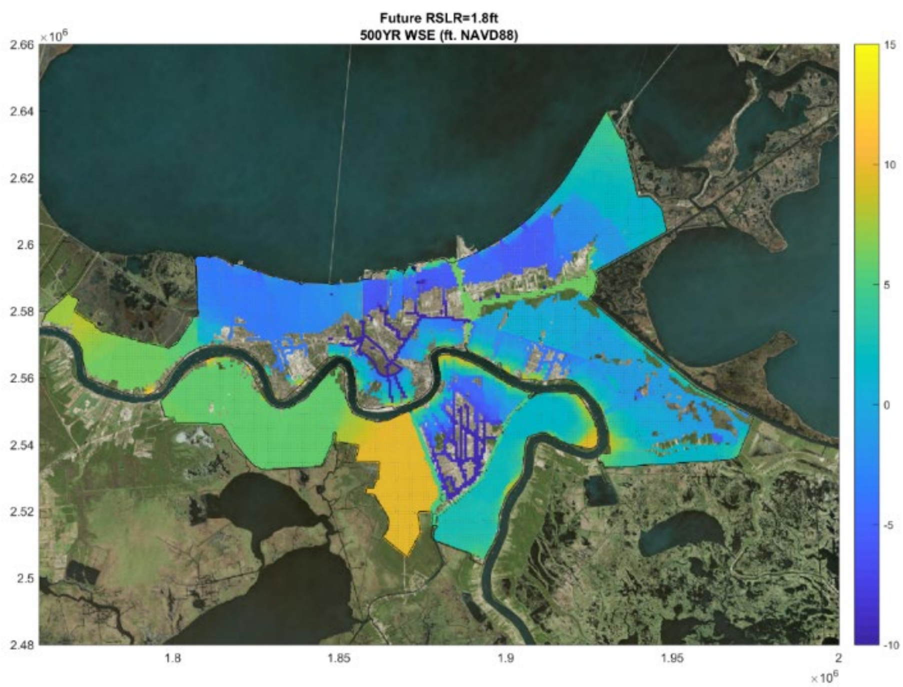

Figure 31. 500 year peak water surface elevation (ft. NAVD88) for future 2073 intermediate RSLC conditions – without project

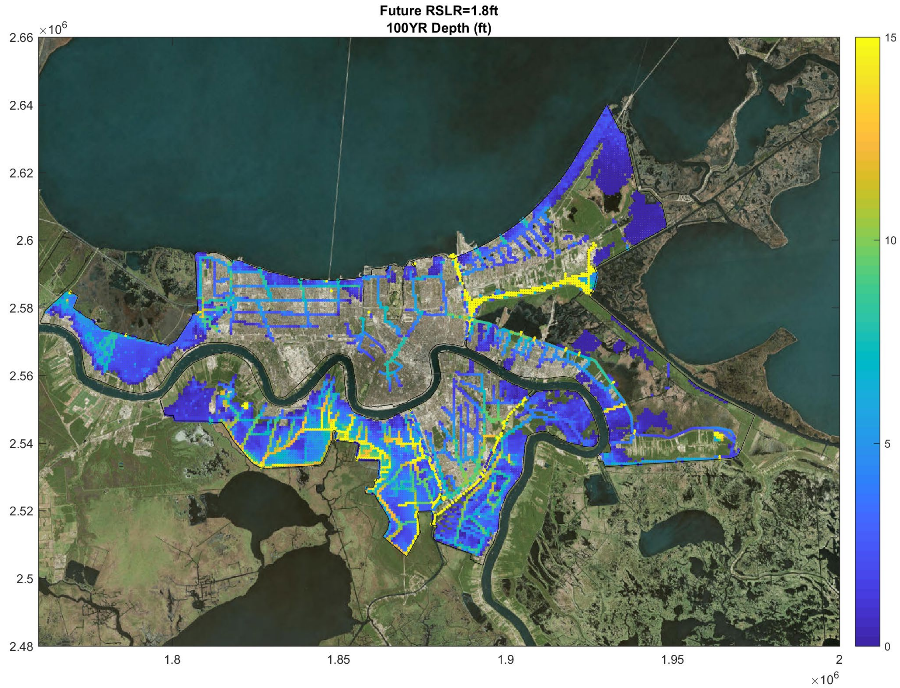

Figure 32. 100 year peak depth (ft) for future 2073 intermediate RSLC conditions – without project

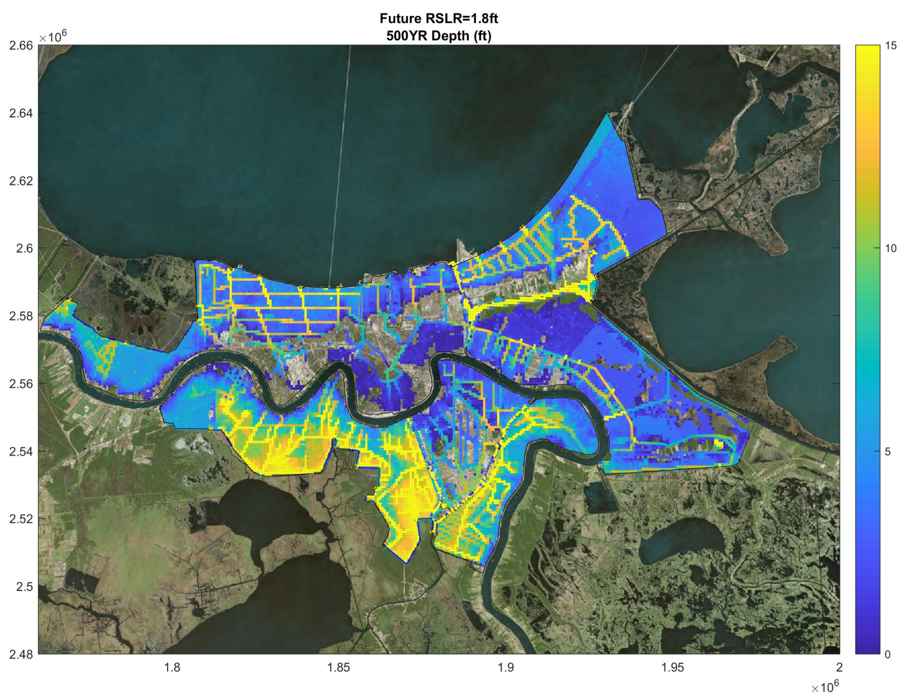

Figure 33. 500 year peak depth (ft) for future 2073 intermediate RSLC conditions – without project

Table 6. IHNC Corridor water level statistics for existing and future conditions

LPV-WBV STUDY RAS MODEL OUTPUT				
Without Rain and Wind Setup (RAW OUTPUT)				
	RSLR= 0.0	**RSLR= 1.3ft**	**RSLR= 1.8ft**	**RSLR= 3.4ft**
0010YR	-999	-999	-999	-999
0020YR	3.05	3.07	3.08	3.16
0050YR	3.61	3.64	3.66	3.87
0100YR	3.93	3.99	4.02	4.58
0200YR	4.25	4.4	4.45	6.12
0500YR	4.92	6.26	6.74	8.85
1000YR	6.24	11.59	11.95	12.61
With Rain and Wind Setup				
0050YR	4.8	4.8	4.9	5.1
0100YR	5.2	5.3	5.3	5.9
0200YR	5.9	6.0	6.1	7.7
0500YR	6.5	7.9	8.3	10.5
90% Water Levels				
50YR	5.8	**5.9**	**5.9**	**6.1**
100YR	6.2	**6.3**	**6.3**	**6.9**
200YR	7.0	**7.0**	**7.1**	**8.7**
500YR	7.7	**9.0**	**9.5**	**11.6**

a. Exterior water level statistics

The CPRA ADCIRC+SWAN simulations were processed with the ERDC JPM-OS statistical code to produce exterior surge and wave statistics for existing and future conditions. Exterior surge and wave statistics are needed to determine the required 100YR design elevations for the 2073 future condition for the intermediate and high RSLC scenarios. The statistical code was run on the CPRA ADCIRC+SWAN results for a small area encompassing HSDRRS. Figure 34 through Figure 36 display the 100YR and 500YR still water level, significant wave height and mean wave period for existing conditions (RSLC = 0 ft). Figure 37 through Figure 39 display the 100YR and 500YR still water level, significant wave height and mean wave period for future conditions (RSLC = 2 ft). Surge and wave statistics were linear interpolated and extrapolated for RSLC of 1.8 and 3.4 ft. The extrapolation to RSLC=3.4 ft is more uncertain than the interpolated values for RSLC=1.8ft.

Figure 40 through Figure 42 display comparisons between the older post-Katrina surge and wave statistics and the updated statistics produced for this study. The 100YR/500YR water levels and waves are mostly consistent aside from a few differences. The CPRA ADCIRC+SWAN simulations assigned a flow boundary of 325,000 cfs for the Mississippi River. This value is significantly lower than previous Corps estimates for Mississippi River discharge assigned for surge hazard modeling. In the past, the Corps evaluated a range of discharges and determined that 400,000 cfs gives reasonable surge values in the river and is consistent with more sophisticated statistical analysis of coincident hazards. Due to the lower 325,000 cfs boundary condition for the Mississippi River, a significant discrepancy exists between the older Corps surge statistics in the river and the statistics produced with the CPRA ADCIRC+SWAN simulations. The comparison in Figure 34 shows how 100YR and 500YR water levels are much lower with the updated statistics. The main reason for this discrepancy is the lower antecedent discharge assumed in the CPRA ADCIRC+SWAN simulations, but some of the discrepancy might be attributed to the new ERDC statistical code. Another discrepancy between the new and old statics existing in the mean wave periods on the WBV and portions of the LPV, as shown in Figure 42.

It was decided to adjust the surge statistics in the river to account for a higher 400,000 cfs. This adjustment provided surge values in the river that are more consistent with more sophisticated analysis conducted for design of HSDRRS. The adjustment was based on a regression analysis comparing surge levels between the CPRA ADCIRC+SWAN simulations and the older set of ADCIRC+STWAVE simulations which assumed 400,000cfs. The adjustment increases surge values in the river by approximately 1 to 2.5ft. The adjusted surge levels in the river are shown in Figure 43.

More information concerning the CPRA ADCIRC+SWAN simulations can be found online here:

http://coastal.la.gov/wp-content/uploads/2017/04/Attachment-C3-25.1_FINAL_04.05.2017.pdf

http://coastal.la.gov/our-plan/2012-coastal-masterplan/cmp-appendices/

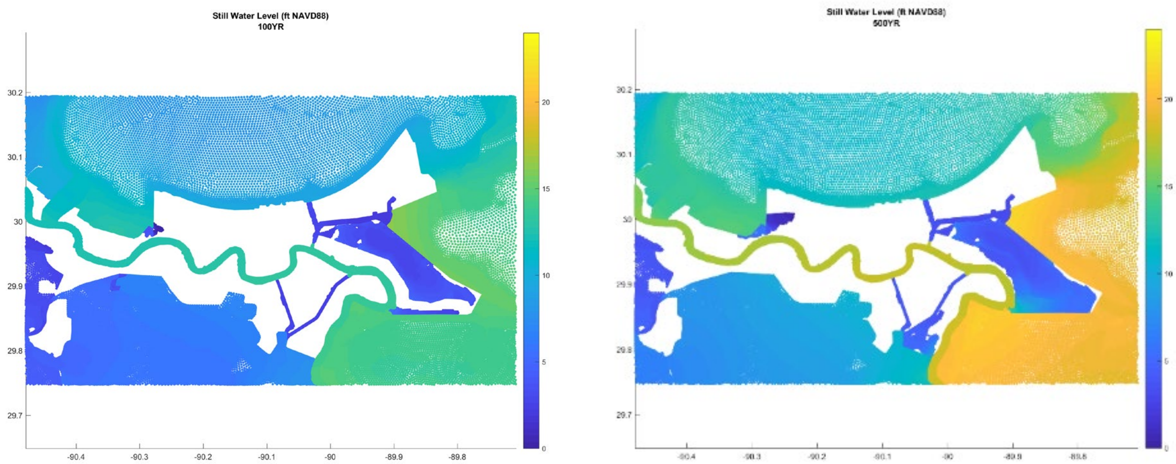

Figure 34. 100YR and 500YR still water levels (ft. NAVD88) for existing conditions (RSLC=0 ft)

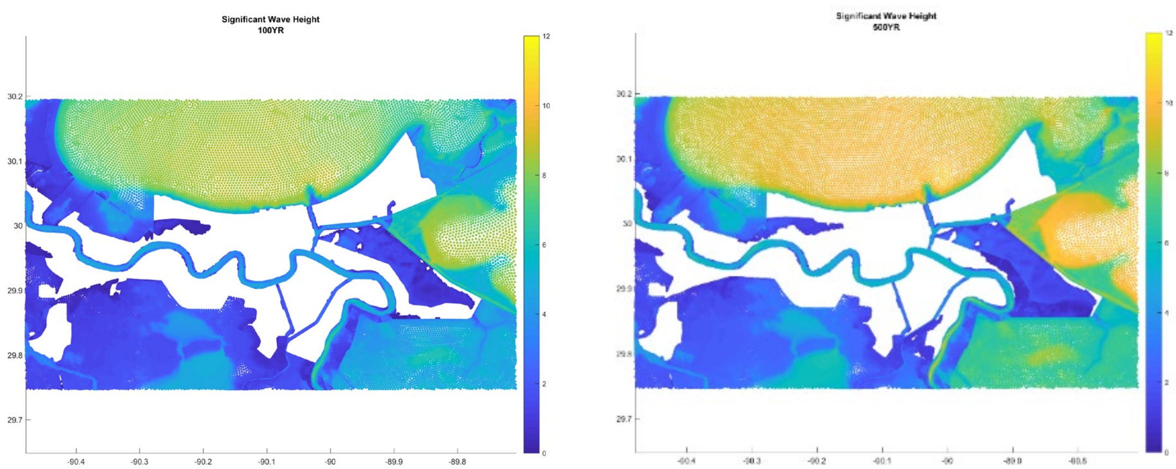

Figure 35. 100YR and 500YR significant wave heights (ft) for existing conditions (RSLC=0 ft)

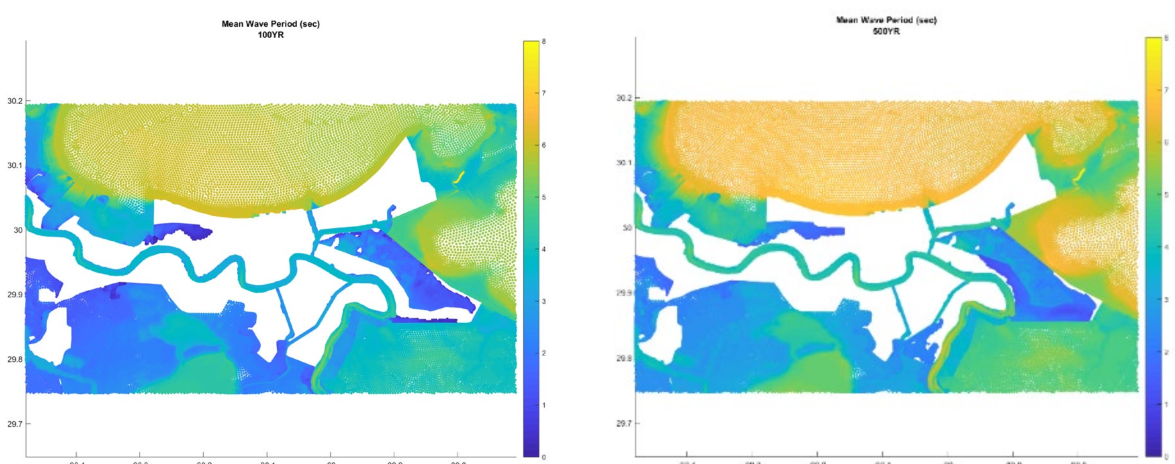

Figure 36. 100YR and 500YR mean wave period (sec) for existing conditions (RSLC=0 ft)

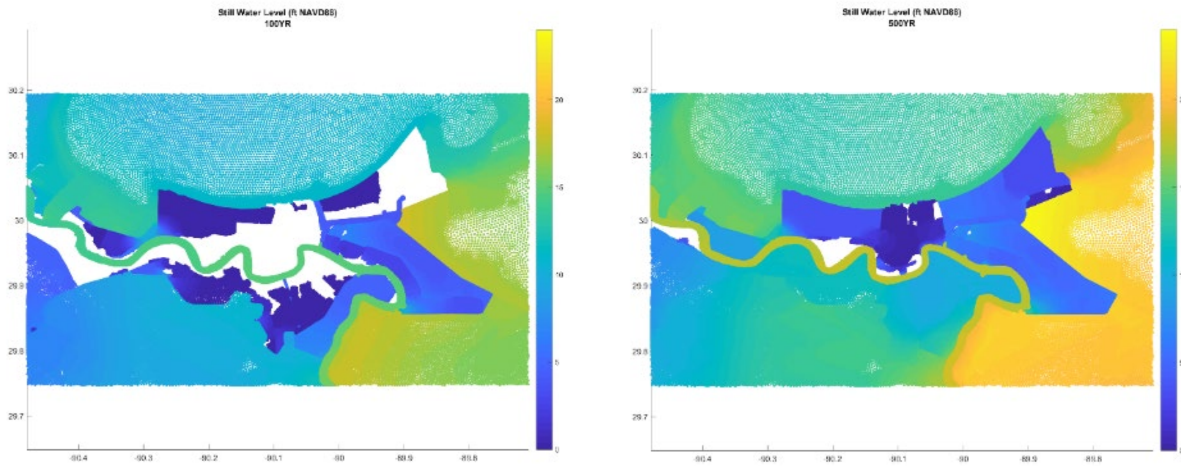

Figure 37. 100YR and 500YR still water levels (ft. NAVD88) for future conditions (RSLC=2 ft)

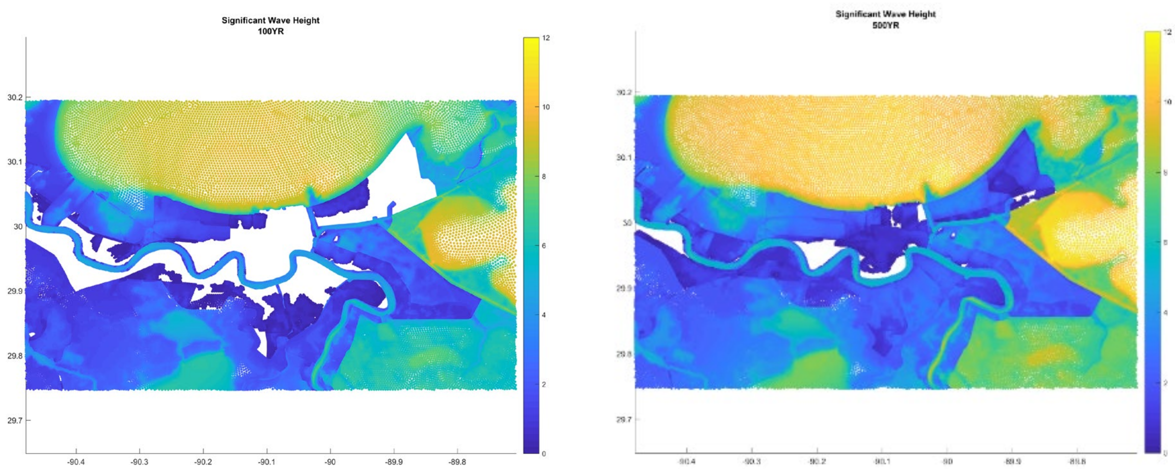

Figure 38. 100YR and 500YR significant wave heights (ft) for future conditions (RSLC=2 ft)

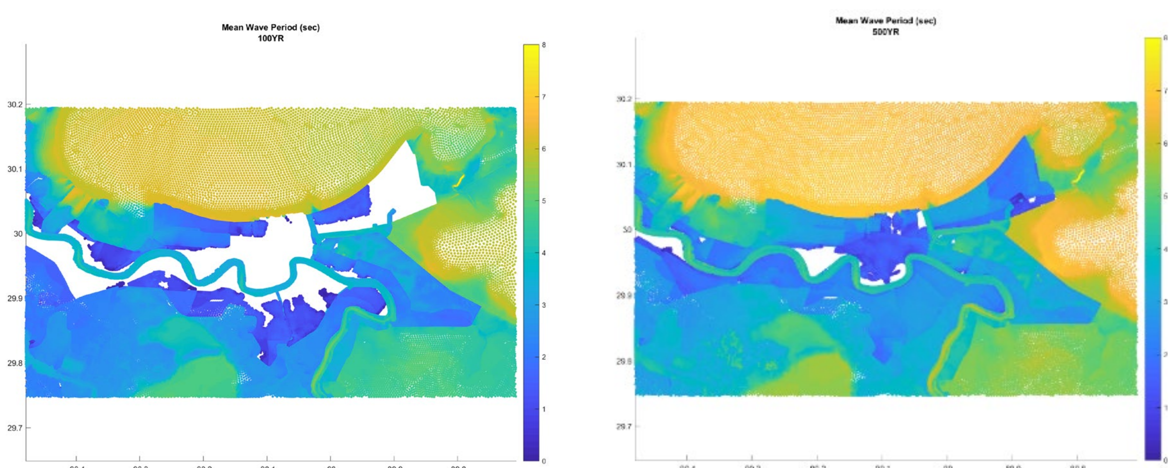

Figure 39. 100YR and 500YR mean wave period (sec) for future conditions (RSLC=2 ft)

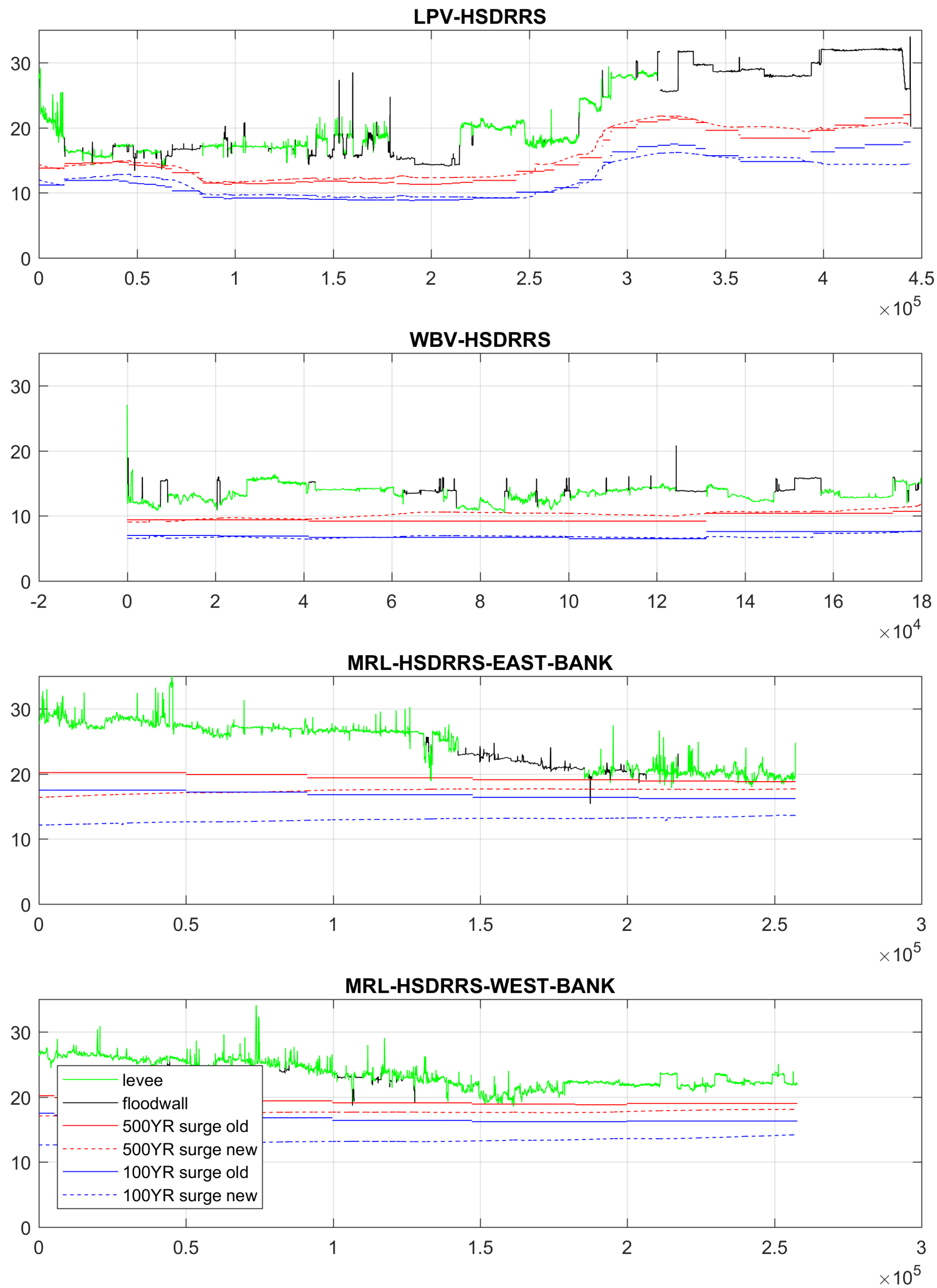

Figure 40. Comparison of new and old 100YR and 500YR still water level statistics (ft. NAVD88)

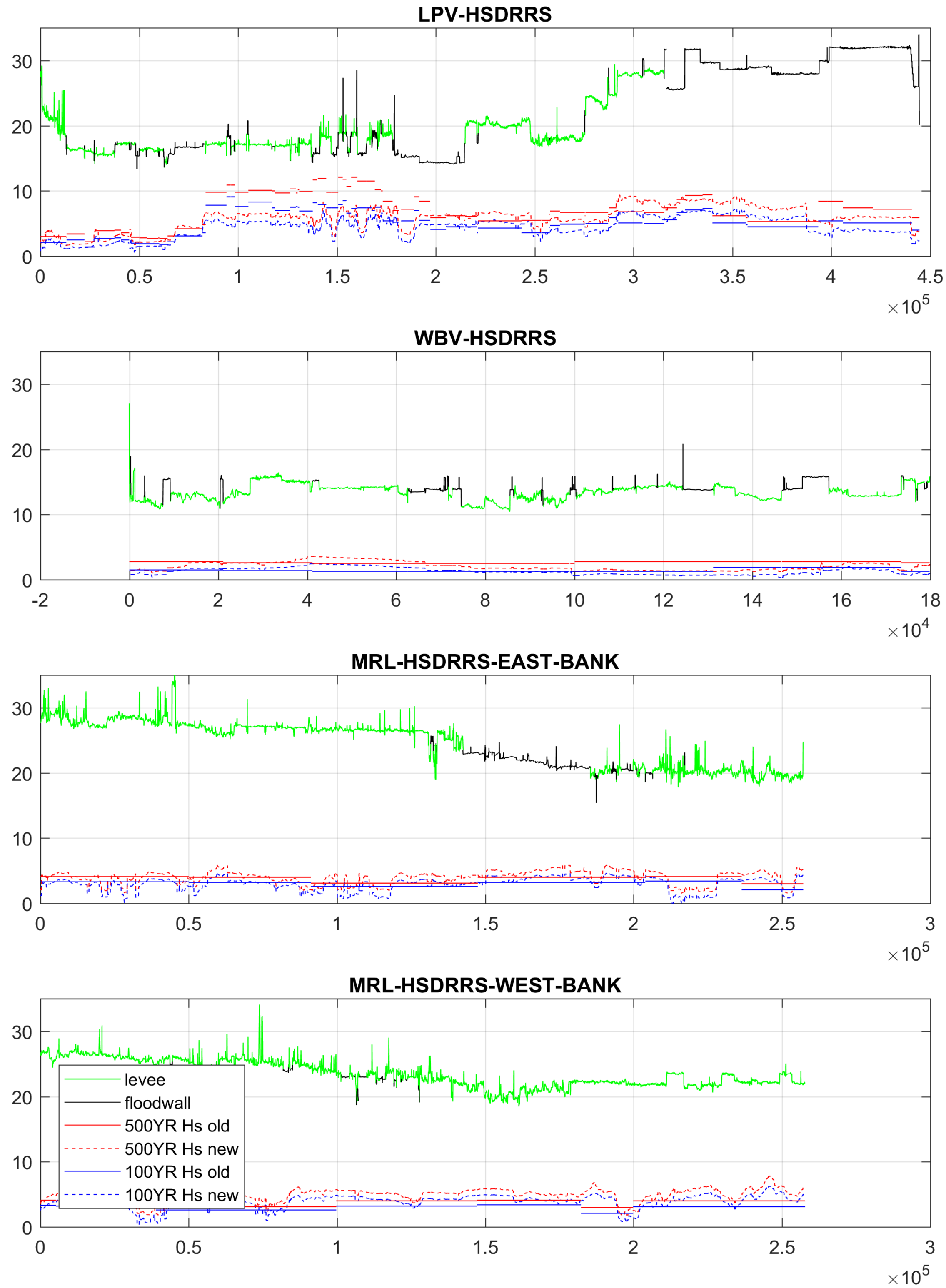

Figure 41. Comparison of new and old 100YR and 500YR significant wave height statistics (ft)

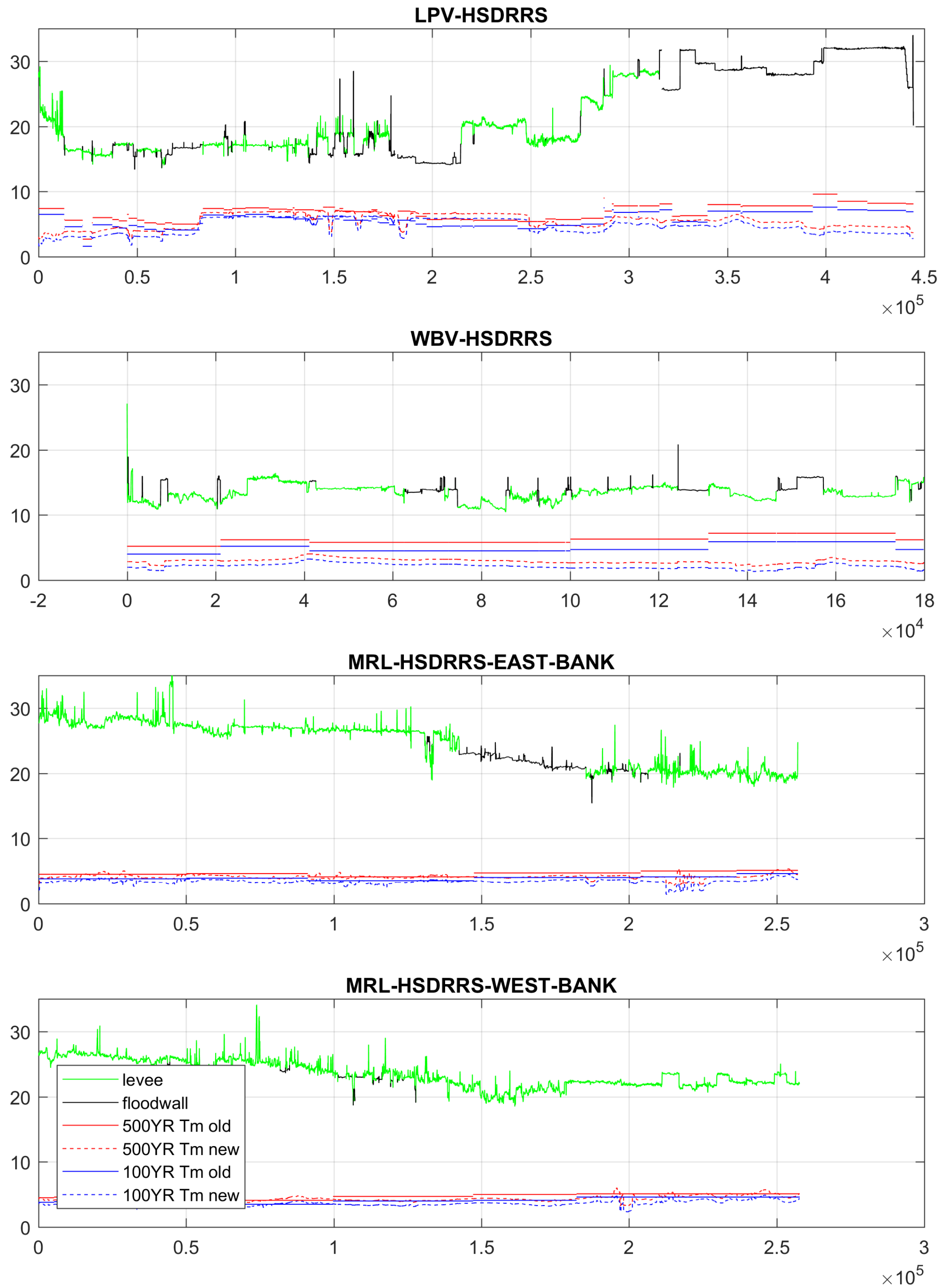

Figure 42. Comparison of new and old 100YR and 500YR mean wave period statistics (sec)

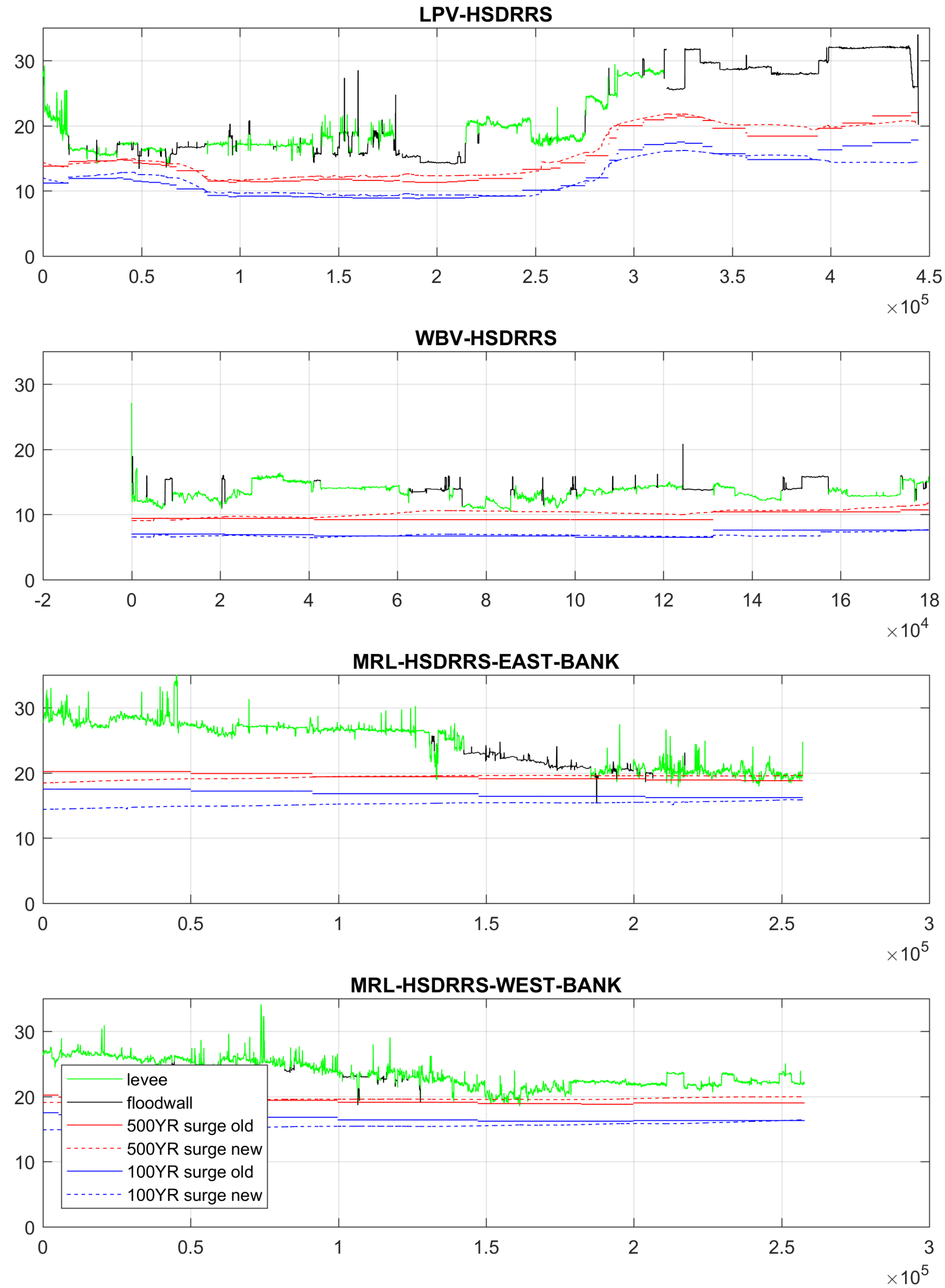

Figure 43. Comparison of new and old 100YR and 500YR still water level statistics with correction applied the Mississippi River surge statistics (ft NAVD88)

3.10 MISSISSIPPI RIVER DISCHARGE DURING HURRICANE SEASON

The 400,000 cfs Mississipi River discharge design assumption was checked against observed flow records during hurricane season. Figure 44 displays the entire record of observed daily dicharges for the lower Mississippi River along with the cumulative probability distribution of discharges by month. The plot shows how discharge in the river is typically lower than 400,000 during the peak of hurricane season (August/Sept), but there are exceptions. The original HSDRRS analysis processed river discharges from 1976 to 2002 and computed cumulative probability of discharges for each month during hurricane season. Figure 45 displays the cumulative probability of discharge for each month in hurricane season based on data from 1976 to 2002. This data, along with storm frequency information was needed to compute surge statistics in the river. Figure 46 displays the cumulative probability of discharge for each month in hurricane season based on data from 1976 to 2019. When the latest data is added and statistics processed, there appears to be small increase in the expected discharge during hurricane season. For example, the 50% or mean discharge during July (a month with relatively low storm activity) was approximately 410,000cfs with the data from 1976 to 2002. When the data is updated, the mean discharge during July becomes 450,000cfs. Updating the assumed design discharge from 400,000 to 450,000 might change design water levels by 0.5ft to 1.0ft based on crude approximations.

Another assumption that can change stage-frequency information in the river is observed storm frequency by month. In the older HSDRRS analysis, a sample of 14 observed storms impacting the New Orleans area provided the hurricane probability by month. Table 7 contains the storm probabilities by month assumed in the original HSDRRS analysis. Since 2005, more storms have impacted New Orleans including:

Storm	Date
Hurricane Gustav	August 31, 2008
Hurricane Ike	September 13, 2008
Hurricane Ida	November 10, 2009
Tropical Storm Lee	September 4, 2011
Hurricane Isaac	August 29, 2012
Hurricane Nate	October 8, 2017
Hurricane Barry	July 10, 2019

These additional storms occurring since 2005 may change some of the assumptions about storm frequency and ultimately impact the stage-frequency estimates in the river. An additional analysis was performed on NOAA's HURRDAT records. The entire storm dataset was filtered for Category 1 and above. A spatial analysis of storm frequency is provided in Figure 47 for years 1941 to 2005, and in Figure 48 for years 1941 to 2019. When the latest data (2005 to 2019) is added, the storm frequency estimates appear to lower slightly in the Northern Gulf of Mexico.

The latest storm frequency and river discharge data suggests that the assumptions made concerning storm frequency and discharge frequency are still valid for a feasibility level study. However, the observed discharges have changed enough to warrant a revisit during later design assessments such as the PED phase of this project.

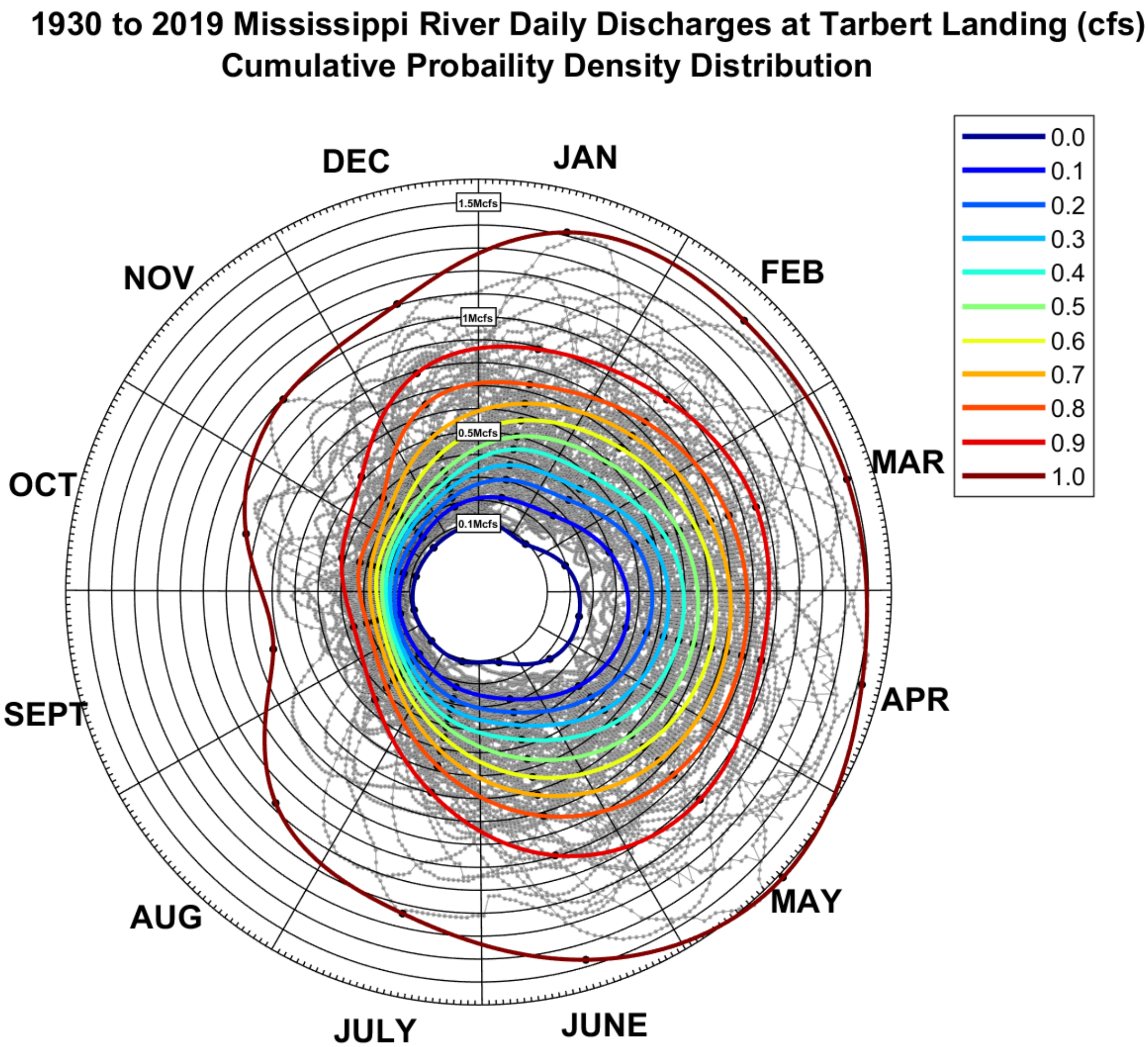

Figure 44. Cumulative probability density distribution of lower Mississippi River discharges and daily discharge observations (1930 to 2019)

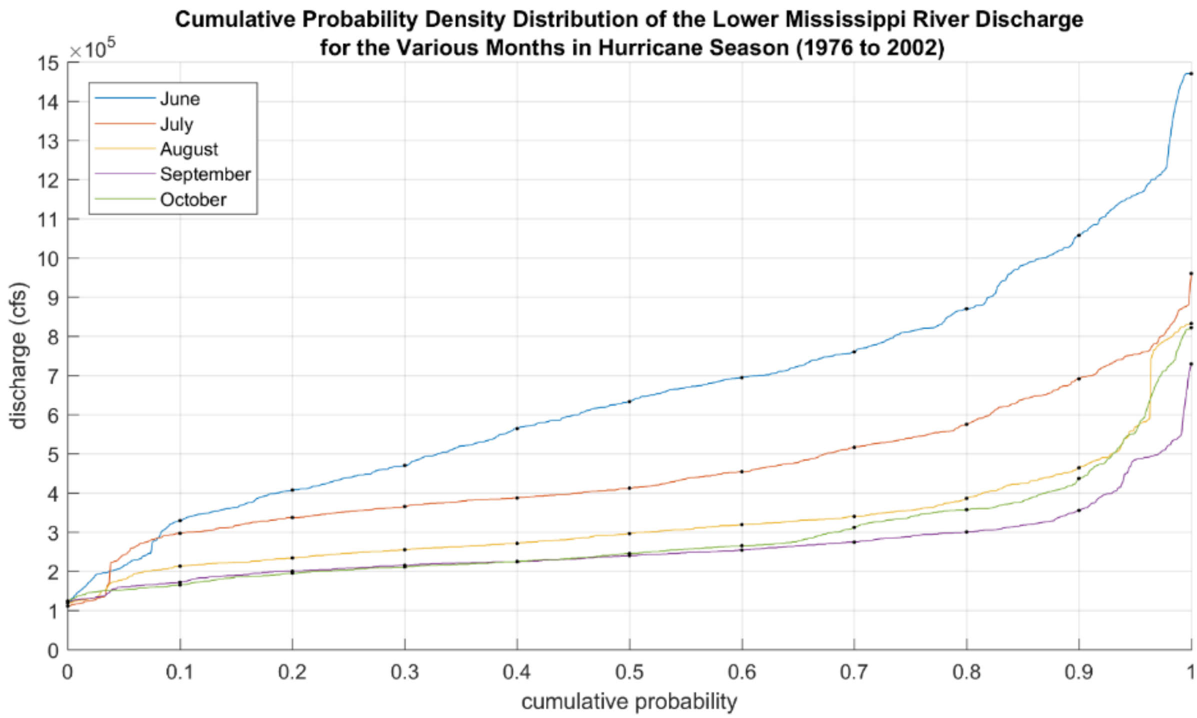

Figure 45. Cumulative probability density distribution of the lower Mississippi river during hurricane season (1976 to 2002 data)

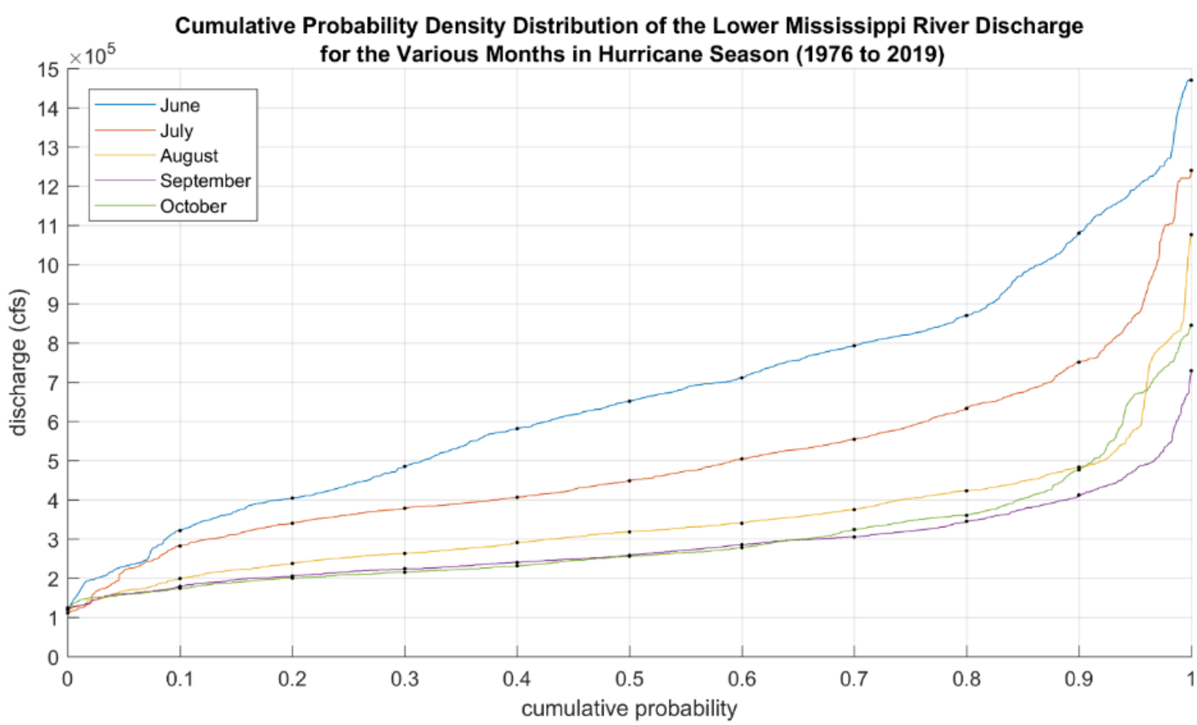

Figure 46. Cumulative probability density distribution of the lower Mississippi river during hurricane season (1976 to 2019 data)

Table 7. Probability density of hurricanes in various months based on hurricanes in the New Orleans areas in the period 1941 – 2005.

	June	July	August	September	October	Total
No. of hurricanes	1	1	4	6	2	14
p(m)	1/14	1/14	4/14	6/14	2/14	1

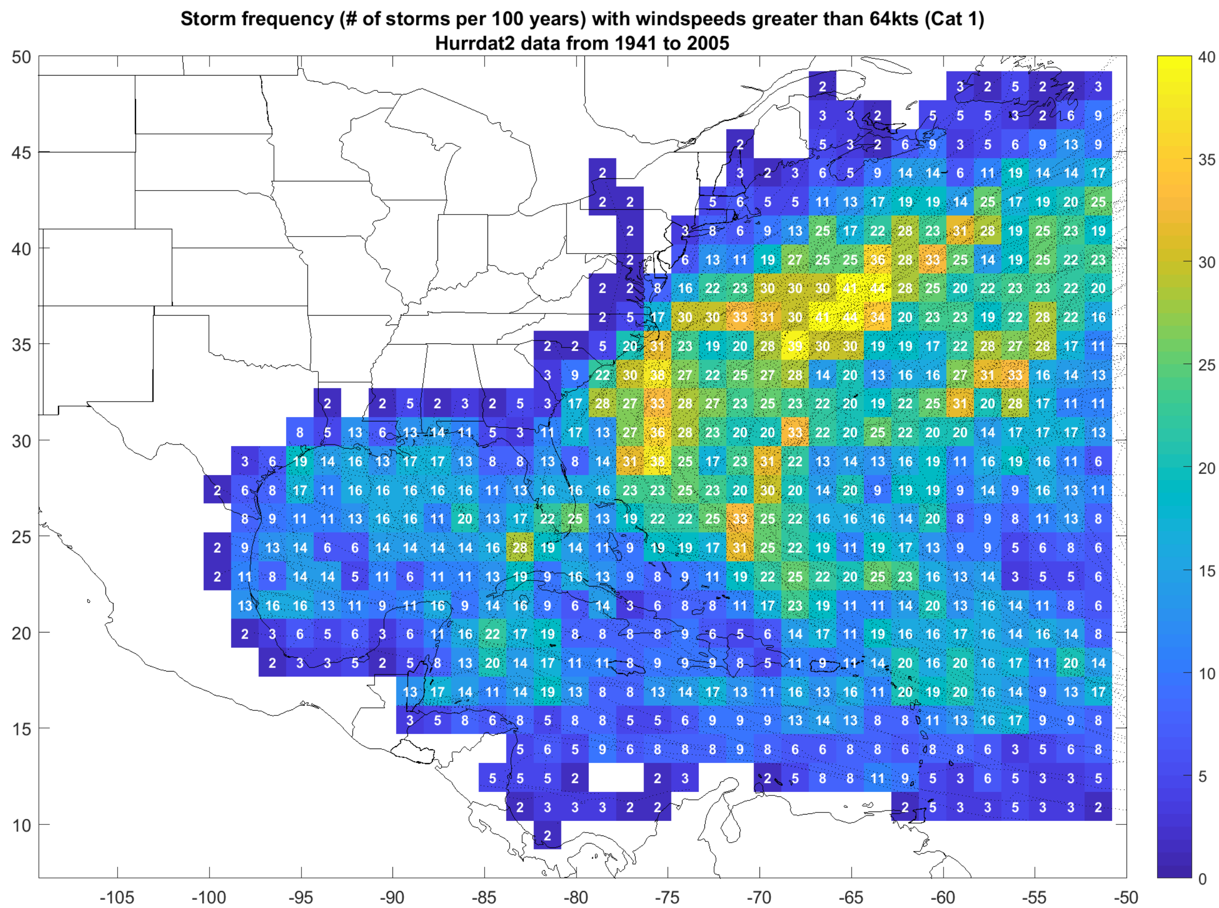

Figure 47. Category 1 and above storm frequency using NOAA HURRDAT filtered for years 1941 to 2005

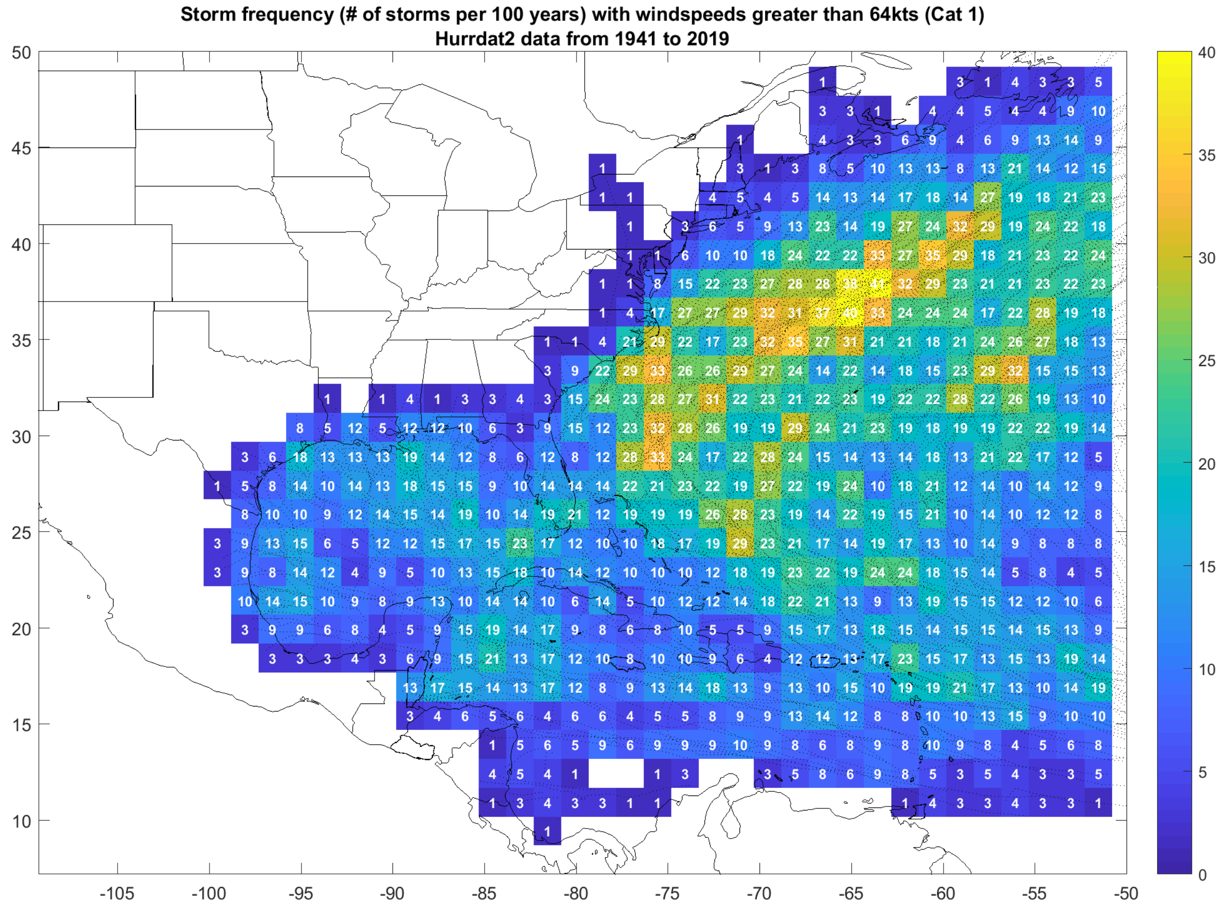

Figure 48. Category 1 and above storm frequency using NOAA HURRDAT filtered for years 1941 to 2019

3.11 FUTURE CONDITIONS 2073 – WITH PROJECT

100YR design elevations for the 2073 intermediate RSLC condition were determined using a Monte Carlo based overtopping tool developed with Matlab. The Monte Carlo approach is thoroughly documented in the original HSDRRS Design Elevation Report. Monte Carlo analysis is a statistical method to evaluate the probability distribution of a particular output parameter of concern, given uncertain input parameters. In this case, we are concerned about the overtopping rate of the levee or floodwall section, and we are uncertain about water levels, wave heights and wave periods, also known as the levee design hydraulic boundary conditions. The Monte Carlo analysis creates many different combinations of input parameters (water levels and waves) and estimates overtopping rate for each sample. Some input parameters such as levee elevation and slope are assumed to be constant in each iteration. The overtopping rates are estimated using the empirical Eurotop wave overtopping equations. The final product of the Monte Carlo simulation is a distribution of overtopping rates, including the 50% and 90% non exceedance overtopping rates (q-50 and q-90).

The overtopping formulae used in the Monte Carlo scripts have been updated to use equation 5.10, 5.11 and 5.17 (Figure 11 and Figure 12) from the Eurotop manual. The updated Monte Carlo code output was compared to the example output provided in the design elevation report.

The comparison shows the updated overtopping functions do not have a tremendous effect on final required design elevation for the segment evaluated. The original DER provided a required elevation of 16.5ft NAVD88 for segment JL01, while the updated script provided 16.0ft NAVD88. Figure 49 displays an example of the new Monte Carlo output for section JL-01 assuming the same hydraulic boundary conditions applied in the original DER. Figure 50 displays the output from the original code.

1% design elevations were determined for the entire HSDRRS perimeter using an automated version the Monte Carlo based design script. Figure 51 displays the 2073 required 100YR levee and floodwall elevations for the intermediate RSLC scenario. The required design elevations should be considered as a rough estimate. Further site-specific analysis might refine the required design elevations. The future 2073 required design elevations were provided to the PDT.

The resiliency check is simply an extra design constraint which ensure the levee or floodwall elevation is at or above the 0.2% still water elevation at 50% confidence. In some cases, specifically on the WBV, this design check determines the final design elevation of the levee, but it is not the governing factor in deciding final design elevations at all segments of the system. The “resiliency check” is a sanity check on final 1% H&H design elevations. Setting the levee elevation to at least the 0.2% still water ensures some level of risk reduction for events beyond the 1%, but it is does not ensure full resiliency out to 0.2% conditions. True resiliency has more to do with armoring

The “cross-over” points are the locations where the MR&T design grade intersects the hurricane design grades for the MRL co-located levees and floodwalls. The location of the cross-over points along the MRL were determined to be river mile 90.5 for the east bank and river mile 95.5 for the west bank for intermediate RSLC projections (RSLC=1.8ft) for the 100YR design.

The cross-over point is determined by the intersection of the MR&T grade with the 1% hurricane design grade. The hurricane design grade is derived from the estimated water levels and waves for a given future year. With RSLC, waves and surge increase in the river, which in turn drives the required 1% hurricane design elevations higher, which pushes the cross-over further up-stream. The translation of the cross-over does not influence waves and surge, overtopping or inundation, but it is the other way around, waves and surge influence the cross-over. The location of the cross-over points make no difference in the estimated interior flood risk or how it is calculated, nor does it influence design elevations. It is merely the transition from MR&T grade to HSDRRS grade. The cross-over point is more important in determining which project is responsible for funding levee lifts and maintenance. Levees above the cross-over are funded by MR&T, while levee upgrades below are funded by HSDRRS.

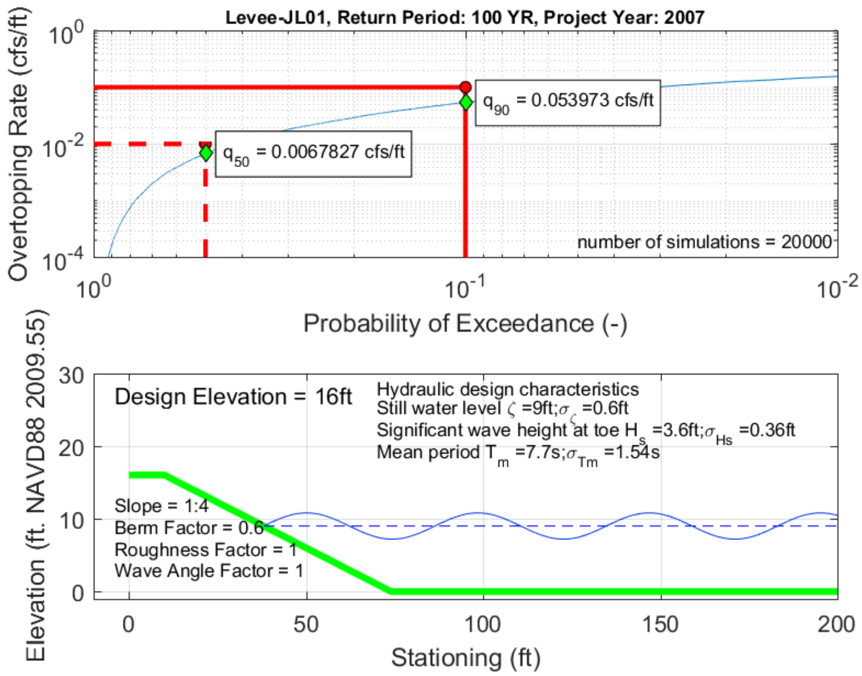

Figure 49. Example of Monte Carlo output for the Jefferson Lakefront levee JL01 from updated code.

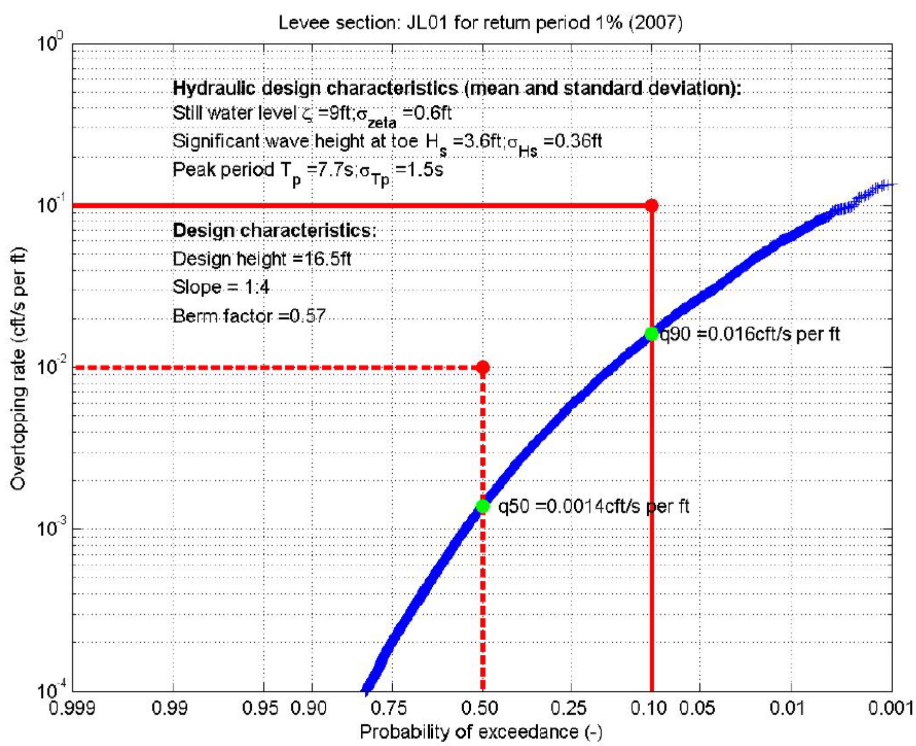

Figure 50. Example of Monte Carlo output for the Jefferson Lakefront levee JL01 from 2007 code.

Design elevations were re-computed at each segment taking into account wave berms and other natural ground elevations on the flood-side of the levee/floodwall. When these features were taken into account, the wave heights were reduced in some areas and this resulted in lower overtopping and lower required design elevations. The lower required design elevations reduced to need to rip out and replace certain expensive floodwalls. I would consider the first round of design elevations as a very rough draft that was updated as the project progressed. The system includes 427 unique design segments, each with their own hydraulic boundary conditions (SWL, Hs, Tp and uncertainty), geometry, and foreshore parameters. The second round of designs involved going to every segment and identifying foreshore elevations. In the Monte Carlo overtopping analysis, these higher foreshore areas reduce wave heights. These features are not captured in ADCIRC+SWAN models, so they must be incorporated into the Monte Carlo overtopping analysis.

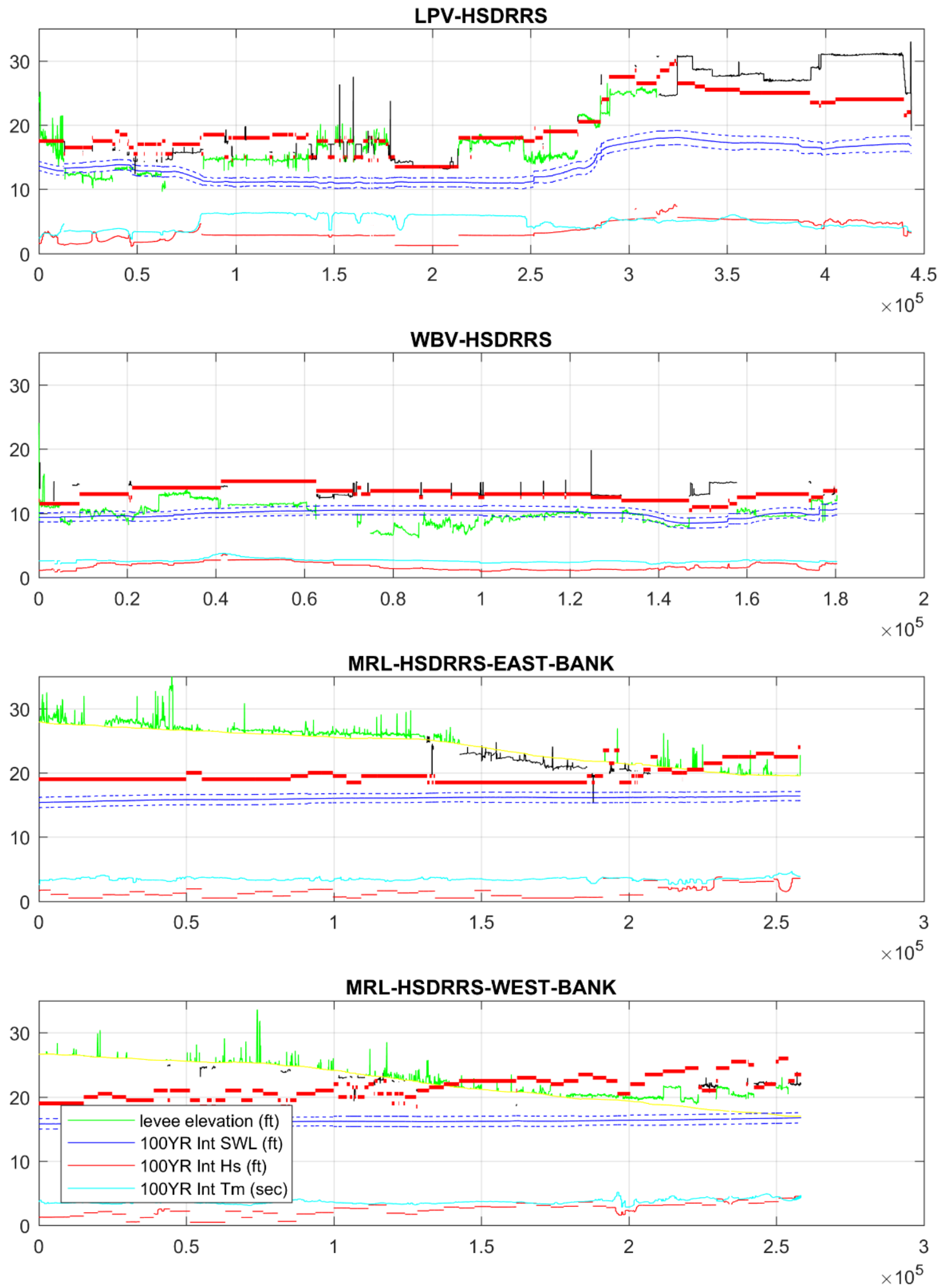

Figure 51. 2073 100YR required design elevations (thick red line) and still water level (SWL), significant wave height (Hs) and mean wave period (Tm) for intermediate RSLC scenario

The overtopping and RAS simulations were conducted for the with-project condition. Figure 53 displays the resulting 100YR inundation for the future with-project condition for the intermediate

RSLC scenario (RSLC=1.8ft). The levee and floodwall lifts delivered with the 2073 100YR system prevent the massive inundation estimated in the without-project condition, as presented in Figure 30. 500YR with-project inundation is presented in Figure 54 for the intermediate RSLC scenario. The 100YR system still allows some inundation within the polder for the 500YR event, but it is significantly less than the without project condition. Figure 55 and Figure 56 display the 100YR and 500YR flood depths for the with project condition (100YR HSDRRS) assuming intermediate RSLC conditions.

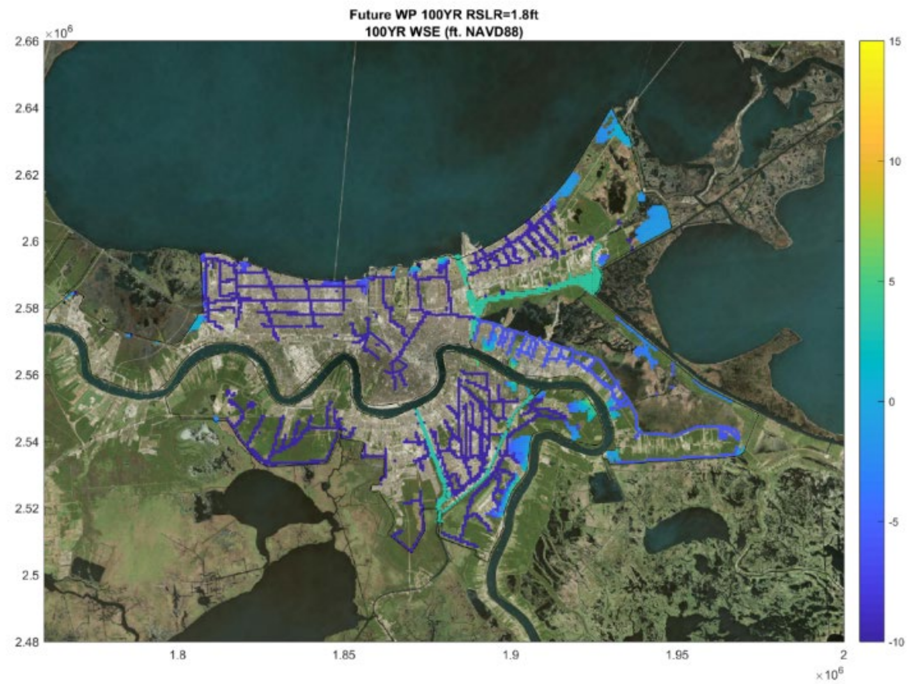

Figure 52. 100 year peak water surface elevation (ft. NAVD88) for future 2073 intermediate RSLC scenario – With 100YR HSDRRS

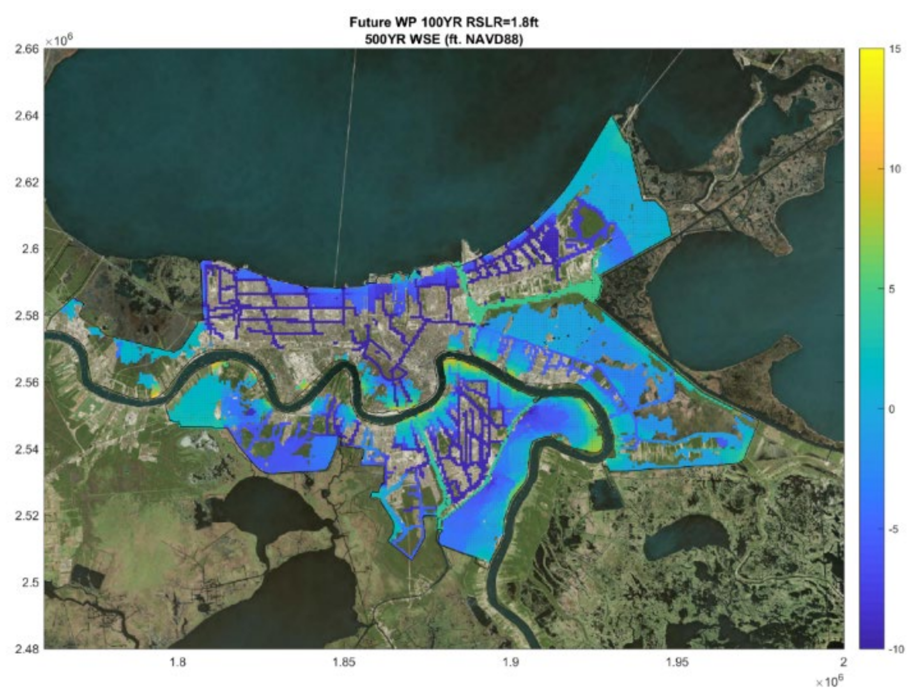

Figure 53. 500 year peak water surface elevation (ft. NAVD88) for future 2073 intermediate RSLC scenario – With 100YR HSDRRS

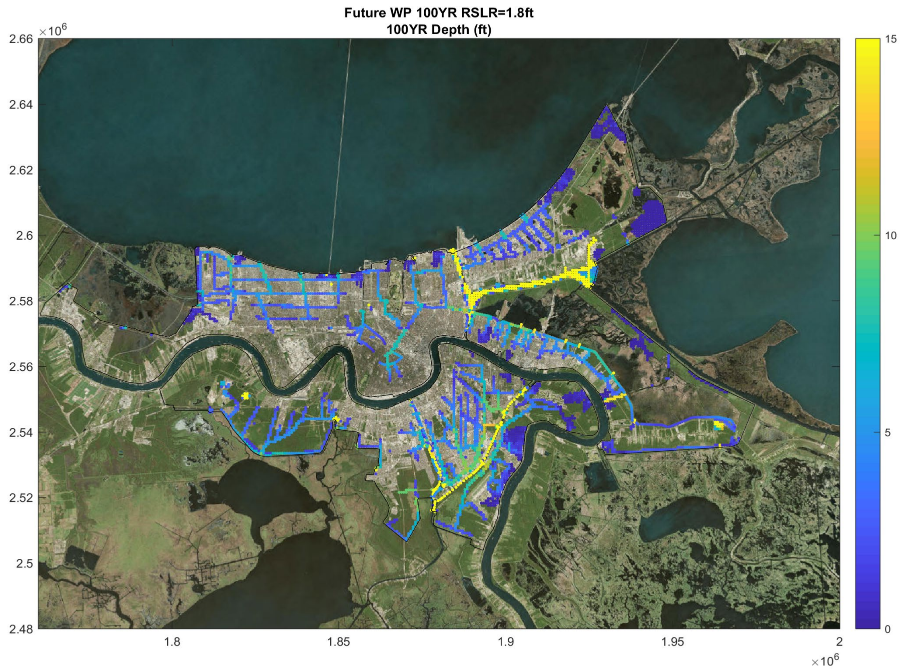

Figure 54. 100 year peak depth (ft.) for future 2073 intermediate RSLC scenario – With 100YR HSDRRS

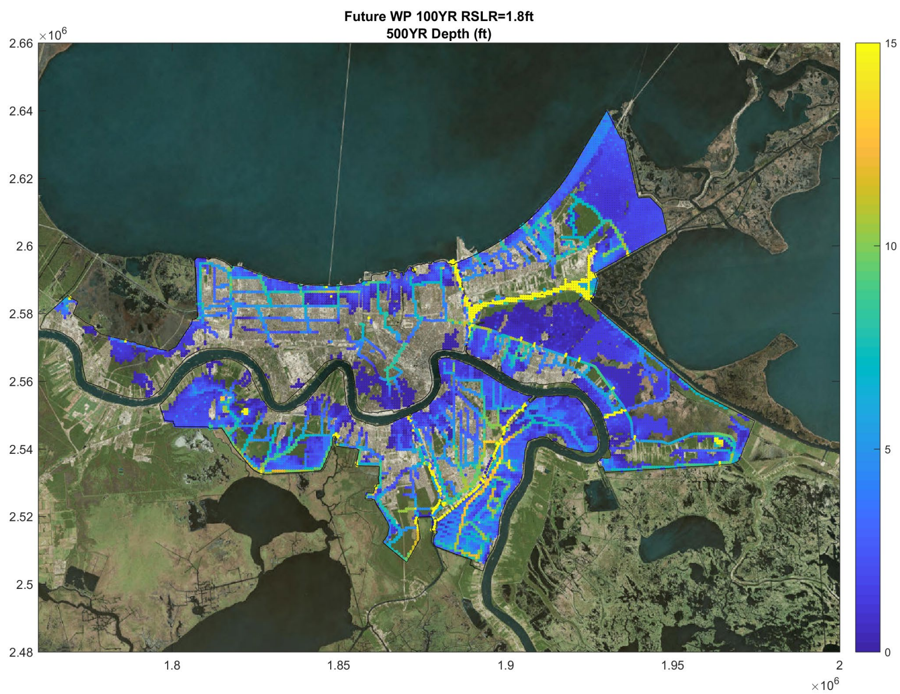

Figure 55. 500 year peak depth (ft.) for future 2073 intermediate RSLC scenario – With 100YR HSDRRS

3.12 PROJECT IMPACTS

ADCIRC simulations of all 152 storms were completed for future condition assuming intermediate RSLR for with and without the 100YR levee system. Future condition without project simulations show tremendous interior inundation as the system no longer meets the 100YR design criteria due to levee settlement and RSLR. When the system is lifted to 100YR future design elevations, the interior flood volumes will be displaced and raise water levels in the exterior. The ADCIRC simulations of with and without project gives an estimate of the induced flooding impacts for 2070 conditions, when the differences in interior/exterior water levels between with and without project are expected to be largest. Figure 60 through Figure 65 display the 50 through 1000YR without project water levels. The without project simulations and resulting statistics show a large volume of water entering the polders around the 100YR and above. Figure 66 through Figure 71 display the 50 through 1000YR with project water levels. The with project simulations show less inundation inside the polder, especially for 100YR conditions. Figure 72 through Figure 77 show the difference in water level between with and without project for the various alternatives. The worst increase in exterior flooding occurs for the 1000YR storm surge. For the extreme return period, the interior water levels in some areas are reduced by 10ft, exterior water levels generally increase less than 0.5ft. The actual water level statistics were passed to the PDT in order to evaluate economics effects and impacts to other projects.

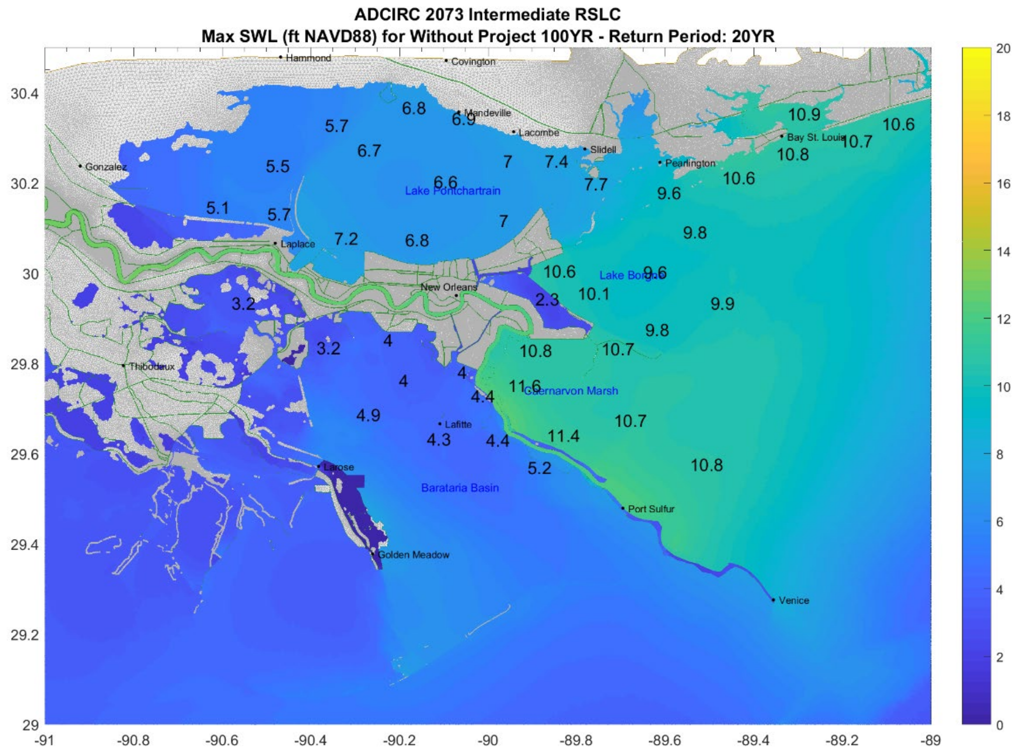

Figure 56. 2070 Without Project 20 year peak water surface elevation (ft. NAVD88)

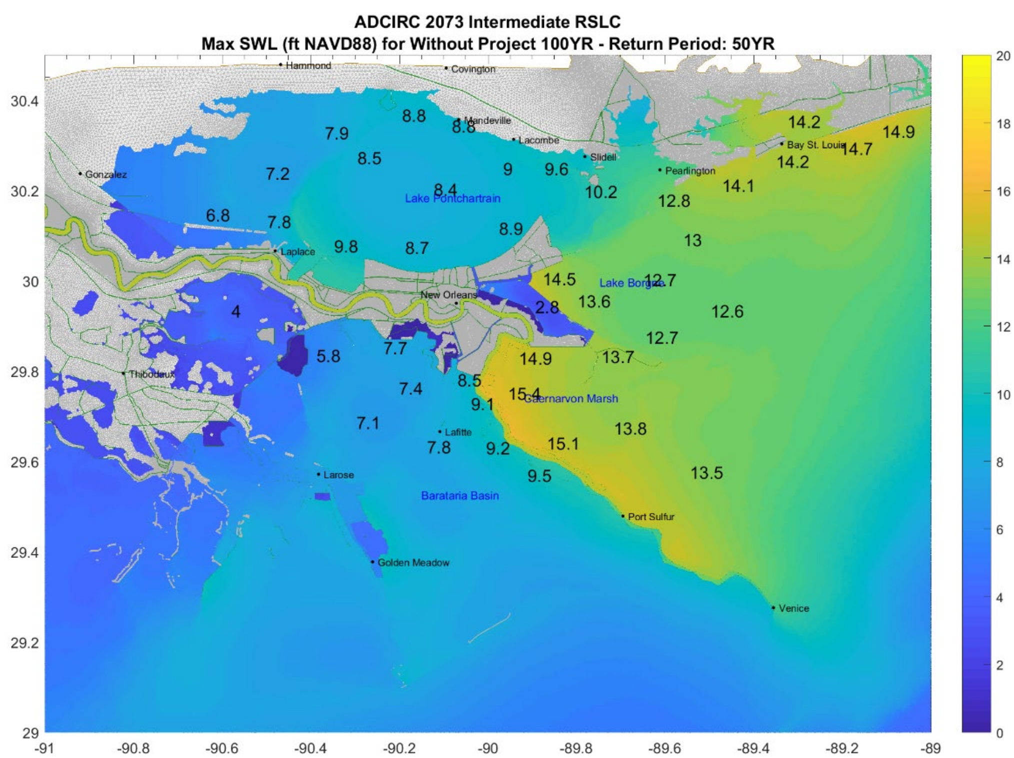

Figure 57. 2070 Without Project 50 year peak water surface elevation (ft. NAVD88)

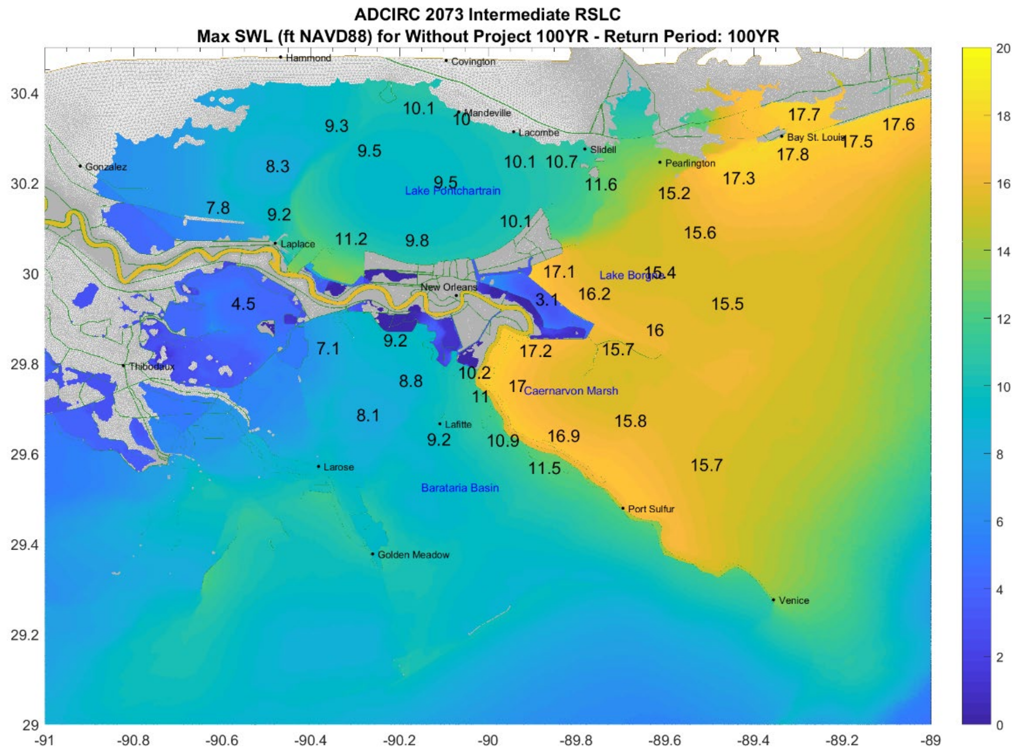

Figure 58. 2070 Without Project 100 year peak water surface elevation (ft. NAVD88)

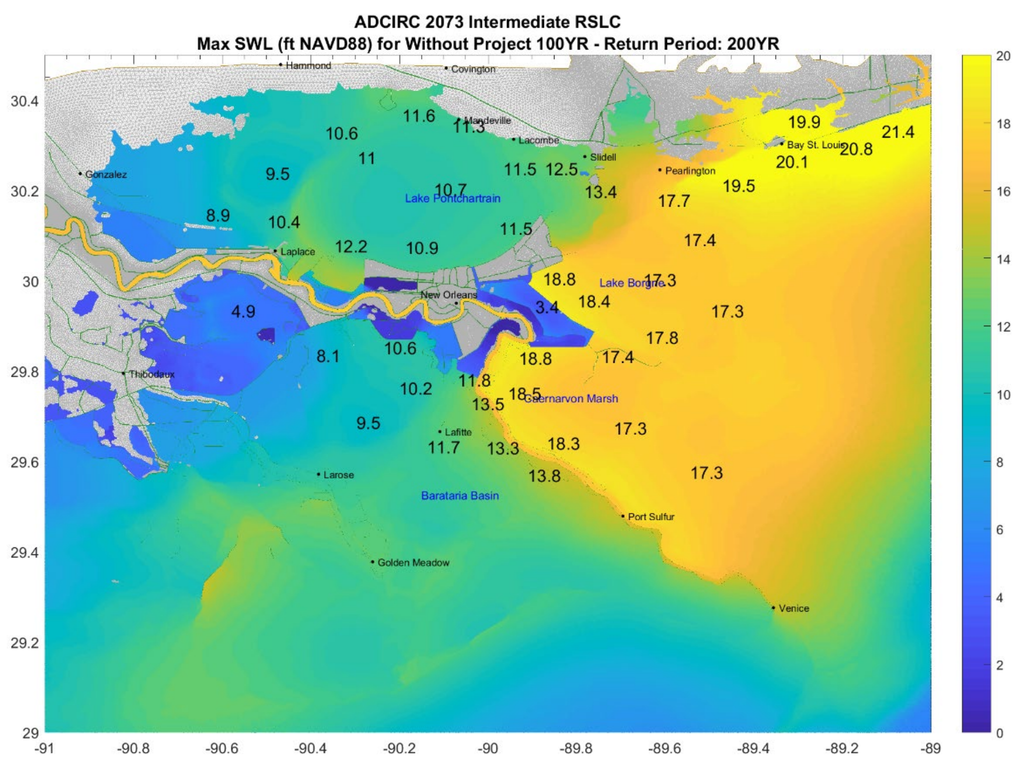

Figure 59. 2070 Without Project 200 year peak water surface elevation (ft. NAVD88)

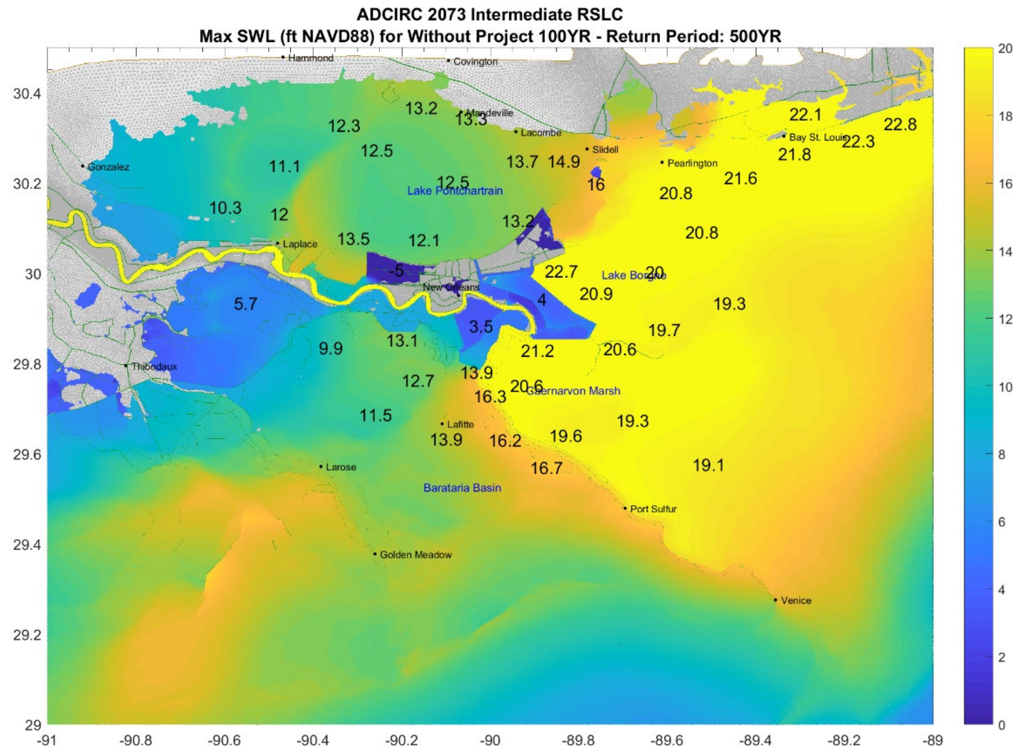

Figure 60. 2070 Without Project 500 year peak water surface elevation (ft. NAVD88)

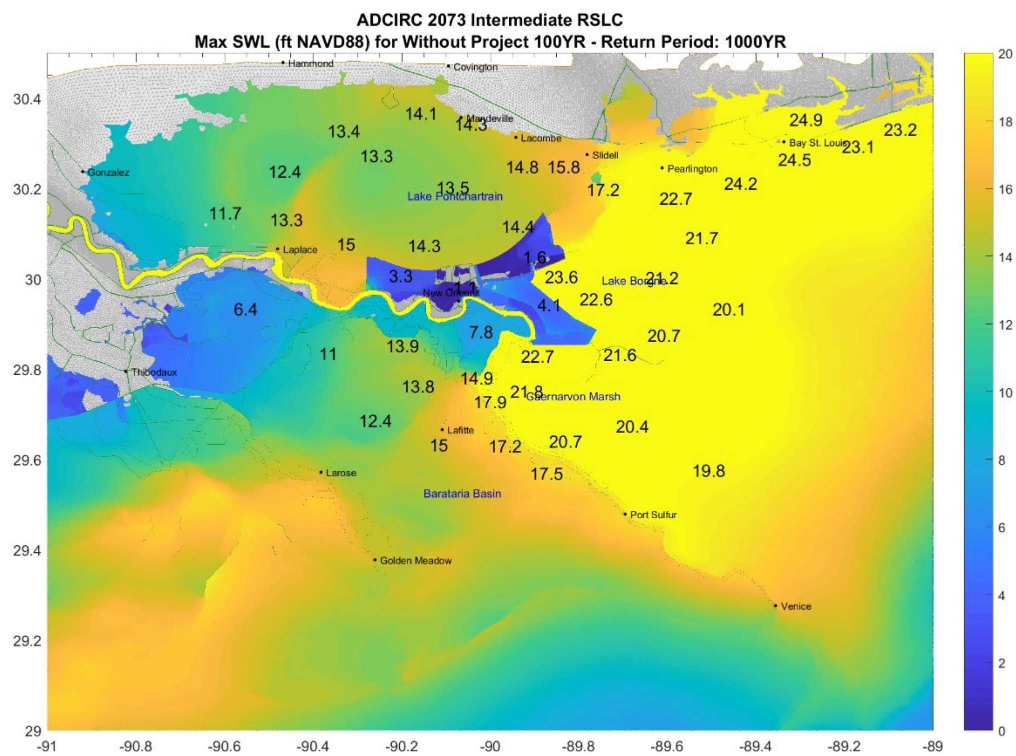

Figure 61. 2070 Without Project 1000 year peak water surface elevation (ft. NAVD88)

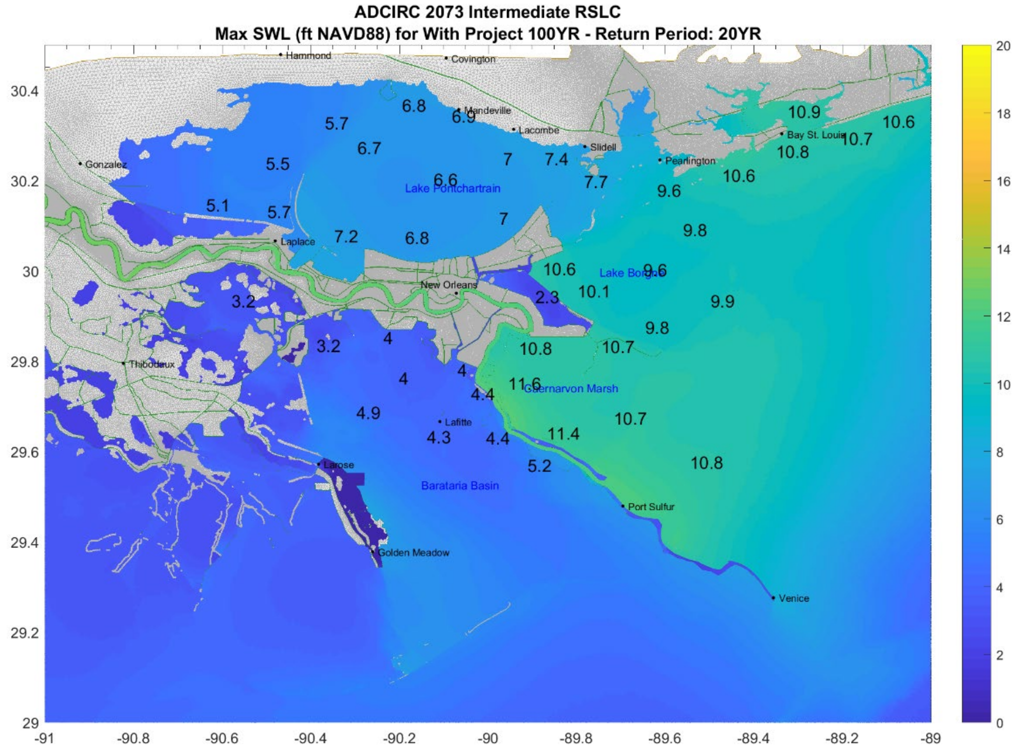

Figure 62. 2070 With Project 20 year peak water surface elevation (ft. NAVD88)

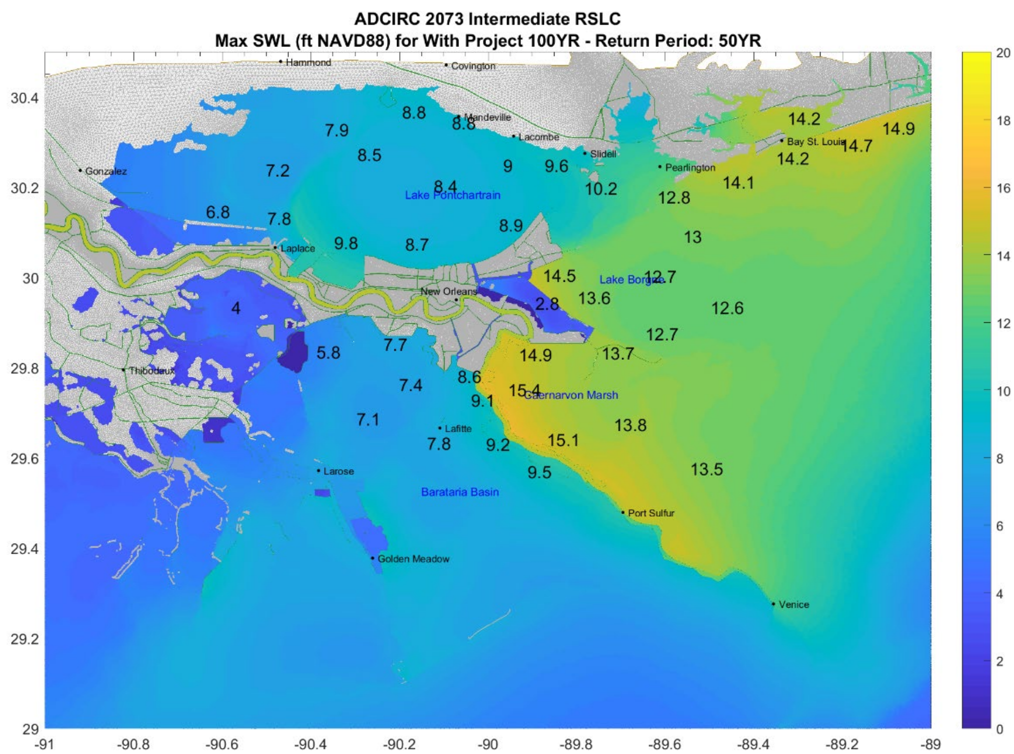

Figure 63. 2070 With Project 50 year peak water surface elevation (ft. NAVD88)

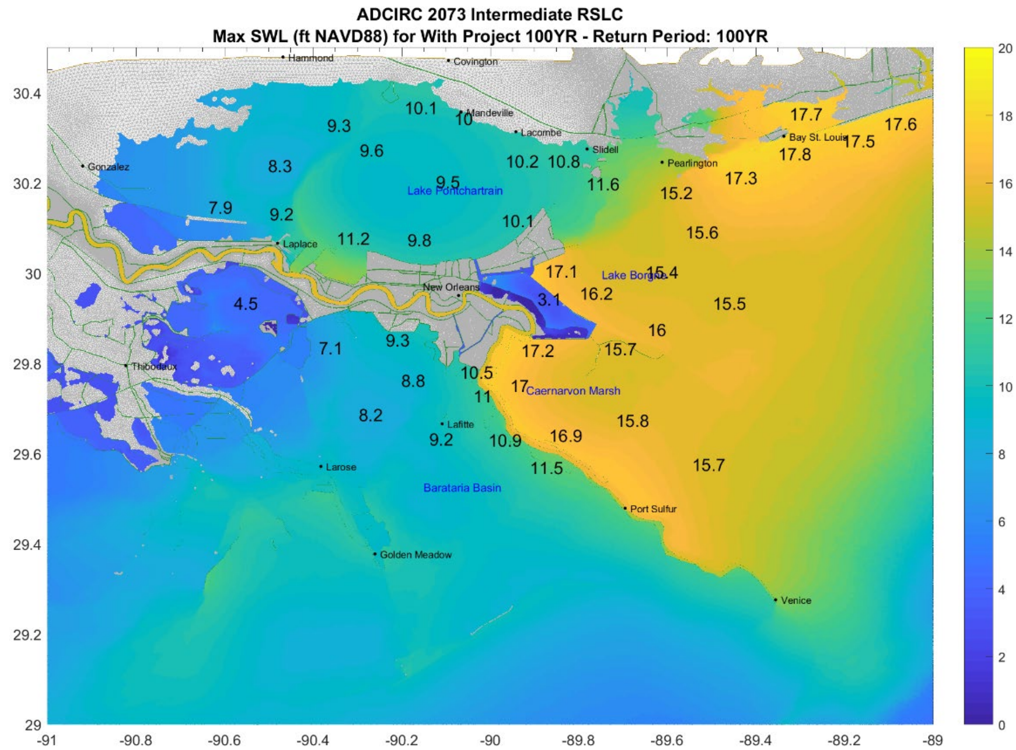

Figure 64. 2070 With Project 100 year peak water surface elevation (ft. NAVD88)

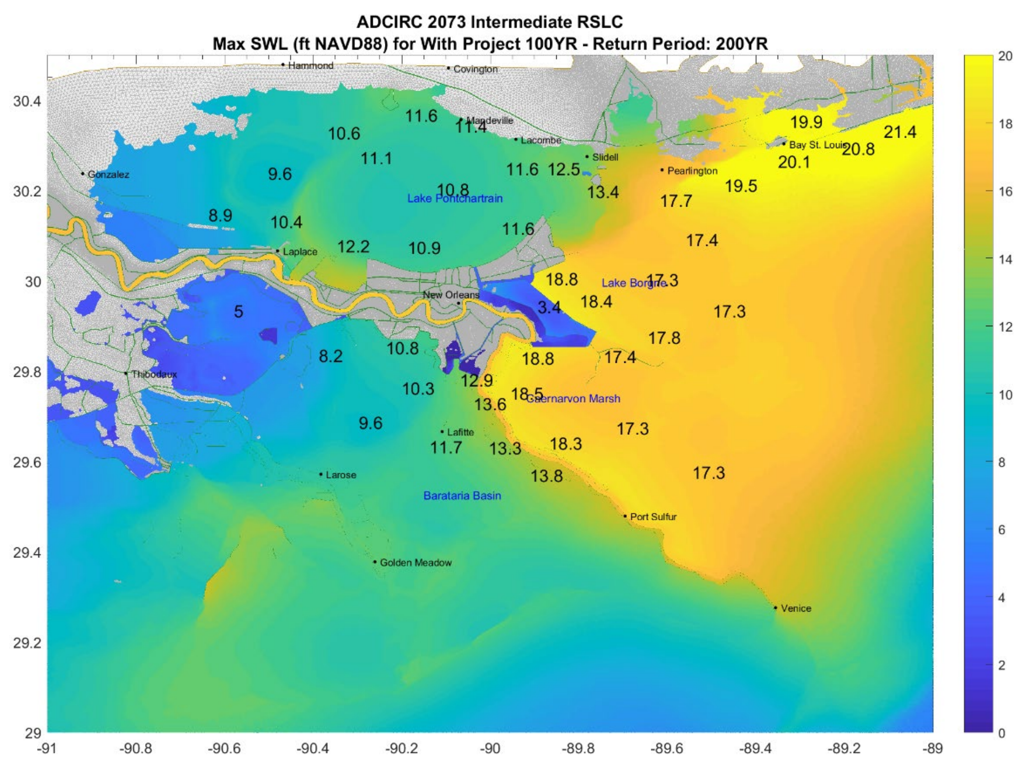

Figure 65. 2070 With Project 200 year peak water surface elevation (ft. NAVD88)

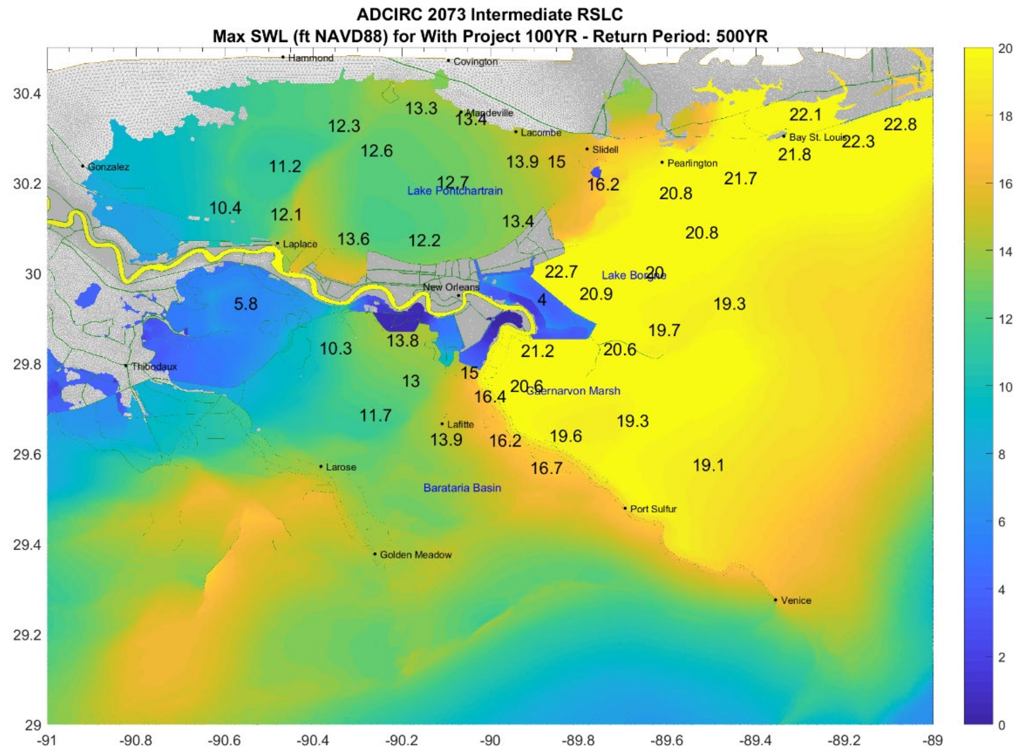

Figure 66. 2070 With Project 500 year peak water surface elevation (ft. NAVD88)

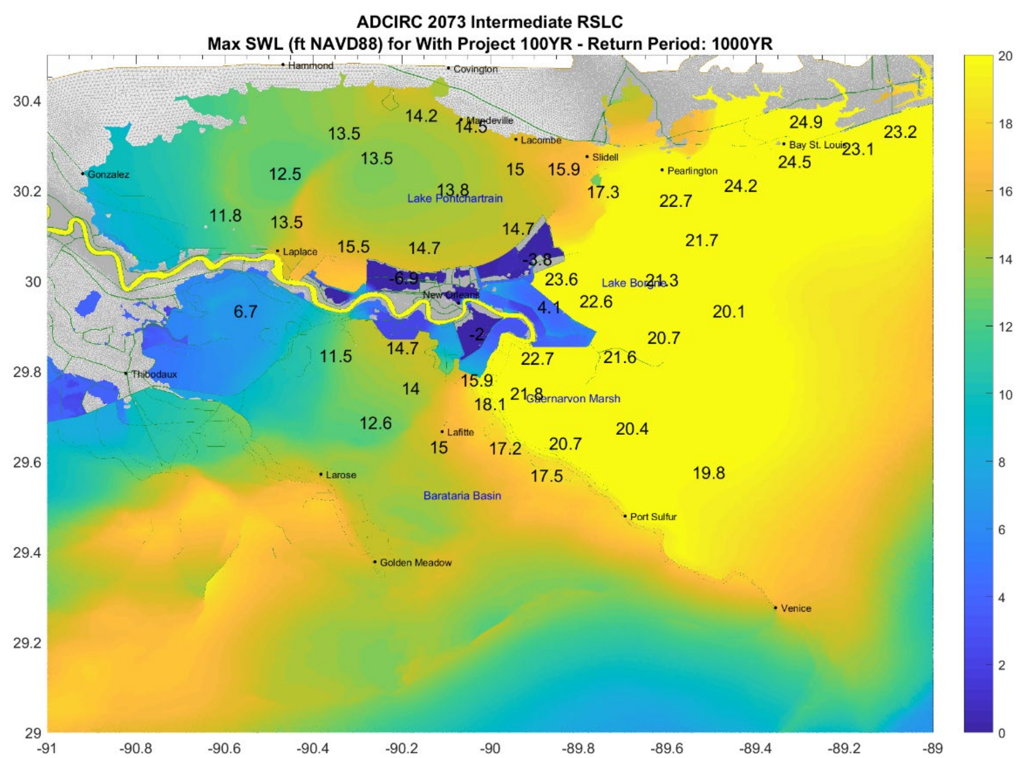

Figure 67. 2070 With Project 1000 year peak water surface elevation (ft. NAVD88)

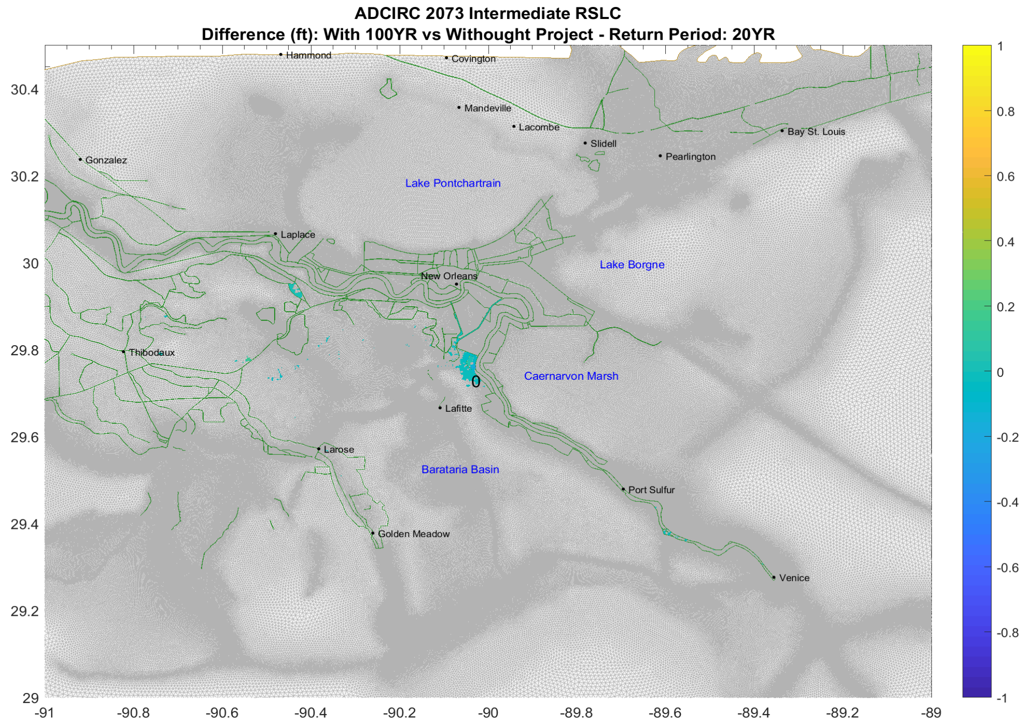

Figure 68. Difference in 20 year maximum water surface elevation between with and without project (ft)

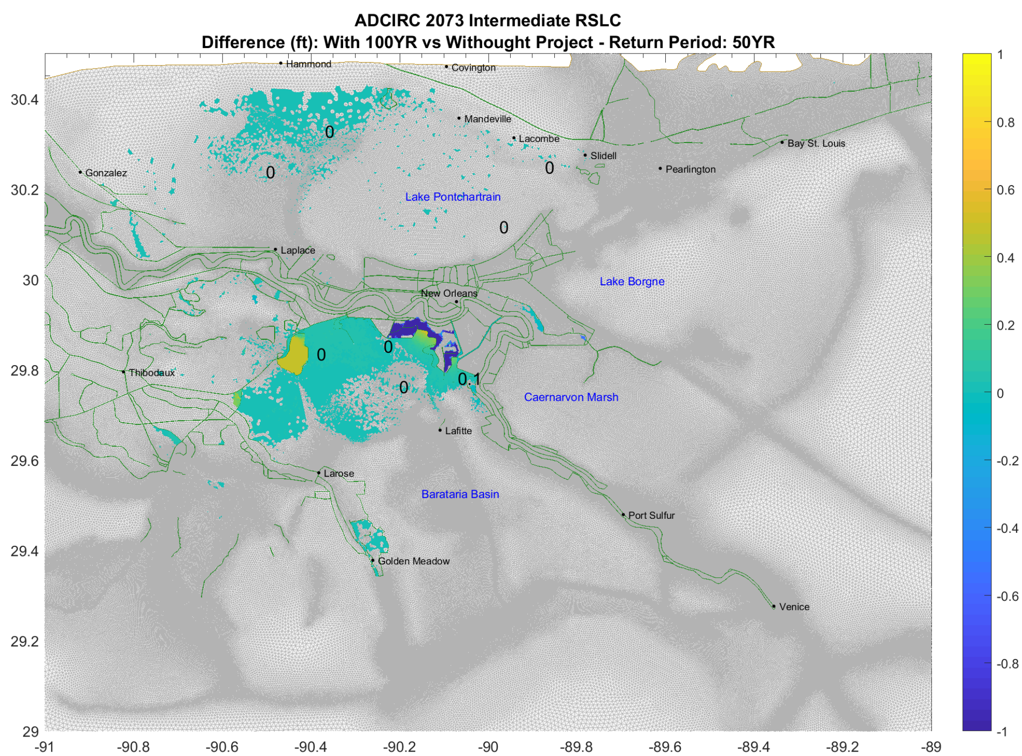

Figure 69. Difference in 50 year maximum water surface elevation between with and without project (ft)

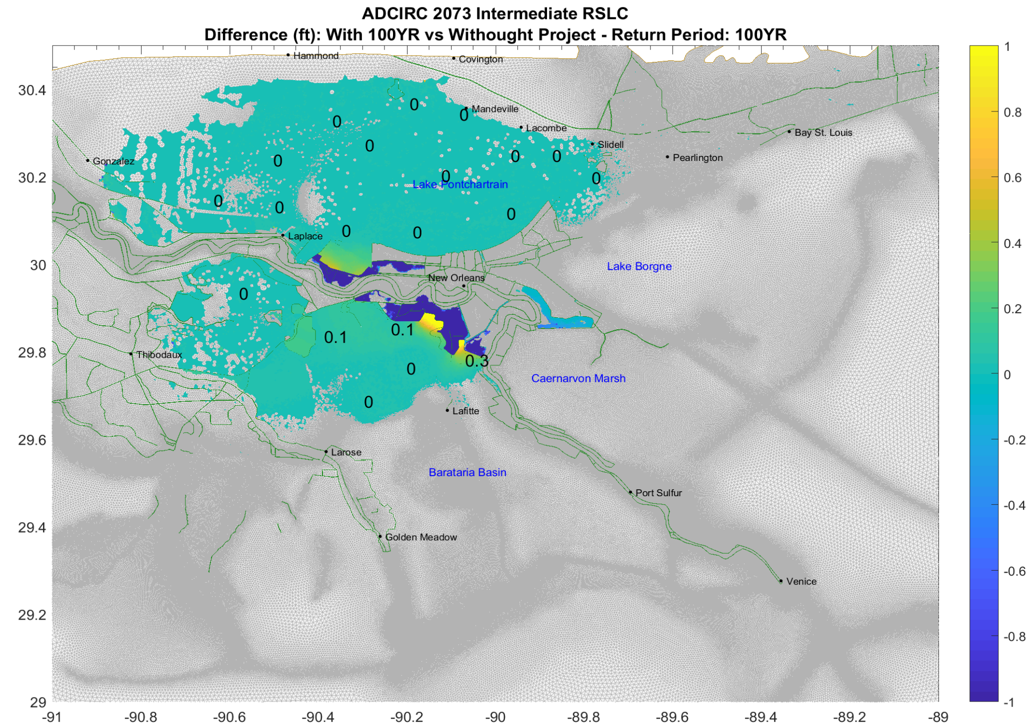

Figure 70. Difference in 100 year maximum water surface elevation between with and without project (ft)

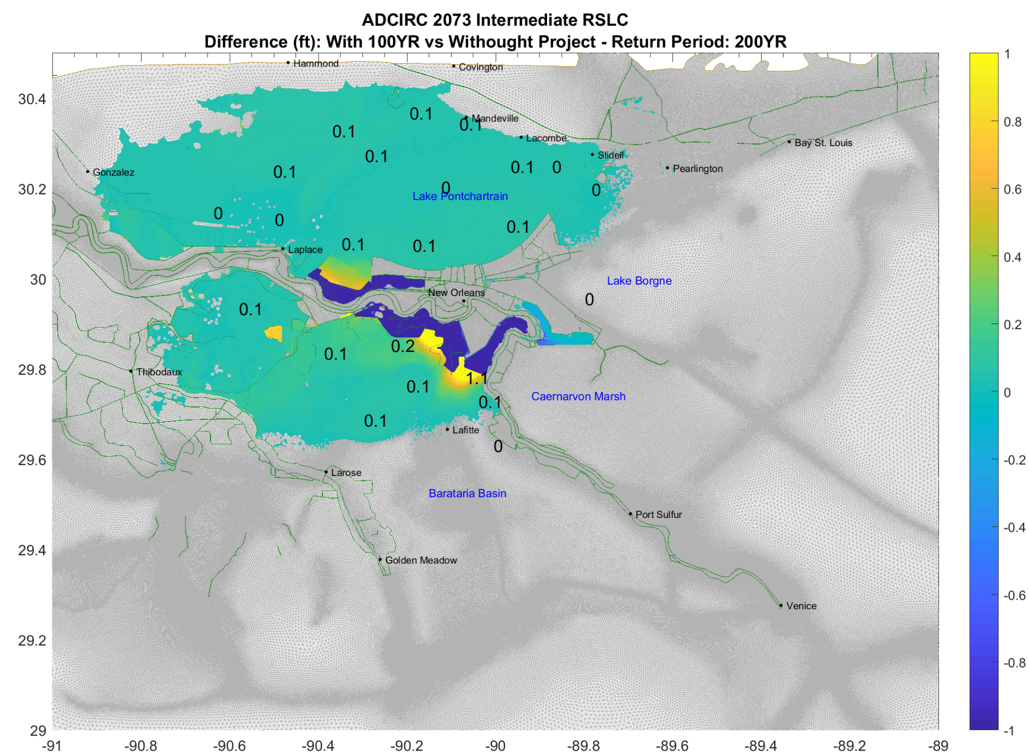

Figure 71. Difference in 200 year maximum water surface elevation between with and without project (ft)

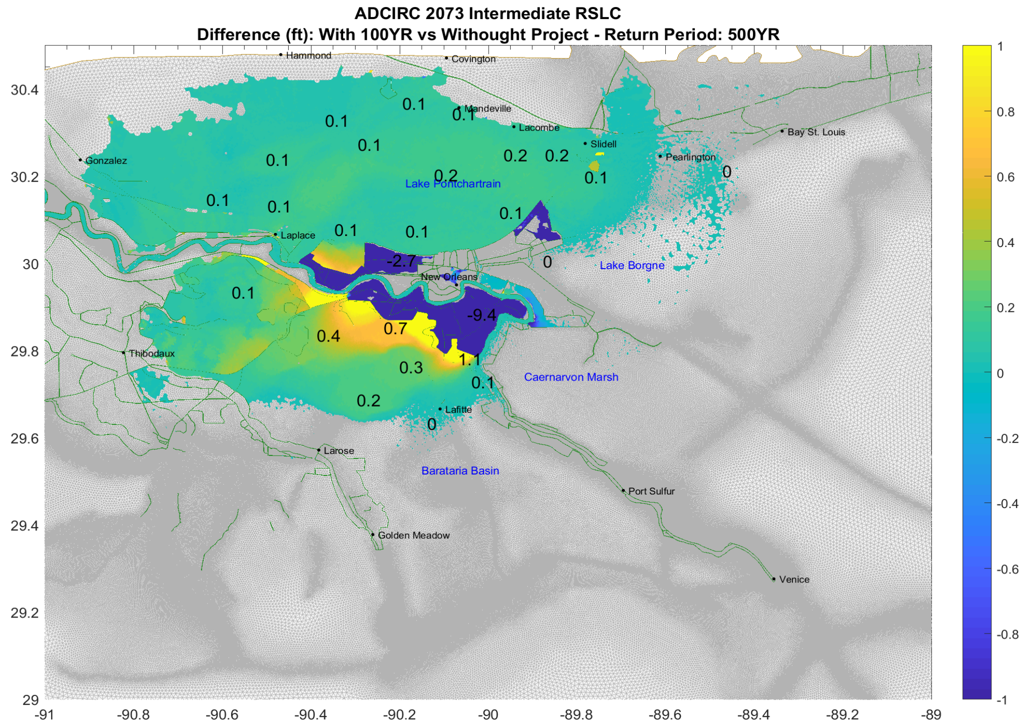

Figure 72. Difference in 500 year maximum water surface elevation between with and without project (ft)

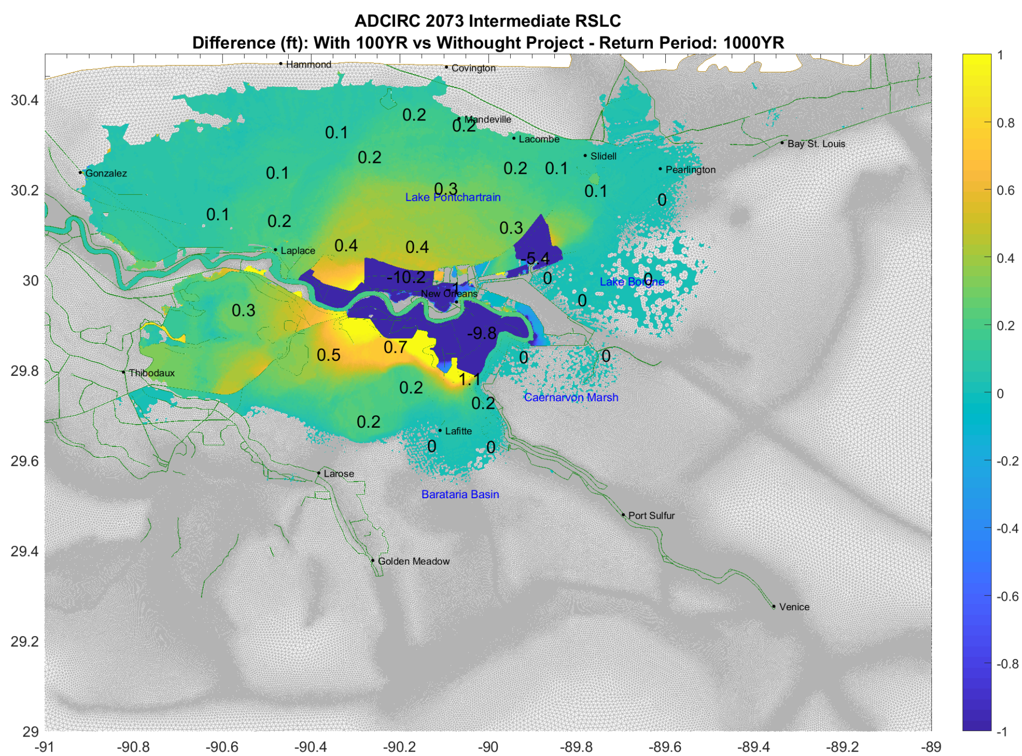

Figure 73. Difference in 1000 year maximum water surface elevation between with and without project (ft)

3.13 CRITICAL INFRASTRUCTURE DISCUSSION

USACE guidance requires that special consideration is given to critical infrastructure within the polder such as hospitals, airports, schools, refineries, other high value facilities. The guidance requires the PDT to evaluate possible solutions to further reduce flood risk for critical infrastructure. In the case of HSDRRS, one potential solution might be compartmentalization by either building a small ring levee or floodwall around certain areas containing critical infrastructure. The PDT did identify certain pieces of critical infrastructure within the floodplain, but could not identify realistic ways to further reduce flood risk in these areas. One of the challenges of a separate ring levee or floodwall around a specific portion of the dense urban area is the lack of real estate and high cost of construction in the urban setting. Furthermore, any area compartmentalized would need its own interior drainage system, such as a small pump station to remove rainfall flooding. The existing sub-surface drainage system for any given compartmentalized area would need to be modified, leading to additional design challenges and project costs. Ultimately, the PDT decided the best way to further reduce risk for critical infrastructure would be raising and armoring the perimeter system.

4 ASSUMPTIONS AND LIMITATIONS

HEC-RAS MODEL

- The HEC-RAS polder model used in this analysis was validated with hurricane Katrina. Katrina would be the only storm available for validation of the interior flood model. Hurricane Betsy may be another storm that could be used for validation but data is limited from the 1960s. Typically, hydraulic models are validated with more than one storms. Without more validation, there is a high degree of uncertainty in interior flooding results.
- The pump station flows in HEC-RAS are controlled by the rating curve. In reality, the flow is governed by the interior and exterior stage and the specific pump-efficiency curve for each station as well as other operating criteria which are uncertain. The modeling also assumes all pump stations will be in operation and achieve full capacity.
- No rainfall time-series are available for the 152 synthetics storms. Rainfall was not included in the HEC-RAS simulations. The lack of rainfall associated with the synthetic storms is perhaps offset by the neglect of many of the smaller scale subsurface drainage features.
- Sub-surface drainage features were not accounted for in HEC-RAS geometry. Specifically, all catch basins and small culverts in subdivisions that bring water to the large open canals are not modeled. This lack of subsurface drainage features has an effect of raising water levels in neighborhoods since water is forced to flow overland instead of underground in culverts. Subsurface drainage would likely have a small effect during large overtopping events as the culvert volume would quickly be overwhelmed.

LEVEE FRAGILITY

- No breaching or floodwall failures was accounted for in the HEC-RAS modeling. Breaching would make the interior inundation potentially much worse for certain storms.
- The assumption of no breaching may be reasonable assuming most levees are armored with high performance, turf reinforced map (HPTRM) and the backside of floodwalls are armored with splash pads. Some levees are not armored including those above the

cross-over point on the MRL. During extreme overtopping events, such as the 500YR or 1000YR without-project, breaching may have less of an influence since the polder is filling to extreme water levels anyways.

- Breaching and levee fragility would be difficult to incorporate into the existing framework of the HEC-RAS model. The weir equation and Eurotop wave overtopping equations are used to determine volumes entering the system. These equations work well for levees and floodwalls that stay intact. During a breach, the equations no longer apply, since the interior can fill and slow down inflows. In other words, the flow into the system becomes tail-water influenced. Also, the situation becomes even more complex, because if there is a breach, the exterior water level drops, reducing head and reducing flows. Modeling breaching is complicated and would push the limits of the one-way coupling of the current model set-up.
- Fragility curves are likely highly uncertain and require a probabilistic approach to fully evaluate. A probabilistic or Monte Carlo based approach to levee fragility and interior flood risk requires many more simulations, perhaps thousands, which is beyond the current capabilities of the interior model.
- The damages due to breaching are most likely in the higher return periods (500YR to 1000YR). For without project conditions, the model is already showing large areas completely inundated. In this case, the effect of breaching might not change the annual expected damages, since the structures are already underwater. If the study provides a high BCR for the 100YR alternative without including breaching, the BCR would likely become stronger if breaching were included, since that would lead to higher expected damages for without project and future without project conditions. The 100YR system, if authorized and funded, will reduce damages associated with breaching, especially with armoring added to all levee segments. Armoring is an essential component of HSDRRS resiliency and reduces the possibility of breaching.

OVERTOPPING CALCS

- The water levels, significant wave heights, and wave periods used in the overtopping calculations are based on the results of the 2017 CPRA surge and wave modeling. An updated surge hazard analysis is currently being developed by CPRA and ERDC. New surge and wave estimates are expected to be different than the values developed for this study. It is entirely possible that the updated water levels could be several feet different, and thus the 100YR required design elevations might shift by a similar amount.
- The wave overtopping calculations for the simulation of synthetic storms are based on the average discharge equations. A more conservative equation could be used. Wave overtopping is a significant component of total overtopping volume for certain storms. For storms with free flow overtopping, wave overtopping is less significant in the total overtopping volume.
- The overtopping calculations and resulting inundation estimates are all 50% or average value deterministic estimates evaluated deterministically. The uncertainty in water levels was not evaluated in the overtopping and inundation calculations. For example, 90% confidence estimates of inundation would be significantly higher. A probabilistic approach would be useful to evaluate the uncertainty in exterior water levels, waves and overtopping volumes. Ultimately, the economic modeling of damages in the interior accounting for uncertainty in the water levels.

- The exterior water levels assumed in the overtopping calculations are not effected by volume lost to overtopping. In reality, there may be a drawdown effect on the exterior once a levee is overtopped. The modeling assumes that any volume lost to the polder interior is replaced by the storm.
- The exterior water levels assumed for the with project overtopping and design calculations are assumed to not be effected by the with project levee lift. In reality, a raised levee will prevent inundation in the interior and amplify exterior water levels. This amplification effect was found to be rather small in the ADCIRC simulations of with and without project simulations.
- The surge and wave time-series assume coincident peaks. In reality, the timing of peak surge and wave may not correspond exactly.
- In overtopping calculations for design, wave direction is assumed to be perpendicular to the levee for all Monte Carlo samples.

WATER LEVEL STATISTICS

- Interior water level statistics were computed with the latest JPM-OS code from ERDC. The code was applied as-is with no modification or verification, although surge statistics from the post-Katrina study (2007 to 2009) were compared to the latest statistics and found to be comparable.
- No estimate of uncertainty is provided in the interior water level statistics. Instead, to address uncertainty, the economics team assigned a “length of record” in FDA. The results of the ERDC statistical code are 50% or average value. 90% statistics would be significantly higher.

2021

Lake Pontchartrain & Vicinity GRR
Appendix D – Risk Assessment
Executive Summary

US Army Corps of Engineers
New Orleans District

U.S. Army Corps of Engineers, New Orleans District

Non-Federal Sponsor: Coastal Protection and Restoration Authority Board of Louisiana

July 2021

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EXECUTIVE SUMMARY

MVN District and the MVN Risk Cadre have completed a semi-quantitative risk assessment (SQRA) for the Lake Pontchartrain and Vicinity (LPV) project system and West Bank and Vicinity (WBV) project system in general accordance with published guidance in support of the general reevaluation report (GRR), which will reevaluate the performance of the LPV project system and WBV project system given the combined effects of consolidation, settlement, subsidence, and sea level rise over time, and determine if additional actions are recommended to sustain the current 1% level of risk reduction for coastal storms.

Due to the limited time and funding available to conduct the risk assessment, a full SQRA that examines all potential failure modes was not able to be conducted. Given the authorizing language to “address consolidation, settlement, subsidence, sea level rise, and new datum to restore Federally authorized hurricane and storm damage reduction projects”, the risk assessment performed for this study focused on risks related to overtopping of the levee system. This decision is supported by examination of the available Screening Level Risk Assessments, which identified overtopping of levees as the major risk driver and was fully coordinated with the USACE Levee Safety Program team. The system may have other potential modes of failure prior to overtopping but the risk assessment did not seek to fully identify or quantify any risks not related to overtopping.

Incremental Risks

The incremental risk (due to failure or breach) includes a consideration of both likelihood of failure and the incremental consequences. The likelihood of failure is a function of both the likelihood of the loading condition that could lead to the failure and the likelihood of failure given the loading condition. During the risk assessment, order-of-magnitude estimates were made for both likelihood of failure and incremental consequences for each risk-driver potential failures mode. The evaluation of each risk-driver potential failure mode was documented as well as the team’s confidence in the order-of-magnitude estimates. Confidence describes the potential impacts to the risk characterization and the decision to take action to reduce risk or reduce uncertainty.

The best estimate of the existing condition average annual incremental life loss is 1E-04 lives per year for LPV and 3E-06 lives per year for WBV, which are considered tolerable from a societal perspective. All overtopping PFMs are below tolerable risk for the existing condition in LPV. The estimated total annual probability of failure (APF) for the existing condition is between 1E-06 and 1E-05 failures per year, which is below the societal tolerable risk line. Confidence in the magnitude of the APF (best estimate for failure likelihood) for these locations was moderate since the order of magnitude of the overtopping is unlikely to change though the team recognized some uncertainty in the ADCIRC modeling. Incremental life loss is primarily driven by the close proximity of the PAR to the landside toe of the levee.

For WBV, all overtopping PFMs are below tolerable risk for the existing condition in WBV. The estimated total annual probability of failure (APF) for the existing condition is between 3E-07 and 3E-06 failures per year, which is below the societal tolerable risk line. Confidence in the magnitude of the APF (best estimate for failure likelihood) for these locations was moderate since the order of magnitude of the overtopping is unlikely to change though the team recognized some uncertainty in the ADCIRC modeling.

The best estimate of the future without action condition (FWAC) average annual incremental life loss is 3E-02 lives per year for LPV and 1E-01 lives per year for WBV. For LPV, the estimated total annual probability of failure (APF) for the FWAC is between 1E-04 and 1E-03 failures per year, which is above the societal tolerable risk line. The largest source of incremental risk in LPV for the FWAC is the overtopping with breach due to overtopping with waves of the armored levees leading to breach in St. Charles Parish eastbank. This area is estimated to settle in the FWAC 3 feet and was analyzed with 1.8 ft relative sea level rise. This resulted in stillwater overtopping between the 1/50 and 1/100 year hurricane events. Confidence in the magnitude of the APF (best estimate for failure likelihood) for these locations was moderate based on uncertainty associated with the future hurricane modeling, duration of overtopping, settlement analysis, and unknowns with the performance of the armoring under real world loading. A breach associated with this failure mode would impact St. Charles Parish eastbank, which has residential and commercial areas behind the levee, with residential areas near the toe.

For WBV the estimated total annual probability of failure (APF) for the FWAC is between 3E-04 and 3E-03 failures per year, which is above the societal tolerable risk line. The incremental risk in WBV for the FWAC is mostly driven by overtopping with breach due to overtopping with waves of armored levees leading to breach in Ames, Westwego, and Belle Chase. These areas are estimated to settle in the FWAC between 2.3 and 3.3 ft and was analyzed with 1.8 feet relative sea level rise. This resulted in stillwater overtopping between the 1/100 and 1/200 year hurricane events for Belle Chase and less than the 1/50 year hurricane event for Ames and Westwego. Confidence in the magnitude of the APF (best estimate for failure likelihood) for these locations was moderate based on uncertainty with the future hurricane modeling, duration of overtopping, settlement analysis, and unknowns with the performance of the armoring under real world loading. A breach associated with this failure mode would impact Ames, Westwego, and Belle Chase, which has residential and commercial areas behind the levee. In the Ames and Westwego area residential are at the toe of the levee.

Two with project scenarios were evaluated for LPV and WBV for the future with project condition. Both scenarios are evaluated at the 1.8 feet relative sea level rise, but the storms varied between the 1% and 0.5% AEP. The best estimate of the future with project 1% AEP is an average annual incremental life loss is 3E-04 lives per year for LPV and 3E-03 lives per year for WBV. The best estimate of the future with project 0.5% AEP is an average annual incremental life loss is 1E-04 lives per year for LPV and

1E-05 lives per year for WBV. The estimated total annual probability of failure (APF) for the with project is between 3E-07 and 3E-06 failures per year for LPV and 3E-05 and 3E-04 failures per year for WBV at the 1% AEP. The estimated total annual probability of failure (APF) for the with project is between 1E-07 and 1E-06 failures per year for both LPV and WBV at the 0.5% AEP. The risk for LPV at the 1% and 0.5 AEP are below the societal tolerable risk line. The risks for WBV at the 1% AEP are above the societal tolerable risk line due to free flow overtopping at the 1/500 year storm near WBV-12 and risks at the 0.5% AEP is below the societal tolerable risk line. Confidence in the magnitude of the best estimate for failure likelihood for these locations were moderate based on uncertainty with the future hurricane modeling, duration of overtopping, settlement analysis, and unknowns with the performance of the armoring under real world loading.

Non-Breach Risk

There is no non-breach risk for the Existing Condition (EC) from stillwater overtopping up to the 1/500 year storm. For the FWAC the non-breach flood risks were calculated for both LPV and WBV. The likelihood of flooding was estimated to be between 3E-3 and 3E-2 floods per year for LPV and between 1E-2 and 1E-1 floods per year for WBV. The best estimate of average annual non-breach life loss is 3E+01 lives per year for LPV and 1E+01 lives per year for WBV. The non-breach inundation for the FWAC is extensive for both LPV and WBV. For the LPV with project scenarios at 1% and 0.5% AEP there is no non-breach risk up to the 1/500 year storm from stillwater overtopping, as the levels will not have stillwater overtopping at this event. The non-breach risks for WBV with project were not calculated, but at the 1% AEP there is non-breach overtopping due to free flow overtopping at the 1/500 year storm near WBV-12 and this overtopping will be addressed during the PED phase of the project. For WBV with project at the 0.5% AEP there is no non-breach risk up to the 1/500 year storm from stillwater overtopping, as the level will not have stillwater overtopping at this event. Traditional breach modeling does not account for wave overtopping, but for the existing condition and with project scenarios the overtopping rates are low, even up to the 1/500 year storm. There was special modeling performed, which is contained in the H&H appendix that outlines non-breach wave overtopping inundation for all condition of the study.

Confidence and Major Uncertainties

The SQRA team was reasonably confident in the incremental risks described above. For the overtopping with waves of armored levees leads to breach, confidence in the magnitude of the APF (best estimate for failure likelihood) for these locations were moderate based on uncertainty with the future hurricane modeling, duration of overtopping, settlement analysis, and unknowns with the performance of the armoring under real world loading. The team chose a moderate confidence for consequences as there may be some work or variation in the consequence modeling that may or may not change the order of magnitude of the model. With long warning times most of the population would be out of harm's way before the hurricane impacts the area. Most of the parishes, however, have large numbers of low income and homeless populations. Surveys were sent to the parishes to gather evacuation information and evacuation plans from the parishes and state were reviewed to ensure warning times were correct. Even though a Mileti and Sorensen interview was not conducted with each parish, the survey and evacuations plans aided in understanding how the parishes would react and a full interview may not change the input parameters.

Recommendations

1. The local emergency management has a good hurricane specific evacuation plan for the parishes. USACE should work with the local sponsors and emergency management personnel and the communities to raise evacuation awareness.
2. Perform post storm inspection to monitor performance of system to identify how armored and unarmored levees and levee to floodwall tie-ins performed during wave overtopping. The Colorado State University (CSU) testing of armored and unarmored levees was ~ 3 hours. The levee to floodwall tie-in design has not been tested during a real world event. Inspection of levees after an event can better inform performance of the system.
3. Existing HPTRM testing was limited to 4 CFS/ft and did not result in a failure. This volume is well above the HSDRRS overtopping allowable 0.1 CFS/ft. Additional testing would be required to find the HPTRM's failure limit. However, this limit will be for a much lower frequency overtopping event than the 1/100 year event. Please note, Galveston District is considering testing on HPTRM. These test results could help understand HPTRM performance during higher flow rates and durations.
4. Monitor marsh platforms around the systems to better understand degradation and its effects on wave heights and surge levels. Marsh platforms provide protection to levees by reducing wave heights and surge levels. As the marsh platforms degrade this may affect the wave characteristics and surge levels in the future.
5. Perform periodic levee surveys to verify settlement. Settlement predictions need to be verified by periodic surveys to identify if settlement is actually occurring at the predicted rate.
6. Monitor settlement under levee floodwall tie-in. Settlement has occurred under the concrete that is part of the levee floodwall tie-ins. This needs to be monitored and repairs need to be made as needed to ensure proper function of the tie-in. If repairs are not made, this will affect the performance of the tie-in.
7. The MRL I-walls are not part of the LPV nor WBV system authorization. Due to the potential for hurricane storm surge above the 1/100 year level, it is possible that MRL I-walls could see loadings above their authorized design grade. For this, MRL I-walls above the existing crossover points should be reviewed further in a separate risk assessment where the full range of possible loadings are considered.
8. Loading conditions for LPV and WBV T-walls should be monitored for changes that could result in overstressing of foundation piles. If loading conditions change in the future, the T-walls should be re-evaluated accordingly.

2021

Lake Pontchartrain & Vicinity GRR Appendix E – Structural Engineering

US Army Corps of Engineers
New Orleans District

U.S. Army Corps of Engineers, New Orleans District

Non-Federal Sponsor: Coastal Protection and Restoration Authority Board of Louisiana

March 2021

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LAKE PONTCHARTRAIN & VICINITY GRR
APPENDIX E – STRUCTURAL ENGINEERING

1 INTRODUCTION

1.1 OVERVIEW

This appendix presents the analysis of the hard structures in the Lake Pontchartrain and Vicinity (LPV) system.

1.2 SCOPE

The scope of this analysis consists of compiling data to describe the current condition of the LPV hard structures, determining which structures will fail to provide the required level of risk reduction for a relative sea level rise (RSLR) of.1.8 ft for 100-year design elevations, and providing recommended modifications to those structures to bring them up to the required level of risk reduction. The 200-year plan was developed to consider if additional risk reduction would be economically supported but was not fully developed due to the limitations of the authorizing language.

1.2.1 STUDY AREA

For this analysis, the LPV system was divided into 8 segments: St. Charles Parish East Bank, Jefferson Parish Lakefront, Orleans Parish Metro Lakefront, Orleans Parish Lakefront East, South Point to MRGO/GIWW Closure, IHNC and GIWW Basin, St. Bernard Parish, and LPV-MRL.

1.2.1.1 ST. CHARLES PARISH EAST BANK

The St. Charles Parish portion of the LPV system is located north of Airline Highway (U.S. Highway 61). It runs from the Bonnet Carré Spillway East Guide Levee to the Jefferson-St. Charles Parish boundary at the New Orleans Airport East-West runway terminus. Five drainage structures are included. Floodwalls are located at Interstate 310 (I-310), Shell Pipeline Crossing, Good Hope and at the Gulf South Pipeline Crossing. A double track railroad floodgate is located near the eastern end of the segment where the Canadian National Railroad crosses through the protection system. Figure 1-1 shows the St. Charles Parish East Bank segment. Table 1-1 lists the sections and their corresponding descriptions.

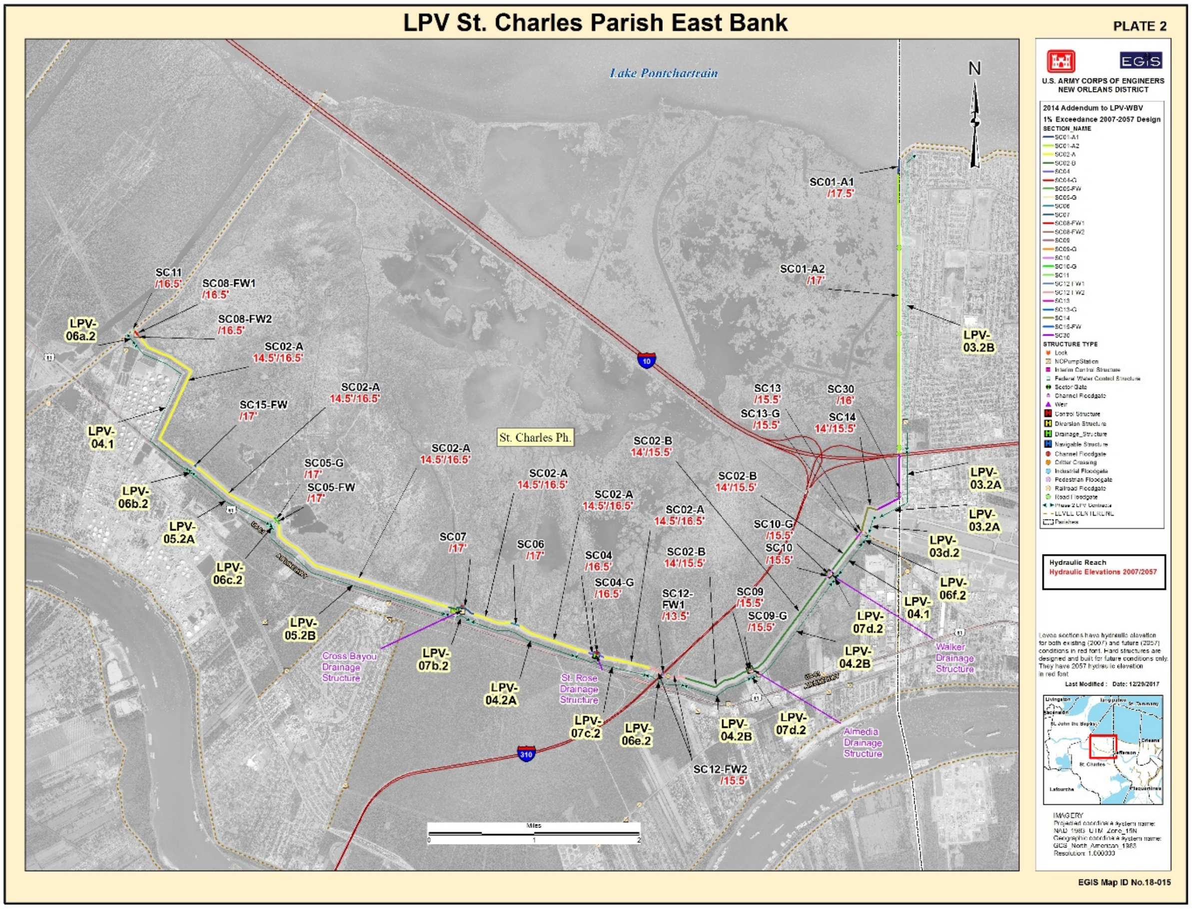

Figure 1-1. St. Charles Parish East Bank

Table 1-1. St. Charles Parish East Bank Hard Structures

Section	Description
SC11	Bonnet Carré Tie-In Floodwall
SC08-FW1	Bayou Trepagnier Complex Fronting Protection
SC08-FW2	Bayou Trepagnier Complex T-Walls
SC15-FW	Shell Pipeline Floodwall
SC05-FW	Good Hope Floodwall
SC05-G	Good Hope Gate
SC05-FW	Good Hope Floodwall
SC07	Cross Bayou Canal T-Wall
SC06	Gulf South Pipeline T-Wall
SC04	St. Rose Canal Drainage Structure
SC04-G	St. Rose Canal Drainage Gate
SC04	St. Rose Canal Drainage Structure
SC12-FW2	I-310 Floodwall
SC12-FW1	I-310 Floodwall Under Ramps
SC12-FW2	I-310 Floodwall
SC09	Almedia Drainage Structure
SC09-G	Almedia Drainage Gate
SC09	Almedia Drainage Structure
SC10	Walker Drainage Structure
SC10-G	Walker Drainage Gate
SC10	Walker Drainage Structure
SC13-FW	ICRR Gate Monolith T-Wall
SC13-G	ICRR Floodgate
SC13-FW	ICRR Gate Monolith T-Wall
SC30	West Return Wall Transition
SC01-A2	St. Charles Return Wall 17.0 ft.
SC01-A1	St. Charles Return Wall 17.5 ft.

1.2.1.2 JEFFERSON PARISH LAKEFRONT

The Jefferson Parish Lakefront portion of the LPV system is located along the bank of Lake Pontchartrain. It runs in an east-west direction from the 17th Street Canal at the Orleans-Jefferson Parish Line to the Jefferson-St. Charles Parish Return Levee. Along this alignment are four pumping stations and several recreation areas at Bonnabel, Williams and Causeway Blvds. Figure 1-2 shows the Jefferson Parish Lakefront segment. Table 1-2 lists the sections and their corresponding descriptions.

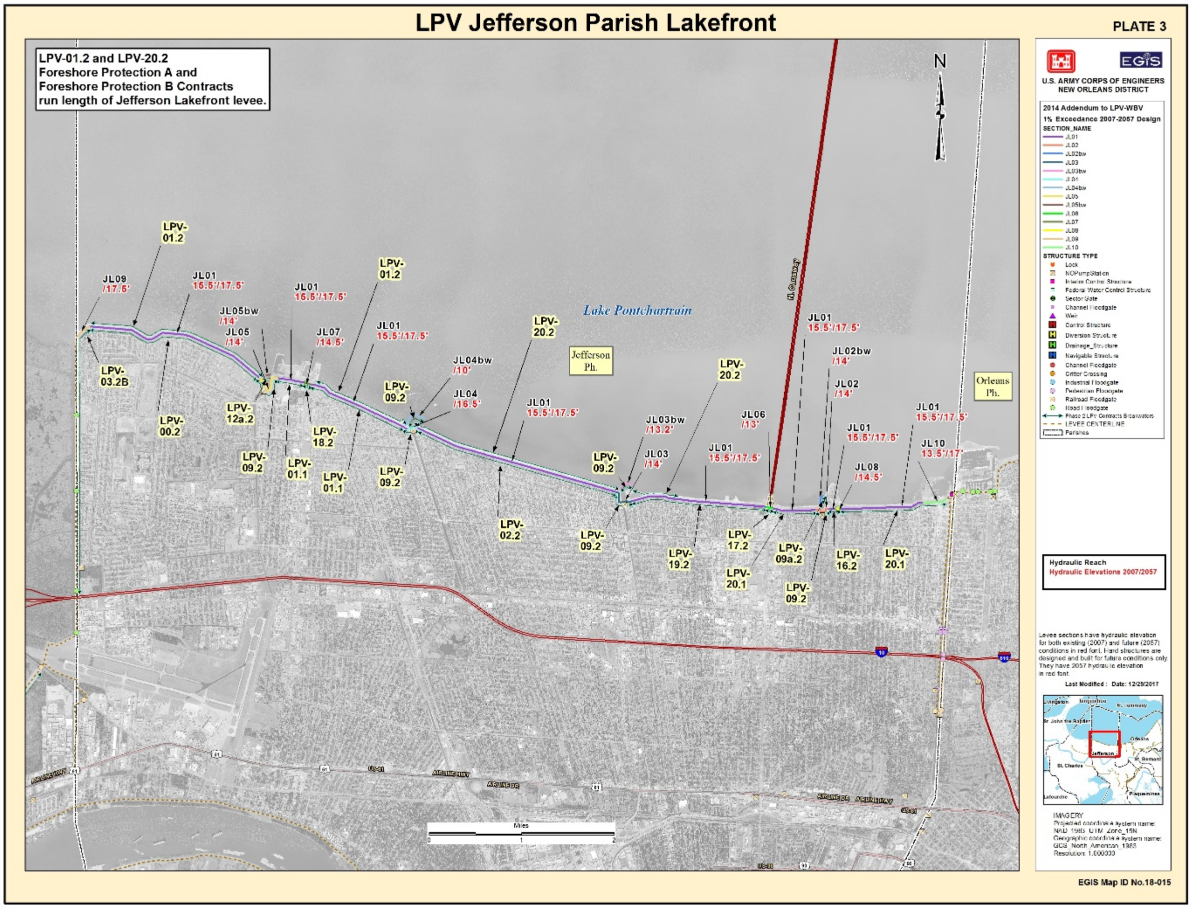

Figure 1-2. Jefferson Parish Lakefront

Table 1-2. Jefferson Parish Lakefront Hard Structures

Section	Description
JL09	Return Wall
JL05	Duncan PS #4 Fronting Protection
JL07	Williams Blvd. Floodgate
JL04	Elmwood PS #3 Fronting Protection
JL03	Suburban PS #2 Fronting Protection
JL06	Causeway Northbound and Southbound T-Wall
JL02	Bonnabel PS #1 Fronting Protection
JL08	Bonnabel Boat Launch Floodgate

1.2.1.3 ORLEANS PARISH METRO LAKEFRONT

The Orleans Parish Metro Lakefront portion of the LPV system covers the Lake Pontchartrain lakefront from the Jefferson Parish line to the Inner Harbor Navigation Canal (IHNC). This segment includes three canal closures, multiple floodgates, and sections of floodwall at the New Orleans Marina, along the Topaz St. levee, at Bayou St. John, along the former location of Pontchartrain Beach, and at the intersection of Lakeshore Dr. and Franklin Ave. Figure 1-3 shows the Orleans Parish Metro Lakefront segment. Table 1-3 lists the sections and their corresponding descriptions.

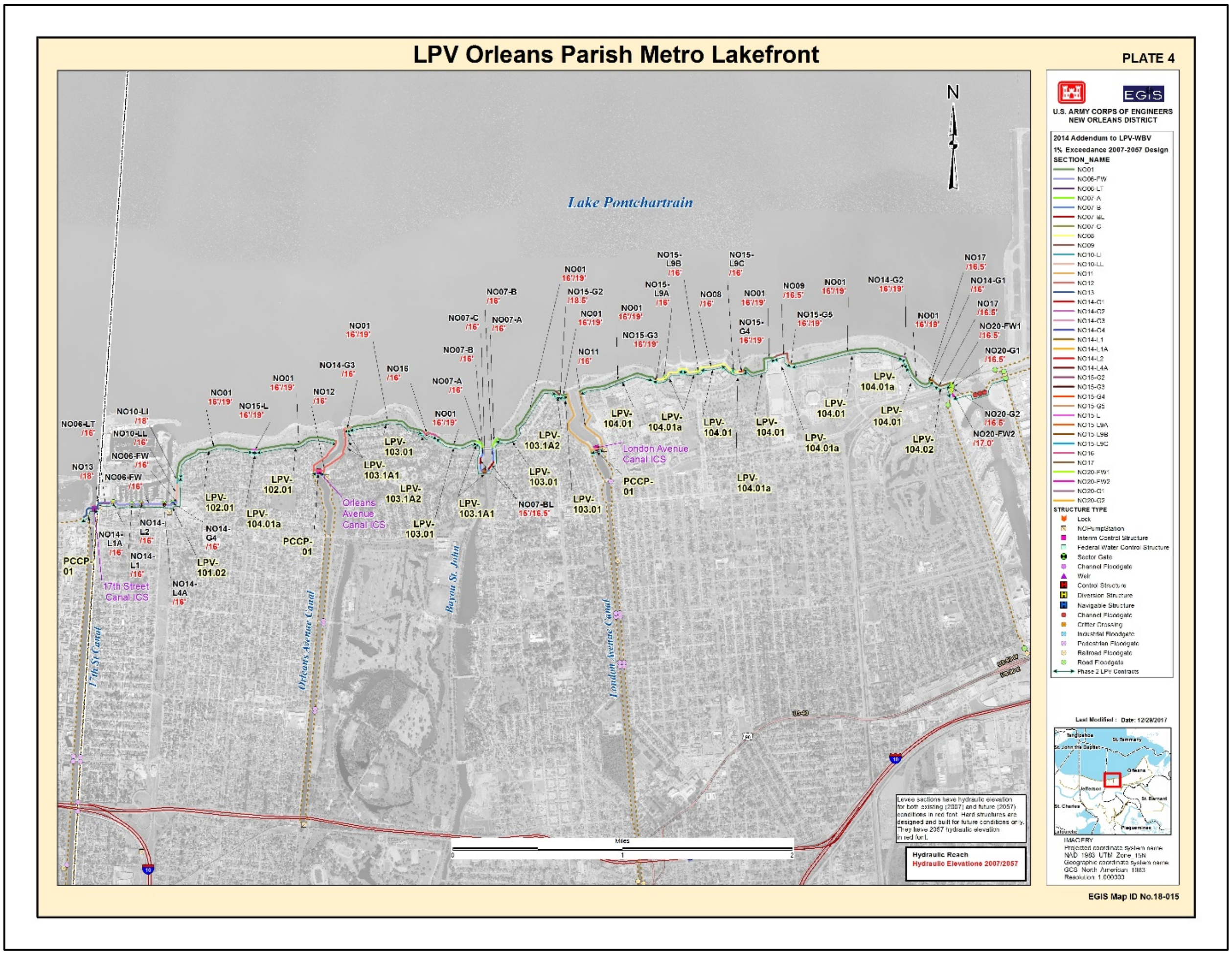

Figure 1-3. Orleans Parish Metro Lakefront

Table 1-3. Orleans Parish Metro Lakefront Hard Structures

Section	Description
NO13	17th St. Outfall Canal Closure
NO13	17th St. Outfall Canal Closure
NO06-LT	NO Marina Levee/Floodwall Combo
NO06-FW	NO Marina Floodwall
NO14-L1A	West Roadway Gate
NO06-FW	NO Marina Floodwall
NO14-L1	West Marina Gate
NO06-FW	NO Marina Floodwall
NO14-L2	East Marina Gate
NO06-FW	NO Marina Floodwall
NO14-L4A	Pontchartrain Blvd Gate
NO06-FW	NO Marina Floodwall
NO14-G4	Floodgate at Lakeshore Dr just N of Lake Marina Ave.
NO06-FW	NO Marina Floodwall
NO10-LL	Topaz St. Levee/Floodwall Combination
NO10-LI	Topaz St. Levee/Floodwall Combination
NO12	Orleans Ave. Outfall Canal Closure
NO14-G3	Floodgate at Marconi
NO16	Lakeshore Drive near Rail St. Floodgate
NO07-A	Bayou St. John Lakefront Floodwall
NO07-B	Bayou St. John Bayou Floodwall
NO07-B	Bayou St. John Bayou Floodwall
NO07-C	Bayou St. John Sector Gate
NO07-B	Bayou St. John Bayou Floodwall
NO07-B	Bayou St. John Bayou Floodwall
NO07-A	Bayou St. John Lakefront Floodwall
NO15-G2	Lakeshore Drive Floodgate W of London Ave. Canal
NO11	London Ave. Outfall Canal Closure
NO08	Pontchartrain Beach Floodwall
NO15-L9A	West Floodgate at Pontchartrain Beach
NO08	Pontchartrain Beach Floodwall
NO15-L9B	Center Floodgate at Pontchartrain Beach
NO08	Pontchartrain Beach Floodwall
NO15-L9C	East Floodgate at Pontchartrain Beach

Section	Description
NO08	Pontchartrain Beach Floodwall
NO09	American Standard Floodwall
NO17	Leroy Johnson Drive
NO14-G1	Floodgate near Seabrook L13
NO17	Leroy Johnson Drive
NO20-FW1	Floodwall Under Leon C. Simon Dr. near Seabrook (W)
NO20-G1	Boat Launch Gate Near Seabrook (West)
NO20-FW1	Floodwall Under Leon C. Simon Dr. near Seabrook (W)
NO20-G2	Norfolk Southern Railroad Gate near Seabrook (West)
NO20-FW1	Floodwall Under Leon C. Simon Dr. near Seabrook (W)
NO20-FW2	I-Wall Tie-in to Seabrook Gate (West)

1.2.1.4 ORLEANS PARISH LAKEFRONT EAST

The Orleans Parish Lakefront East portion of the LPV system covers the New Orleans East lakefront from the IHNC to South Point. This segment includes three pumping stations, one pipeline crossing, and sections of floodwalls at the New Orleans Lakefront Airport, along the Citrus Lakefront Levee, at Lincoln Beach, and a transition section at South Point. Figure 1-4 shows the Orleans Parish Lakefront East segment. Table 1-4 lists the sections and their corresponding descriptions.

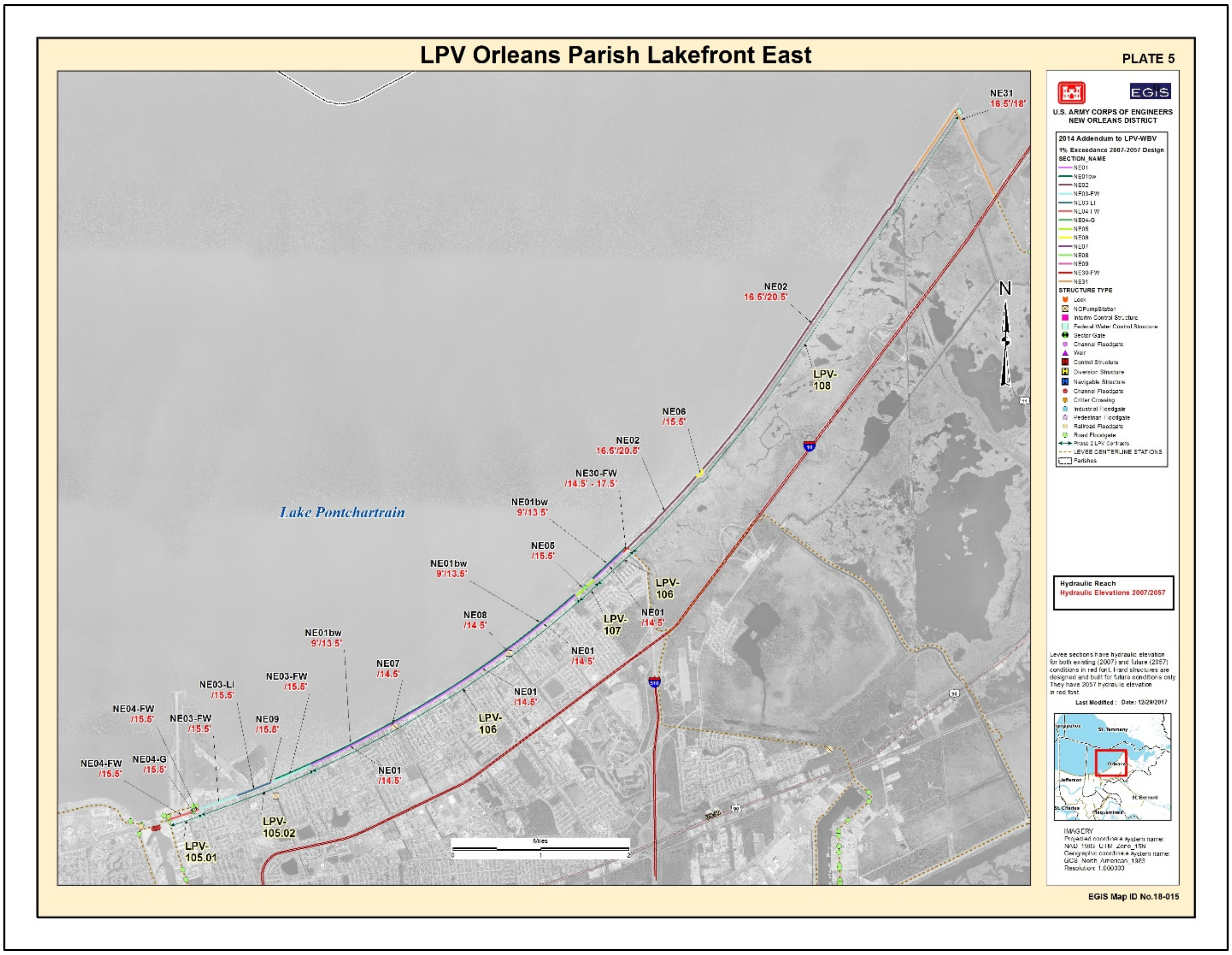

Figure 1-4. Orleans Parish Lakefront East

Table 1-4. Orleans Parish Lakefront East Hard Structures

Section	Description
NE04-FW	New Orleans Lakefront Airport West Floodwall
NE04-G	Downman Road Gate
NE04-FW	New Orleans Lakefront Airport West Floodwall
NE03-FW	New Orleans Lakefront Airport East T-Wall
NE03-LI	New Orleans Lakefront Airport East Lv/FW Combo
NE09	St. Charles Pump Station (OP #16)
NE03-FW	New Orleans Lakefront Airport East T-Wall
NE01	Citrus Lakefront Levee/I-Wall Combination
NE07	Citrus Pump Station (OP #10)
NE01	Citrus Lakefront Levee/I-Wall Combination
NE08	Jahncke Pump Station (OP #14)
NE01	Citrus Lakefront Levee/I-Wall Combination
NE05	Lincoln Beach Floodwall
NE01	Citrus Lakefront Levee/I-Wall Combination
NE30-FW	Transition Reach from NE01-NE02 T-Walls
NE06	Collins Pipeline Crossing Floodwall

1.2.1.5 SOUTH POINT TO MRGO/GIWW CLOSURE

The South Point to MRGO/GIWW Closure portion of the LPV system covers the segment from South Point to the Lake Borgne Surge Barrier. This segment includes one section of floodwall at the end of the New Orleans Back Levee closest to the Lake Borgne Surge Barrier, one pumping station and three floodgates: two at highway crossings and one at a railroad crossing. Figure 1-5 shows the South Point to MRGO/GIWW Closure segment. Table 1-5 lists the sections and their corresponding descriptions.

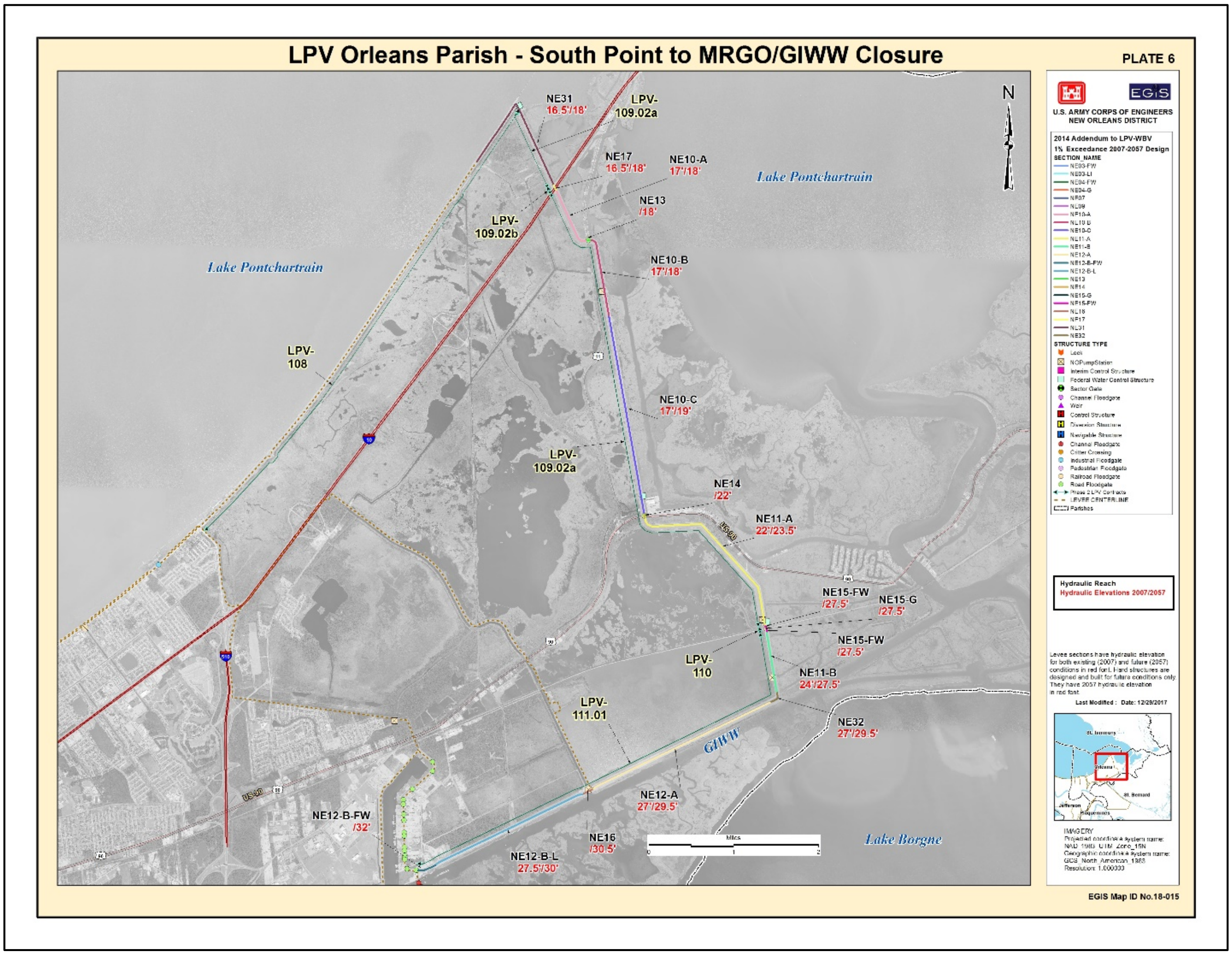

Figure 1-5. South Point to MRGO/GIWW Closure

Table 1-5. South Point to MRGO/GIWW Closure Hard Structures

Section	Description
NE13	Highway 11 Floodgate
NE14	Highway 90 Floodgate
NE15-FW	CSX RR Floodwall
NE15-G	CSX RR Floodgate
NE15-FW	CSX RR Floodwall
NE16	New Orleans East PS 15 T-Walls
NE12-B-FW	Tie-ins between NE12B and IHNC T-Wall

1.2.1.6 IHNC AND GIWW BASIN

The IHNC and GIWW Basin portion of the LPV system consists of the levees and floodwalls encompassing the Inner Harbor Navigation Canal (IHNC), Gulf Intracoastal Waterway (GIWW) and a portion of the Mississippi River Gulf Outlet (MRGO) where it joins the GIWW. This segment includes the Lake Borgne Surge Barrier, IHNC Lock, Bayou Bienvenue Floodgate and Seabrook Closure Complex; six pumping stations; and floodwall sections under the Paris Rd. Bridge, along the IHNC and at the Michoud Canal and Slip. Figure 1-6 shows the IHNC and GIWW Basin segment. Table 1-6 lists the sections and their corresponding descriptions. This analysis only includes perimeter floodwalls; therefore only the Seabrook Closure Complex, GIWW, Lake Borgne Surge Barrier, Bayou Bienvenue Floodgate, and MRGO Closure floodwalls were analyzed.

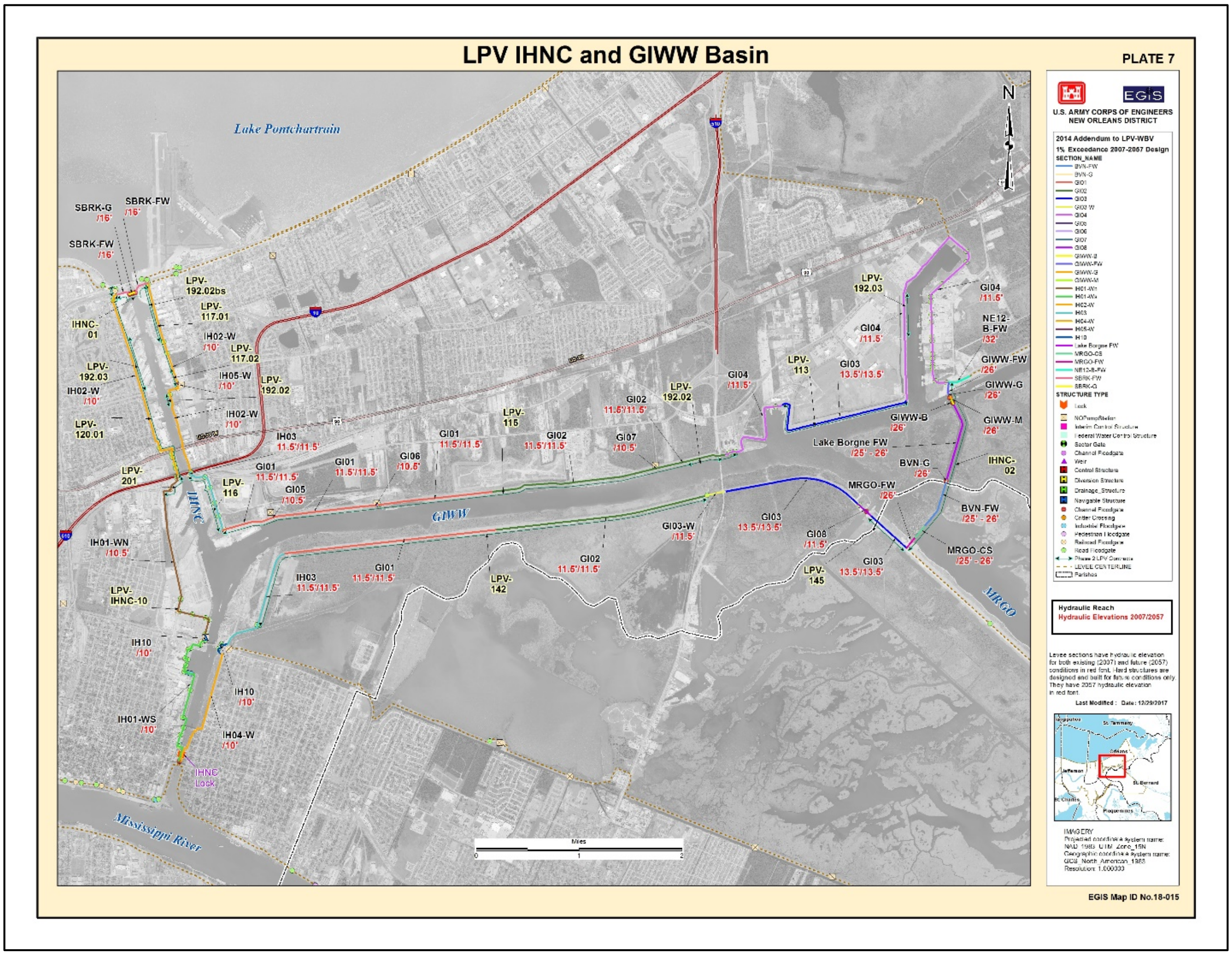

Figure 1-6. IHNC and GIWW Basin

Table 1-6. IHNC and GIWW Basin Hard Structures

Section	Description
SBRK-FW	Seabrook Closure Complex East Tie-in Walls
SBRK-G	Closure Gate at Seabrook
SBRK-FW	Seabrook Closure Complex East Tie-in Walls
GIWW-FW	GIWW Tie-in T-Walls to Levee
GIWW-G	Navigable Floodgate at GIWW
GIWW-M	GIWW Monoliths
GIWW-B	GIWW Concrete Swing Barge
Lake Borgne FW	Lake Borgne Floodwall Crenel/Merlon (N Barrier Wall)
BVN-G	Navigable Floodgate at Bayou Bienvenue
BVN-FW	Bayou Bienvenue Braced Floodwall
MRGO-CS	MRGO Closure Floodwall Crenel
MRGO-FW	Tie-in T-Walls and at MRGO Levee

Based on the maximum water level (100-year, high RSLC) in the IHNC Basin of El. 6.9 (See Table 5, LPV/WBV Hydrology and Hydraulics Report, Dated March 2020), the existing I-walls have been determined to be at low risk of failure due to several factors. First, there is a current Regulated Navigation Area rule in place and enforced by the US Coast Guard (USCG) for this area. Under the Captain of the Port order, any vessel capable of causing a potential hazard during a storm event will be forced to exit the basin prior to the storm event. The USCG also coordinates with USACE Operations Division to inspect and document all potential floating hazards within the IHNC basin prior to and during each hurricane season. An Operation Plan is developed between the organizations with detailed plans on utilizing the IHNC lock and Lake Borne Barrier Gate to evacuate vessels prior to the storm event. Through previous analysis of the IHNC basin performed by Structures Branch, it was determined that a low risk water level inside the IHNC basin was El. 8.0 (NAVD 88 2004.65). For this water elevation, due to the existing ground and berm sections near the I-walls, it was determined that any large vessel or barge would ground out prior to coming in contact with any wall. All the floodwalls in the IHNC basin are reinforced with adequate scour protection (either concrete or grouted riprap), but none of these walls would be overtopped at El. 6.9. For these reasons, it was determined that for the LPV/WBV GRR Study, that these walls be considered low risk of failure for our analysis.

1.2.1.7 ST. BERNARD PARISH

The St. Bernard Parish portion of the LPV system extends from the Lake Borgne Surge Barrier to the Caernarvon Freshwater Diversion Structure. This segment includes one pumping station, the Bayou Dupre Control Structure, the Caernarvon sector gate, three roadway floodgates, and either floodwall or levee and floodwall sections for the rest of the segment. Figure 1-7 shows the St. Bernard Parish segment. Table 1-7 lists the sections and their corresponding descriptions.

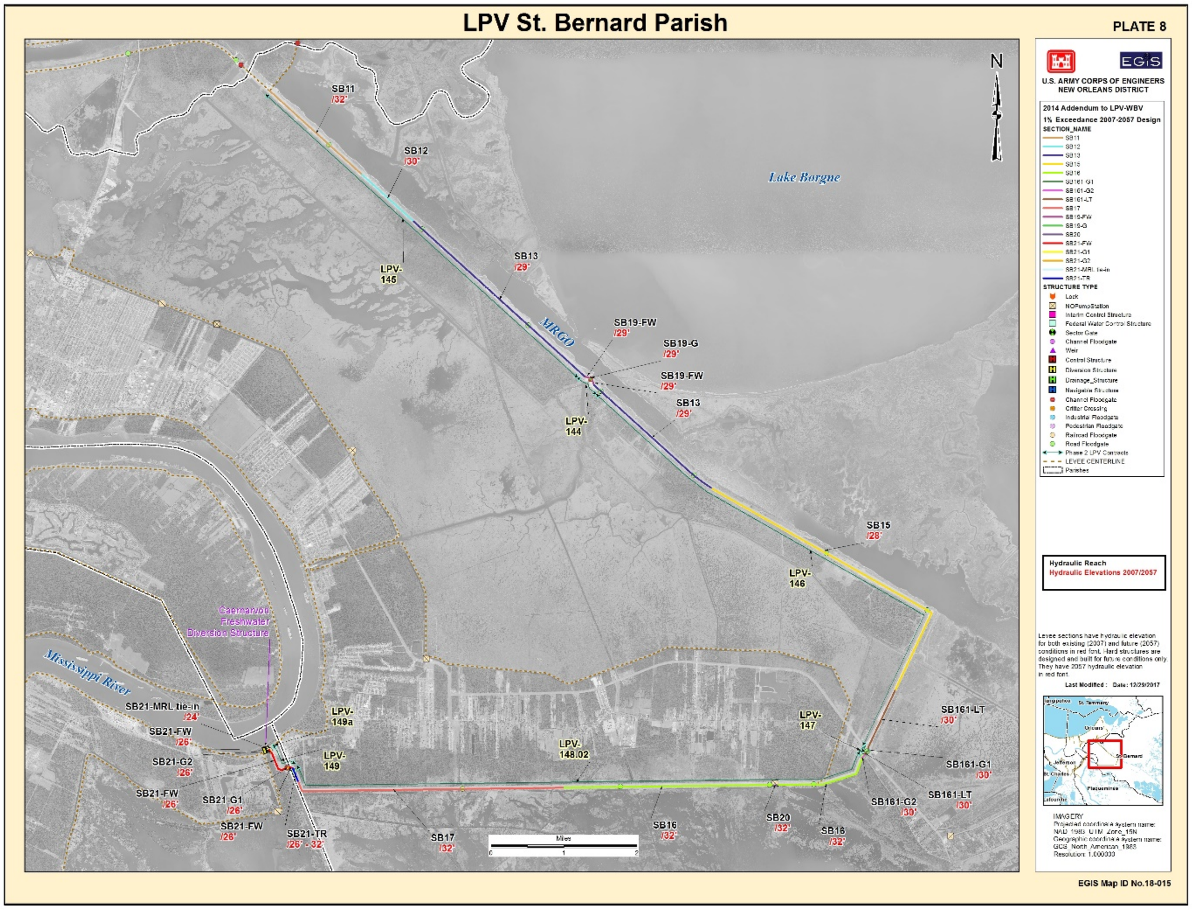

Figure 1-7. St. Bernard Parish

Table 1-7. St. Bernard Parish Hard Structures

Section	Description
SB11	MRGO Levee to IHNC Surge Barrier Tie-in
SB12	MRGO Levee/Floodwall Combo
SB13	MRGO Levee – Bayou Bienvenue to Bayou Dupre
SB19-FW	Bayou Dupre T-Wall Tie-ins
SB19-G	Bayou Dupre Control Structure
SB19-FW	Bayou Dupre T-Wall Tie-ins
SB13	MRGO Levee – Bayou Bienvenue to Bayou Dupre
SB15	MRGO Levee – Bayou Dupre to Hwy 46
SB161-LT	Bayou Road to Hwy 46 Levee/Floodwall Combo
SB161-G1	Caernarvon to Verret Hwy 46 Floodgate
SB161-LT	Bayou Road to Hwy 46 Levee/Floodwall Combo
SB161-G2	Caernarvon to Verret Bayou Rd Floodgate
SB16	Caernarvon to Verret
SB20	St. Mary Pump Station (PS #8)
SB16	Caernarvon to Verret
SB17	Caernarvon to Verret
SB21-TR	Caernarvon Canal Transition Floodwall Reach
SB21-FW	Caernarvon to Mississippi River Floodwall
SB21-G1	Caernarvon Canal Sector Gate
SB21-FW	Caernarvon to Mississippi River Floodwall
SB21-G2	Caernarvon Canal Hwy 39 Gate and RR Gate
SB21-FW	Caernarvon to Mississippi River Floodwall
SB21-MRL tie-in	Tie-in to MRL

The Hurricane and Storm Damage Risk Reduction System (HSDRRS) in St. Bernard Parish consists of six projects (Lake Pontchartrain & Vicinity (LPV)-144, 145, 146, 147, 148.02, and 149) that provide hurricane risk reduction against a storm surge with an annual 1 percent probability of occurrence (100-year). Three of these projects (LPV-145, 146, and 148.02) include approximately 21.4 miles of pile supported T-walls constructed atop existing levee embankment. A majority of the piles beneath the T-Walls utilized sacrificial steel for corrosion protection.

To date, multiple design concerns with potential impacts to longevity were raised. Multiple numerical modeling and field investigation efforts were performed to address these concerns. Ultimately, the LPV-154 contract was developed to provide field data on the actual performance of the floodwall foundation at specific, predetermined locations. Corrosion monitoring devices were installed to verify the actual corrosion rates. To monitor the effects of consolidation on the H-piles and to validate the moments predicted by the numerical models, electrical resistance strain gages and vibrating wire strain gages were installed on the H-piles at multiple locations. Additional piezometers and magnetic extensometers were installed within the LPV-145, LPV-146, and LPV-148.02 contract reaches to validate the estimated future settlement. These monitoring devices are used to predict if, and when, the moment capacity of the H-piles may be exceeded.

1.2.1.8 LPV-MRL

The LPV-MRL portion of the LPV system consists of the levees and floodwalls along the east bank of the Mississippi River. This segment includes numerous road and railroad floodgates. Figure 1-8 shows the LPV-MRL segment. Table 1-8 lists the sections and their corresponding descriptions.

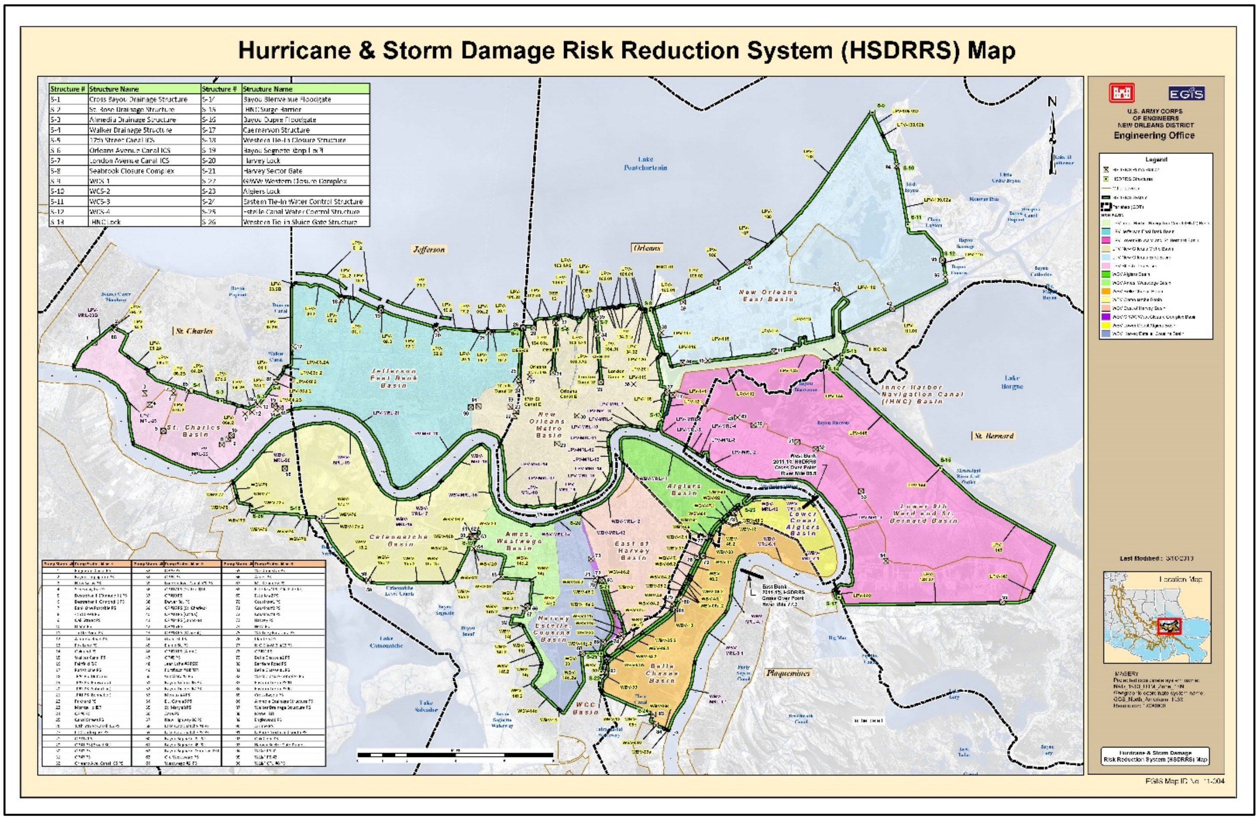

Figure 1-8. LPV-MRL

Table 1-8. LPV-MRL Hard Structures

Section	Description
103E-LF	LPV-MRL-19 Carrollton Bend to Nashville to Napoleon
103E-LF	LPV-MRL-19 Carrollton Bend to Nashville to Napoleon
103E-LF	LPV-MRL-19 Carrollton Bend to Nashville to Napoleon
100E-F	LPV-MRL-18 Nashville to Napoleon FW
99E-F	LPV-MRL-17 Louisiana Wharves Levee/LPV-MRL-16 Capping Sheet Piling Louisiana Wharves
98E-F	LPV-MRL-15 Louisiana to Jackson FW
97E-F	LPV-MRL-14 Jackson to Thalia FW
96E-F	LPV-MRL-14 Jackson to Thalia FW/LPV-MRL-13 Thalia to Poydras FW
95E-F	LPV-MRL-11 Canal to Toulouse FW/LPV-MRL-10 Dumaine fW
94E-F	LPV-MRL-9 Barracks to Montegut FW/LPV-MRL-8 Montegut to Independence FW
93E-F	LPV-MRL-7 Independence to IHNC FW
93E-F	LPV-MRL-6 IHNC Lock to Arabi Levee and FW
92E-LF	LPV-MRL-6 IHNC Lock to Arabi Levee and FW
91E-LF	LPV-MRL-5 Arabi Levee and FW
91E-F	LPV-MRL-5 Arabi Levee and FW
91E-LF	LPV-MRL-4 Amstar Levee and FW
91E-LF	LPV-MRL-3 Chalmette Battlefield Slip
91E-F	LPV-MRL-3 Chalmette Battlefield Slip
91E-LF	LPV-MRL-3 Chalmette Battlefield Slip
91E-LF	LPV-MRL-3 Chalmette Battlefield Slip
91E-F	LPV-MRL-3 Chalmette Battlefield Slip
91E-LF	LPV-MRL-3 Chalmette Battlefield Slip
91E-F	LPV-MRL-3 Chalmette Battlefield Slip
90E-LF	LPV-MRL-2 Chalmette Battlefield Levee and FW
88E-LF	LPV-MRL-1 Caernarvon-Chalmette Battlefield

2 METHODOLOGY

2.1 MODELS USED

Models were not utilized for this analysis. For further information on how the analysis was completed, see paragraphs 3.2, 4.2 and 5.2.

3 EXISTING CONDITIONS

3.1 ASSUMPTIONS

Since the hard structures throughout the LPV system stretch for many miles, the system was divided into sections within segments, as listed in the tables of paragraph 1.2.1, STUDY AREA. For the LPV reach, the system consists of approximately 93.7 miles of levee, 40.4 miles of I-wall, and 16.2 miles of T-wall. The scope of this analysis consists of compiling data to describe the current condition of the LPV hard structures. The top of wall elevations for this analysis are based on EGIS data and the elevations are assumed to be same as provided in the 1% HSDRRS Design Elevation Report. These 2057 100-yr HSDRRS design elevations are close to existing survey elevations, since all floodwalls in the post-Katrina upgrade were constructed to 2057 requirements. For simplicity, the average top of wall elevations for each section were used. While the top of wall elevation may vary some within a section, it is unlikely to vary significantly. The following tables compare the existing average top of wall elevation in each segment to the 2057 design elevation to determine if any floodwalls fail to meet the height for the requirements established in the original HSDRSS design. The original HSDRRS design was determined using on older ADCIRC model with different future conditions assumptions. Therefore, the design elevations in this section cannot be directly compared to the design elevations recommended by this current study. For further information on the 2057 100-year design elevations, see the original 2011 HSDRRS 1% Design Elevation Report.

3.2 ANALYSIS

The average 2057 100-year design elevations were compared to the average top of wall elevations. The average top of wall and 2057 100-year design elevations, as well as the amount each section is deficient, are presented in Table 3-1 through Table 3-8 below. Minor differences between design and survey elevations noted in the table below do not currently impact the system's ability to provide the 1% level of risk reduction.

Table 3-1. St. Charles Parish Hard Structures Information – Existing Conditions

Section	Top of Wall Elevation	Design Elevation	Deficiency
SC11	18.5 ft	16.5 ft	N/A
SC08-FW1	18.2 ft	16.5 ft	N/A
SC08-FW2	16.6 ft	16.5 ft	N/A
SC15-FW	17.1 ft	17.0 ft	N/A
SC05-FW	17.1 ft	17.0 ft	N/A
SC05-G	17.5 ft	17.0 ft	N/A
SC05-FW	17.1 ft	17.0 ft	N/A
SC07	17.3 ft	17.0 ft	N/A
SC06	17.2 ft	17.0 ft	N/A
SC04	16.6 ft	16.5 ft	N/A
SC04-G	16.4 ft	16.5 ft	0.1 ft
SC04	16.6 ft	16.5 ft	N/A
SC12-FW2	15.8 ft	15.5 ft	N/A
SC12-FW1	14.7 ft	13.5 ft	N/A
SC12-FW2	15.8 ft	15.5 ft	N/A
SC09	15.5 ft	15.5 ft	N/A
SC09-G	15.6 ft	15.5 ft	N/A
SC09	15.5 ft	15.5 ft	N/A
SC10	15.5 ft	15.5 ft	N/A
SC10-G	15.5 ft	15.5 ft	N/A

Section	Top of Wall Elevation	Design Elevation	Deficiency
SC10	15.5 ft	15.5 ft	N/A
SC13-FW	15.5 ft	15.5 ft	N/A
SC13-G	15.8 ft	15.5 ft	N/A
SC13-FW	15.5 ft	15.5 ft	N/A
SC30	15.6 ft	16.0 ft	0.4 ft
SC01-A2	17.0 ft	17.0 ft	N/A
SC01-A1	17.3 ft	17.5 ft	0.2 ft

Table 3-2. Jefferson Parish Lakefront Hard Structures Information – Existing Conditions

Section	Top of Wall Elevation	Design Elevation	Deficiency
JL09	17.4 ft	17.5 ft	0.1 ft
JL05	18.9 ft	14.0 ft	N/A
JL07	16.9 ft	14.5 ft	N/A
JL04	20.4 ft	16.5 ft	N/A
JL03	17.0 ft	14.0 ft	N/A
JL06	15.3 ft	13.0 ft	N/A
JL02	17.0 ft	14.0 ft	N/A
JL08	17.0 ft	14.5 ft	N/A

Table 3-3. Orleans Parish Metro Lakefront Hard Structures Information – Existing Conditions

Section	Top of Wall Elevation	Design Elevation	Deficiency
NO13	18.0 ft	18.0 ft	N/A
NO13	18.0 ft	18.0 ft	N/A
NO06-LT	16.1 ft	16.0 ft	N/A
NO06-FW	16.0 ft	16.0 ft	N/A
NO14-L1A	15.9 ft	16.0 ft	0.1 ft
NO06-FW	16.0 ft	16.0 ft	N/A
NO14-L1	16.3 ft	16.0 ft	N/A
NO06-FW	16.0 ft	16.0 ft	N/A
NO14-L2	15.9 ft	16.0 ft	0.1 ft
NO06-FW	15.9 ft	16.0 ft	0.1 ft
NO14-L4A	16.0 ft	16.0 ft	N/A
NO06-FW	15.9 ft	16.0 ft	0.1 ft
NO14-G4	16.0 ft	16.0 ft	N/A
NO06-FW	16.0 ft	16.0 ft	N/A
NO10-LL	15.9 ft	16.0 ft	0.1 ft
NO10-LI	18.0 ft	18.0 ft	N/A
NO12	18.0 ft	16.0 ft	N/A

NO14-G3	16.8 ft	16.0 ft	N/A
NO16	17.9 ft	16.0 ft	N/A
NO07-A	18.6 ft	16.0 ft	N/A
NO07-B	16.1 ft	16.0 ft	N/A
NO07-B	16.1 ft	16.0 ft	N/A
NO07-C	16.1 ft	16.0 ft	N/A
NO07-B	16.1 ft	16.0 ft	N/A
NO07-B	16.1 ft	16.0 ft	N/A
NO07-A	18.6 ft	16.0 ft	N/A
NO15-G2	18.6 ft	18.5 ft	N/A
NO11	18.0 ft	16.0 ft	N/A
NO08	18.2 ft	16.0 ft	N/A
NO15-L9A	17.8 ft	16.0 ft	N/A
NO08	18.1 ft	16.0 ft	N/A
NO15-L9B	19.0 ft	16.0 ft	N/A
NO08	18.2 ft	16.0 ft	N/A
NO15-L9C	17.7 ft	16.0 ft	N/A
NO08	18.2 ft	16.0 ft	N/A
NO09	19.0 ft	16.5 ft	N/A
NO17	16.9 ft	16.5 ft	N/A
NO14-G1	16.5 ft	16.0 ft	N/A
NO17	16.9 ft	16.5 ft	N/A
NO20-FW1	16.4 ft	16.5 ft	0.1 ft
NO20-G1	16.4 ft	16.5 ft	0.1 ft
NO20-FW1	16.5 ft	16.5 ft	N/A
NO20-G2	16.5 ft	16.5 ft	N/A
NO20-FW1	16.5 ft	16.5 ft	N/A
NO20-FW2	18.0 ft	17.0 ft	N/A

Table 3-4. Orleans Parish Lakefront East Hard Structures Information – Existing Conditions

Section	Top of Wall Elevation	Design Elevation	Deficiency
NE04-FW	15.3 ft	15.5 ft	0.2 ft
NE04-G	15.3 ft	15.5 ft	0.2 ft
NE04-FW	15.4 ft	15.5 ft	0.1 ft
NE03-FW	15.5 ft	15.5 ft	N/A
NE03-LI	15.5 ft	15.5 ft	N/A
NE09	15.4 ft	15.5 ft	0.1 ft
NE03-FW	15.5 ft	15.5 ft	N/A
NE01	14.6 ft	14.5 ft	N/A
NE07	14.6 ft	14.5 ft	N/A
NE01	14.6 ft	14.5 ft	N/A
NE08	14.5 ft	14.5 ft	N/A
NE01	14.6 ft	14.5 ft	N/A
NE05	15.7 ft	15.5 ft	N/A
NE01	14.6 ft	14.5 ft	N/A
NE30-FW	17.2 ft	16.0 ft	N/A
NE06	17.7 ft	15.5 ft	N/A

Table 3-5. South Point to MRGO/GIWW Closure Hard Structures Information – Existing Conditions

Section	Top of Wall Elevation	Design Elevation	Deficiency
NE13	18.3 ft	18.0 ft	N/A
NE14	22.2 ft	22.0 ft	N/A
NE15-FW	27.7 ft	27.5 ft	N/A
NE15-G	29.0 ft	27.5 ft	N/A
NE15-FW	27.7 ft	27.5 ft	N/A
NE16	30.4 ft	30.5 ft	0.1 ft
NE12-B-FW	31.9 ft	32.0 ft	0.1 ft

Table 3-6. IHNC and GIWW Basin Hard Structures Information – Existing Conditions

Section	Top of Wall Elevation	Design Elevation	Deficiency
SBRK-FW	15.7 ft	16.0 ft	0.3 ft
SBRK-G	15.8 ft	16.0 ft	0.2 ft
SBRK-FW	15.8 ft	16.0 ft	0.2 ft
GIWW-FW	25.9 ft	26.0 ft	0.1 ft
GIWW-G	26.1 ft	26.0 ft	N/A
GIWW-M	26.0 ft	26.0 ft	N/A
GIWW-B	25.8 ft	26.0 ft	0.2 ft
Lake Borgne FW	25.8 ft	25.5 ft	N/A
BVN-G	25.8 ft	26.0 ft	0.2 ft
BVN-FW	25.8 ft	25.5 ft	N/A
MRGO-CS	25.8 ft	25.5 ft	N/A
MRGO-FW	26.0 ft	26.0 ft	N/A

Table 3-7. St. Bernard Parish Hard Structures Information – Existing Conditions

Section	Top of Wall Elevation	Design Elevation	Deficiency
SB11	31.9 ft	32.0 ft	0.1 ft
SB12	29.8 ft	30.0 ft	0.2 ft
SB13	29.0 ft	29.0 ft	N/A
SB19-FW	28.8 ft	29.0 ft	0.2 ft
SB19-G	30.9 ft	29.0 ft	N/A
SB19-FW	28.8 ft	29.0 ft	0.2 ft
SB13	29.0 ft	29.0 ft	N/A
SB15	28.0 ft	28.0 ft	N/A
SB161-LT	29.8 ft	30.0 ft	0.2 ft
SB161-G1	29.7 ft	30.0 ft	0.3 ft
SB161-LT	29.8 ft	30.0 ft	0.2 ft
SB161-G2	29.9 ft	30.0 ft	0.1 ft
SB16	32.0 ft	32.0 ft	N/A
SB20	31.9 ft	32.0 ft	0.1 ft
SB16	32.0 ft	32.0 ft	N/A
SB17	32.0 ft	32.0 ft	N/A

SB21-TR	27.7 ft	29.0 ft	1.3 ft
SB21-FW	26.4 ft	26.0 ft	N/A

Section	Top of Wall Elevation	Design Elevation	Deficiency
SB21-G1	25.8 ft	26.0 ft	0.2 ft
SB21-FW	26.4 ft	26.0 ft	N/A
SB21-G2	33.5 ft	26.0 ft	N/A
SB21-FW	26.4 ft	26.0 ft	N/A
SB21-MRL tie-in	22.3 ft	24.0 ft	1.7 ft

Table 3-8. LPV-MRL Hard Structures Information – Existing Conditions

Section	Top of Wall Elevation	Design Elevation	Deficiency
103E-LF	25.3 ft	17.5 ft	N/A
103E-LF	24.1 ft	17.5 ft	N/A
103E-LF	24.1 ft	17.5 ft	N/A
100E-F	23.0 ft	17.5 ft	N/A
99E-F	22.9 ft	17.5 ft	N/A
98E-F	22.7 ft	17.5 ft	N/A
97E-F	22.2 ft	17.5 ft	N/A
96E-F	21.9 ft	17.5 ft	N/A
95E-F	21.4 ft	17.5 ft	N/A
94E-F	20.9 ft	17.5 ft	N/A
93E-F	20.8 ft	17.5 ft	N/A
93E-F	20.8 ft	17.5 ft	N/A
92E-LF	20.6 ft	17.5 ft	N/A
91E-LF	20.6 ft	17.5 ft	N/A
91E-F	21.3 ft	17.5 ft	N/A
91E-LF	20.6 ft	17.5 ft	N/A
91E-LF	20.5 ft	17.5 ft	N/A
91E-F	20.4 ft	17.5 ft	N/A
91E-LF	20.6 ft	17.5 ft	N/A
91E-LF	20.5 ft	17.5 ft	N/A
91E-F	21.3 ft	17.5 ft	N/A
91E-LF	20.0 ft	17.5 ft	N/A
91E-F	19.8 ft	17.5 ft	N/A

90E-LF	19.9 ft	17.5 ft	N/A
88E-LF	22.5 ft	17.5 ft	N/A

3.3 CONCLUSIONS

Currently, the average top of wall elevations for the majority of the sections in the LPV system are at or above the average 2057 100-year design elevations. Of the deficient sections, the majority are only slightly deficient with deficiencies at or below 0.5 ft. There are also two moderately deficient sections with deficiencies of 1.3 ft and 1.7 ft.

4 FUTURE WITHOUT PROJECT/ACTION CONDITIONS – 100-YEAR

4.1 ASSUMPTIONS

Since the hard structures throughout the LPV system stretch for many miles, the system was divided into sections within segments, as listed in the tables of paragraph 1.2.1, STUDY AREA. The scope of this analysis consists of determining which hard structures in the LPV system will fail to provide the required level of risk reduction for the 2073 100-year RSLR scenario of 1.8 ft. The top of wall elevations for this analysis are based on EGIS data and the 2073 100-year design elevations on data provided by the Hydraulics and Hydrology Branch utilizing a more refined ADCIRC model. Therefore, the design elevations in this section cannot be directly compared to the 2057 100-yr HSDRRS design elevations. For simplicity, the average top of wall and 2073 100-year design elevations for each section were used. While the top of wall elevation may vary some within a section, it is unlikely to vary significantly. For further information on the 2073 100-year design elevations, see the Hydraulics and Hydrology appendix.

4.2 ANALYSIS

The average 2073 100-year design elevations were compared to the average top of wall elevations. The average top of wall and 2073 100-year design elevations, as well as the amount each section is deficient, are presented in Table 4-1 through Table 4-8 below. Table 4-8 only includes sections located downriver of the crossover point. The reductions in some future 100-year elevations are because these design elevations are based upon updated design calculations and updated hydraulic information with updated surge hazard analysis and wave periods.

Table 4-1. St. Charles Parish Hard Structures Information – Future Conditions (2073 100-year)

Section	Top of Wall Elevation	Design Elevation	Deficiency
SC11	18.5 ft	15.5 ft	N/A
SC08-FW1	18.2 ft	15.5 ft	N/A
SC08-FW2	16.6 ft	15.5 ft	N/A
SC15-FW	17.1 ft	15.5 ft	N/A
SC05-FW	17.1 ft	18.0 ft	0.9 ft
SC05-G	17.5 ft	18.0 ft	0.5 ft
SC05-FW	17.1 ft	18.0 ft	0.9 ft
SC07	17.3 ft	17.0 ft	N/A
SC06	17.2 ft	17.5 ft	0.3 ft
SC04	16.6 ft	17.0 ft	0.4 ft
SC04-G	16.4 ft	17.0 ft	0.6 ft
SC04	16.6 ft	17.0 ft	0.4 ft
SC12-FW2	15.8 ft	15.5 ft	N/A
SC12-FW1	14.7 ft	15.5 ft	0.8 ft
SC12-FW2	15.8 ft	15.5 ft	N/A
SC09	15.5 ft	15.5 ft	N/A
SC09-G	15.6 ft	15.5 ft	N/A
SC09	15.5 ft	15.5 ft	N/A
SC10	15.5 ft	15.5 ft	N/A
SC10-G	15.5 ft	15.5 ft	N/A
SC10	15.5 ft	15.5 ft	N/A
SC13-FW	15.5 ft	15.5 ft	N/A
SC13-G	15.8 ft	15.5 ft	N/A
SC13-FW	15.5 ft	15.5 ft	N/A
SC30	15.6 ft	15.5 ft	N/A
SC01-A2	17.0 ft	17.0 ft	N/A
SC01-A1	17.3 ft	18.0 ft	0.7 ft

Table 4-2. Jefferson Parish Lakefront Hard Structures Information – Future Conditions (2073 100-year)

Section	Top of Wall Elevation	Design Elevation	Deficiency
JL09	17.4 ft	15.5 ft	N/A
JL05	18.9 ft	15.0 ft	N/A
JL07	16.9 ft	14.5 ft	N/A
JL04	20.4 ft	15.0 ft	N/A
JL03	17.0 ft	15.0 ft	N/A
JL06	15.3 ft	15.0 ft	N/A
JL02	17.0 ft	15.0 ft	N/A
JL08	17.0 ft	15.0 ft	N/A

Table 4-3. Orleans Parish Metro Lakefront Hard Structures Information – Future Conditions (2073 100-year)

Section	Top of Wall Elevation	Design Elevation	Deficiency
NO13	18.0 ft	15.0 ft	N/A
NO13	18.0 ft	15.0 ft	N/A
NO06-LT	16.1 ft	15.0 ft	N/A
NO06-FW	16.0 ft	15.0 ft	N/A
NO14-L1A	15.9 ft	15.0 ft	N/A
NO06-FW	16.0 ft	15.0 ft	N/A
NO14-L1	16.3 ft	15.0 ft	N/A
NO06-FW	16.0 ft	15.0 ft	N/A
NO14-L2	15.9 ft	15.0 ft	N/A
NO06-FW	15.9 ft	15.0 ft	N/A
NO14-L4A	16.0 ft	15.0 ft	N/A
NO06-FW	15.9 ft	15.0 ft	N/A
NO14-G4	16.0 ft	15.0 ft	N/A
NO06-FW	16.0 ft	15.0 ft	N/A
NO10-LL	15.9 ft	15.0 ft	N/A
NO10-LI	18.0 ft	15.0 ft	N/A

NO12	18.0 ft	15.0 ft	N/A
NO14-G3	16.8 ft	15.0 ft	N/A
NO16	17.9 ft	14.5 ft	N/A
NO07-A	18.6 ft	15.0 ft	N/A
NO07-B	16.1 ft	15.0 ft	N/A
NO07-B	16.1 ft	15.0 ft	N/A
NO07-C	16.1 ft	15.0 ft	N/A
NO07-B	16.1 ft	15.0 ft	N/A
NO07-B	16.1 ft	15.0 ft	N/A
NO07-A	18.6 ft	15.0 ft	N/A
NO15-G2	18.6 ft	14.5 ft	N/A
NO11	18.0 ft	15.0 ft	N/A
NO08	18.2 ft	14.5 ft	N/A
NO15-L9A	17.8 ft	14.5 ft	N/A
NO08	18.1 ft	18.0 ft	N/A
NO15-L9B	19.0 ft	17.0 ft	N/A
NO08	18.2 ft	18.0 ft	N/A
NO15-L9C	17.7 ft	17.5 ft	N/A
NO08	18.2 ft	15.0 ft	N/A
NO09	19.0 ft	14.5 ft	N/A
NO17	16.9 ft	15.0 ft	N/A
NO14-G1	16.5 ft	15.0 ft	N/A
NO17	16.9 ft	15.0 ft	N/A
NO20-FW1	16.4 ft	15.0 ft	N/A
NO20-G1	16.4 ft	15.0 ft	N/A
NO20-FW1	16.5 ft	15.0 ft	N/A
NO20-G2	16.5 ft	15.0 ft	N/A
NO20-FW1	16.5 ft	15.0 ft	N/A
NO20-FW2	18.0 ft	15.0 ft	N/A

Table 4-4. Orleans Parish Lakefront East Hard Structures Information – Future Conditions (2073 100-year)

Section	Top of Wall Elevation	Design Elevation	Deficiency
NE04-FW	15.3 ft	13.5 ft	N/A
NE04-G	15.3 ft	13.5 ft	N/A
NE04-FW	15.4 ft	13.5 ft	N/A
NE03-FW	15.5 ft	13.5 ft	N/A
NE03-LI	15.5 ft	13.5 ft	N/A
NE09	15.4 ft	13.5 ft	N/A
NE03-FW	15.5 ft	13.5 ft	N/A
NE01	14.6 ft	13.5 ft	N/A
NE07	14.6 ft	13.5 ft	N/A
NE01	14.6 ft	13.5 ft	N/A
NE08	14.5 ft	13.5 ft	N/A
NE01	14.6 ft	13.5 ft	N/A
NE05	15.7 ft	13.5 ft	N/A
NE01	14.6 ft	13.5 ft	N/A
NE30-FW	17.2 ft	13.5 ft	N/A
NE06	17.7 ft	15.0 ft	N/A

Table 4-5. South Point to MRGO/GIWW Closure Hard Structures Information – Future Conditions (2073 100-year)

Section	Top of Wall Elevation	Design Elevation	Deficiency
NE13	18.3 ft	16.5 ft	N/A
NE14	22.2 ft	18.5 ft	N/A
NE15-FW	27.7 ft	22.0 ft	N/A
NE15-G	29.0 ft	23.5 ft	N/A
NE15-FW	27.7 ft	23.5 ft	N/A
NE16	30.4 ft	28.5 ft	N/A
NE12-B-FW	31.9 ft	27.5 ft	N/A

Table 4-6. IHNC and GIWW Basin Hard Structures Information – Future Conditions (2073 100-year)

Section	Top of Wall Elevation	Design Elevation	Deficiency
SBRK-FW	15.7 ft	15.0 ft	N/A
SBRK-G	15.8 ft	15.0 ft	N/A
SBRK-FW	15.8 ft	15.0 ft	N/A
GIWW-FW	25.9 ft	27.5 ft	1.6 ft
GIWW-G	26.1 ft	28.5 ft	2.4 ft
GIWW-M	26.0 ft	28.5 ft	2.5 ft
GIWW-B	25.8 ft	28.5 ft	2.7 ft
Lake Borgne FW	25.8 ft	28.5 ft	2.7 ft
BVN-G	25.8 ft	29.0 ft	3.2 ft
BVN-FW	25.8 ft	29.5 ft	3.7 ft
MRGO-CS	25.8 ft	30.0 ft	4.2 ft
MRGO-FW	26.0 ft	29.5 ft	3.5 ft

Table 4-7. St. Bernard Parish Hard Structures Information – Future Conditions (2073 100-year)

Section	Top of Wall Elevation	Design Elevation	Deficiency
SB11	31.9 ft	26.5 ft	N/A
SB12	29.8 ft	26.0 ft	N/A
SB13	29.0 ft	25.5 ft	N/A
SB19-FW	28.8 ft	25.5 ft	N/A
SB19-G	30.9 ft	25.5 ft	N/A
SB19-FW	28.8 ft	25.5 ft	N/A
SB13	29.0 ft	25.0 ft	N/A
SB15	28.0 ft	25.0 ft	N/A
SB161-LT	29.8 ft	23.5 ft	N/A
SB161-G1	29.7 ft	23.0 ft	N/A
SB161-LT	29.8 ft	23.0 ft	N/A
SB161-G2	29.9 ft	23.0 ft	N/A

SB16	32.0 ft	24.0 ft	N/A
SB20	31.9 ft	23.5 ft	N/A
SB16	32.0 ft	23.5 ft	N/A
SB17	32.0 ft	24.0 ft	N/A
SB21-TR	27.7 ft	21.5 ft	N/A
SB21-FW	26.4 ft	22.0 ft	N/A
SB21-G1	25.8 ft	21.5 ft	N/A
SB21-FW	26.4 ft	21.5 ft	N/A

Section	Top of Wall Elevation	Design Elevation	Deficiency
SB21-G2	33.5 ft	22.0 ft	N/A
SB21-FW	26.4 ft	21.5ft	N/A
SB21-MRL tie-in	22.3 ft	21.5 ft	N/A

Table 4-8. LPV-MRL Hard Structures Information –Future Conditions (2073 100-year)

Section	Top of Wall Elevation	Design Elevation	Deficiency
90E-LF	19.9 ft	20.5 ft	0.6 ft
88E-LF	22.5 ft	19.0 ft	N/A

4.3 CONCLUSIONS

Based on this analysis, the majority of the sections in the LPV system will not be deficient with the 2073 100-year RSLR of 1.8 ft. Of the deficient sections, approximately half are significantly deficient with deficiencies ranging from 2.1 ft to 4.2 ft. The other half are slightly deficient with deficiencies ranging from 0.3 ft to 0.9 ft. There is also one moderately deficient section with a deficiency of 1.6 ft.

5 FUTURE WITHOUT PROJECT/ACTION CONDITIONS – 200-YEAR

5.1 ASSUMPTIONS

Since the hard structures throughout the LPV system stretch for many miles, the system was divided into sections within segments, as listed in the tables of paragraph 1.2.1, STUDY AREA. The scope of this analysis consists of determining which hard structures in the LPV system will fail to provide the required level of risk reduction for the 2073 200-year RSLR scenario of 1.8 ft. The top of wall elevations for this analysis are based on EGIS data and the 2073 200-year design elevations on data provided by the Hydraulics and Hydrology Branch utilizing a more refined ADCIRC model. Therefore, the design elevations in this section cannot be directly compared to the 2057 100-yr HSDRRS design elevations.. For simplicity, the average top of wall and 2073 200-year design elevations for each section were used. While the top of wall elevation may vary some within a section, it is unlikely to vary significantly. For further information on the 2073 200-year design elevations, see the Hydraulics and Hydrology appendix.

5.2 ANALYSIS

The average 2073 200-year design elevations were compared to the average top of wall elevations. The average top of wall and 2073 200-year design elevations, as well as the amount each section is deficient, are presented in Table 5-1 through Table 5-8 below. Table 5-8 only includes sections located downriver of the crossover point. The reductions in some future 200-year elevations are because these design elevations are based upon updated design calculations and updated hydraulic information with updated surge hazard analysis and wave periods.

Table 5-1. St. Charles Parish Hard Structures Information – Future Conditions (2073 200-year)

Section	Top of Wall Elevation	Design Elevation	Deficiency
SC11	18.5 ft	16.5 ft	N/A
SC08-FW1	18.2 ft	16.5 ft	N/A
SC08-FW2	16.6 ft	16.5 ft	N/A
SC15-FW	17.1 ft	17.0 ft	N/A
SC05-FW	17.1 ft	19.5 ft	2.4 ft
SC05-G	17.5 ft	19.5 ft	2.0 ft
SC05-FW	17.1 ft	19.5 ft	2.0 ft
SC07	17.3 ft	19.0 ft	1.7 ft
SC06	17.2 ft	19.5 ft	2.3 ft
SC04	16.6 ft	19.0 ft	2.4 ft
SC04-G	16.4 ft	19.0 ft	2.6 ft
SC04	16.6 ft	19.0 ft	2.4 ft
SC12-FW2	15.8 ft	17.0 ft	1.2 ft
SC12-FW1	14.7 ft	17.0 ft	2.3 ft
SC12-FW2	15.8 ft	17.0 ft	1.2 ft
SC09	15.5 ft	17.0 ft	1.5 ft
SC09-G	15.6 ft	17.0 ft	1.4 ft
SC09	15.5 ft	17.0 ft	1.5 ft
SC10	15.5 ft	17.0 ft	1.5 ft
SC10-G	15.5 ft	17.0 ft	1.5 ft
SC10	15.5 ft	17.0 ft	1.5 ft
SC13-FW	15.5 ft	17.5 ft	2.0 ft
SC13-G	15.8 ft	17.5 ft	1.7 ft
SC13-FW	15.5 ft	17.5 ft	2.0 ft
SC30	15.6 ft	17.5 ft	1.9 ft
SC01-A2	17.0 ft	19.0 ft	2.0 ft
SC01-A1	17.3 ft	19.5 ft	2.2 ft

Table 5-2. Jefferson Parish Lakefront Hard Structures Information – Future Conditions (2073 200-year)

Section	Top of Wall Elevation	Design Elevation	Deficiency
JL09	17.4 ft	17.0 ft	N/A
JL05	18.9 ft	16.5 ft	N/A
JL07	16.9 ft	16.5 ft	N/A
JL04	20.4 ft	16.5 ft	N/A
JL03	17.0 ft	17.0 ft	N/A
JL06	15.3 ft	17.0 ft	1.7 ft
JL02	17.0 ft	17.0 ft	N/A
JL08	17.0 ft	17.0 ft	N/A

Table 5-3. Orleans Parish Metro Lakefront Hard Structures Information – Future Conditions (2073 200-year)

Section	Top of Wall Elevation	Design Elevation	Deficiency
NO13	18.0 ft	17.0 ft	N/A
NO13	18.0 ft	17.0 ft	N/A
NO06-LT	16.1 ft	17.0 ft	0.9 ft
NO06-FW	16.0 ft	17.0 ft	1.0 ft
NO14-L1A	15.9 ft	17.0 ft	1.1 ft
NO06-FW	16.0 ft	17.0 ft	1.0 ft
NO14-L1	16.3 ft	17.0 ft	0.7 ft
NO06-FW	16.0 ft	17.0 ft	1.0 ft
NO14-L2	15.9 ft	17.0 ft	1.1 ft
NO06-FW	15.9 ft	17.0 ft	1.1 ft
NO14-L4A	16.0 ft	17.0 ft	1.0 ft
NO06-FW	15.9 ft	17.0 ft	1.1 ft
NO14-G4	16.0 ft	17.0 ft	1.0 ft
NO06-FW	16.0 ft	17.0 ft	1.0 ft
NO10-LL	15.9 ft	17.0 ft	1.1 ft
NO10-LI	18.0 ft	17.0 ft	N/A

NO12	18.0 ft	17.0 ft	N/A
NO14-G3	16.8 ft	17.0 ft	0.2 ft
NO16	17.9 ft	17.0 ft	N/A
NO07-A	18.6 ft	17.0 ft	N/A
NO07-B	16.1 ft	17.0 ft	0.9 ft
NO07-B	16.1 ft	17.0 ft	0.9 ft
NO07-C	16.1 ft	17.0 ft	0.9 ft
NO07-B	16.1 ft	17.0 ft	0.9 ft
NO07-B	16.1 ft	17.0 ft	0.9 ft
NO07-A	18.6 ft	17.0 ft	N/A
NO15-G2	18.6 ft	17.0 ft	N/A
NO11	18.0 ft	17.0 ft	N/A
NO08	18.2 ft	17.0 ft	N/A
NO15-L9A	17.8 ft	17.0 ft	N/A
NO08	18.1 ft	21.0 ft	2.9 ft
NO15-L9B	19.0 ft	19.5 ft	0.5 ft
NO08	18.2 ft	21.0 ft	2.8 ft
NO15-L9C	17.7 ft	19.5 ft	1.8 ft
NO08	18.2 ft	17.0 ft	N/A
NO09	19.0 ft	17.0 ft	N/A
NO17	16.9 ft	17.0 ft	0.1 ft
NO14-G1	16.5 ft	17.0 ft	0.5 ft
NO17	16.9 ft	17.0 ft	0.1 ft
NO20-FW1	16.4 ft	17.0 ft	0.6 ft
NO20-G1	16.4 ft	17.0 ft	0.6 ft
NO20-FW1	16.5 ft	17.0 ft	0.5 ft
NO20-G2	16.5 ft	17.0 ft	0.5 ft
NO20-FW1	16.5 ft	17.0 ft	0.5 ft
NO20-FW2	18.0 ft	17.0 ft	N/A

Table 5-4. Orleans Parish Lakefront East Hard Structures Information – Future Conditions (2073 200-year)

Section	Top of Wall Elevation	Design Elevation	Deficiency
NE04-FW	15.3 ft	15.0 ft	N/A
NE04-G	15.3 ft	15.0 ft	N/A
NE04-FW	15.4 ft	15.0 ft	N/A
NE03-FW	15.5 ft	15.0 ft	N/A
NE03-LI	15.5 ft	15.0 ft	N/A
NE09	15.4 ft	15.0 ft	N/A
NE03-FW	15.5 ft	15.0 ft	N/A
NE01	14.6 ft	15.0 ft	0.4 ft
NE07	14.6 ft	19.0 ft	4.4 ft
NE01	14.6 ft	15.0 ft	0.4 ft
NE08	14.5 ft	15.0 ft	0.5 ft
NE01	14.6 ft	15.0 ft	0.4 ft
NE05	15.7 ft	15.0 ft	N/A
NE01	14.6 ft	15.0 ft	0.4 ft
NE30-FW	17.2 ft	15.0 ft	N/A
NE06	17.7 ft	17.5 ft	N/A

Table 5-5. South Point to MRGO/GIWW Closure Hard Structures Information – Future Conditions (2073 200-year)

Section	Top of Wall Elevation	Design Elevation	Deficiency
NE13	18.3 ft	19.5 ft	1.2 ft
NE14	22.2 ft	22.0 ft	N/A
NE15-FW	27.7 ft	25.5 ft	N/A
NE15-G	29.0 ft	26.5 ft	N/A
NE15-FW	27.7 ft	26.5 ft	N/A
NE16	30.4 ft	31.5 ft	1.1 ft
NE12-B-FW	31.9 ft	31.0 ft	N/A

Table 5-6. IHNC and GIWW Basin Hard Structures Information – Future Conditions (2073 200-year)

Section	Top of Wall Elevation	Design Elevation	Deficiency
SBRK-FW	15.7 ft	17.0 ft	1.3 ft
SBRK-G	15.8 ft	17.0 ft	1.2 ft
SBRK-FW	15.8 ft	17.0 ft	1.2 ft
GIWW-FW	25.9 ft	31.0 ft	5.1 ft
GIWW-G	26.1 ft	32.0 ft	5.9 ft
GIWW-M	26.0 ft	32.0 ft	6.0 ft
GIWW-B	25.8 ft	32.0 ft	6.2 ft
Lake Borgne FW	25.8 ft	32.0 ft	6.2 ft
BVN-G	25.8 ft	33.0 ft	7.2 ft
BVN-FW	25.8 ft	33.0 ft	7.2 ft
MRGO-CS	25.8 ft	34.0 ft	8.2 ft
MRGO-FW	26.0 ft	33.5 ft	7.5 ft

Table 5-7. St. Bernard Parish Hard Structures Information – Future Conditions (2073 200-year)

Section	Top of Wall Elevation	Design Elevation	Deficiency
SB11	31.9 ft	30.0 ft	N/A
SB12	29.8 ft	30.0 ft	0.2 ft
SB13	29.0 ft	29.5 ft	0.5 ft
SB19-FW	28.8 ft	29.5 ft	0.7 ft
SB19-G	30.9 ft	29.5 ft	N/A
SB19-FW	28.8 ft	29.5 ft	0.7 ft
SB13	29.0 ft	29.5 ft	0.5 ft
SB15	28.0 ft	28.5 ft	0.5 ft
SB161-LT	29.8 ft	26.5 ft	N/A
SB161-G1	29.7 ft	26.0 ft	N/A
SB161-LT	29.8 ft	26.0 ft	N/A
SB161-G2	29.9 ft	26.0 ft	N/A

SB16	32.0 ft	28.0 ft	N/A
SB20	31.9 ft	27.5 ft	N/A
SB16	32.0 ft	27.0 ft	N/A
SB17	32.0 ft	28.0 ft	N/A
SB21-TR	27.7 ft	24.5 ft	N/A
SB21-FW	26.4 ft	25.0 ft	N/A
SB21-G1	25.8 ft	24.5 ft	N/A
SB21-FW	26.4 ft	25.0 ft	N/A
SB21-G2	33.5 ft	25.0 ft	N/A
SB21-FW	26.4 ft	24.5 ft	N/A
SB21-MRL tie-in	22.3 ft	24.5 ft	2.2 ft

Table 5-8. LPV-MRL Hard Structures Information –Future Conditions (2073 200-year)

Section	Top of Wall Elevation	Design Elevation	Deficiency
92E-LF	20.6 ft	23.0 ft	2.4 ft
91E-LF	20.6 ft	20.0 ft	N/A
91E-F	21.3 ft	20.0 ft	N/A
91E-LF	20.6 ft	20.0 ft	N/A
91E-LF	20.5 ft	20.0 ft	N/A
91E-F	20.4 ft	20.0 ft	N/A
91E-LF	20.6 ft	20.0 ft	N/A
91E-LF	20.5 ft	20.0 ft	N/A
91E-F	21.3 ft	20.0 ft	N/A
91E-LF	20.0 ft	20.0 ft	N/A
91E-F	19.8 ft	20.0 ft	0.2 ft
90E-LF	19.9 ft	22.5 ft	2.6 ft
88E-LF	22.5 ft	21.0 ft	N/A

5.3 CONCLUSIONS

Based on this analysis, the majority of the sections in the LPV system will be deficient with the 2073 200-year RSLR of 1.8 ft. Of the deficient sections, approximately one third are significantly deficient with deficiencies ranging from 2 ft to 8.2 ft, one third are moderately deficient with deficiencies ranging from 1 ft to 1.9 ft, and one third are slightly deficient with deficiencies ranging from 0.1 ft to 0.9 ft.

6 RECOMMENDED MODIFICATIONS

Based on past experience and engineering judgment, it was initially determined that sections less than 2 ft deficient could be modified by extending the wall stem as necessary and sections with a deficiency of 2 ft or more would need to be demolished and replaced as increasing the stem height by such a large amount would likely result in the foundation becoming insufficient. Subsequently, representative sections with deficiencies below 2 ft were analyzed for the modified wall heights and determined to be insufficient. Based on these analyses, it was determined that walls with deficiencies of 0.5 ft or more would need to be demolished. As this resulted in all but an insignificant amount of wall being demolished, the decision was made that all deficient walls should be demolished. For the 2073 100-yr RSLR future condition, approximately 4,941 linear feet (0.9 miles) of floodwall would be demolished and 11,779 linear feet (2.2 miles) of levee would be replaced with floodwall (see Civil Appendix for details). For the 2073 200-yr RSLR future condition, approximately 81,830 linear feet (15.5 miles) of floodwall would be demolished and approximately 105,820 linear feet (20.0 miles) of floodwall would be modified.

Due to the magnitude and scope of this study, the PDT determined to use a representative cross section of floodwall as a basis for the development of the quantities and cost estimate. The quantities shown in Table 6-1, on the next page, are for a linear foot of floodwall based on the representative section. These quantities were then multiplied by the linear feet of wall required in each area to provide a representative cost estimate. Further explanation is provided in the assumptions listed for the cost estimate in the appropriate appendix.

Table 6-1. Typical Section Quantities (per foot of wall)

Number	Number Description	Quantity	Unit
1	**Mob & Demob**	1.00	LS
2	**Excavation**		
	Structural Excavation	6.02	CY
3	**Civil**		
	Embankment (Structural Backfill)	6.48	CY
	Fertilizing & Seeding	0.001	AC
4	**Foundation**		
	18” Diameter Steel Pipe Pile	38.31	LF
	Sheet Pile	23.00	SF
5	**Structure Concrete**		
	Reinforced Slabs	1.94	CY
	Reinforced Walls	1.44	CY
	Stabilization Slab (4”)	0.19	CY
6	**Demolition**		
	Sheet Piling	1.00	LF
	Pipe Pile/H-Pile	0.46	EA
	Footing	1.33	CY
	Stem	0.89	CY

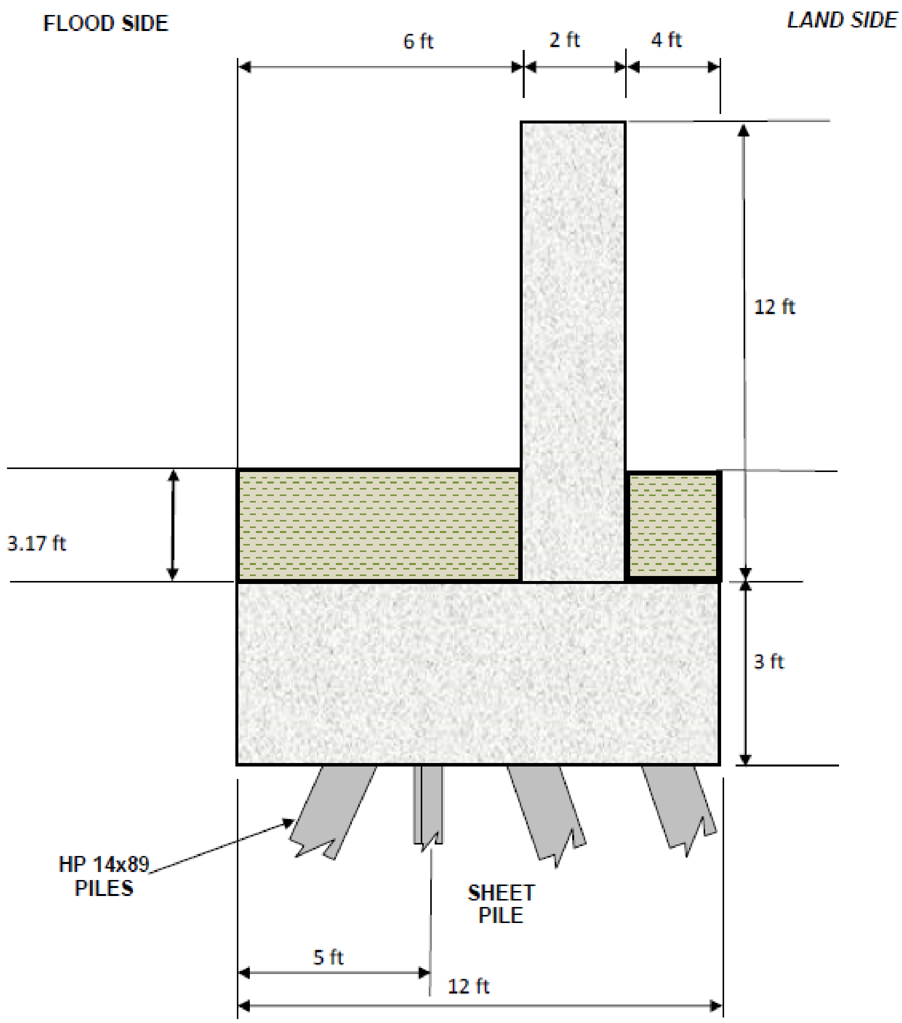

Figure 1-9. Representative Typical Existing T-Wall Cross Section

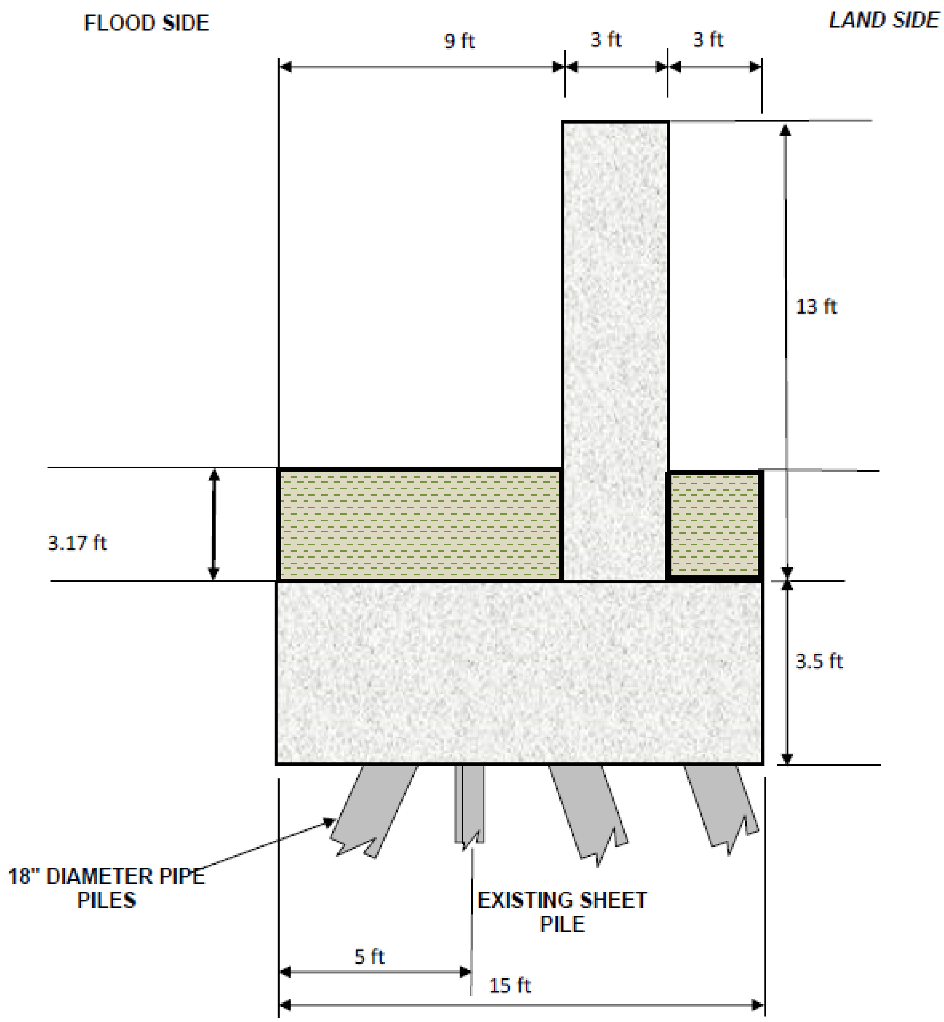

Figure 1-10. Representative Typical Replacement T-Wall Cross Section

7 RISK AND UNCERTAINTY

While the top of wall elevation does vary some, it generally does not vary a significant amount in any given section. Therefore, the level of risk associated with using average elevations for this analysis is low. However, the recommended modifications are based on broad generalizations. Section geometry, soil conditions, and other factors vary from section to section making it very likely that the actual modifications required will differ from those assumed in this analysis.

2021

Lake Pontchartrain & Vicinity GRR
Appendix F – Real Estate

US Army Corps of Engineers
New Orleans District

U.S. Army Corps of Engineers, New Orleans District

Non-Federal Sponsor: Coastal Protection and Restoration Authority Board of Louisiana

July 2021

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LAKE PONTCHARTRAIN & VICINITY GRR
APPENDIX F – REAL ESTATE

1 STUDY NAME AND PURPOSE

1.1 STUDY NAME

The Lake Pontchartrain and Vicinity (LPV) Project System is part of the Greater New Orleans Hurricane Storm Damage Risk Reduction System (HSDRRS) and provides coastal storm risk management for the Greater New Orleans area. The other component of HSDRRS, the West Bank and Vicinity (WBV) Project System, is being re- evaluated in a separate report. The non-federal sponsor (NFS) for this study is the Coastal Protection and Restoration Authority Board of Louisiana (CPRAB).

1.2 STUDY PURPOSE

The purpose of this General Re-Evaluation Report (GRR) with integrated Environmental Impact Statement (EIS) is to analyze alternatives to identify a recommended coastal storm risk management plan to reduce hurricane and storm risk within the LPV study area. The study purpose is to re-evaluate the performance of the LPV System given the combined effects of consolidation, settlement, subsidence and sea level rise and determine if additional actions are recommended to address the economic and life safety risks associated with overtopping of the levee system due to hurricanes and tropical storms. This report satisfies the requirement of the National Environmental Policy Act (NEPA) to evaluate the proposed Federal action. The National Economic Development (NED) Plan alternative reasonably maximizes net economic benefits while remaining consistent with the federal objective of protecting the environment. Alternative 2 was identified as the NED Plan and the Recommended Plan (RP).

This Real Estate Plan (REP) sets forth the real estate requirements and costs for the implementation and construction of the RP as described in greater detail in the GRR for Lake Pontchartrain and Vicinity, Louisiana. The lands, easements, rights-of-way, relocations, and disposal sites (LERRD) required for the Project are outlined in this REP. The information contained herein is tentative and preliminary in nature and intended for planning purposes only.

Prior reports prepared and approved for this Project are as follows:

- Original Project to construct the Lake Pontchartrain and Vicinity, Louisiana Project for hurricane storm damage reduction in southeast Louisiana.
- Flood Control and Coastal Emergencies (FC&CE) Supplemental Modified Original Project to reinforce or replace existing floodwalls to improve the performance of the Original Project.
- Accelerated completion of unconstructed portions of the Original Project

Construction Supplemental modified the Original Project to raise levee heights where necessary and enhance Original Project to provide level of protection necessary to achieve the certification required for National Flood Insurance Program.

1.3STUDY AUTHORIZATION

Section 3017 of WRRDA 2014 (Public Law 113-121) authorizes the Secretary of the Army to carry out measures that address consolidation, settlement, subsidence, sea level rise, and new datum to restore certain federally authorized hurricane and storm damage reduction projects to their authorized levels of protection, if the Secretary determines the necessary work is technically feasible, environmentally acceptable, and economically justified. In addition, the authority to construct measures terminates 10 years after the date of enactment of WRRDA 2014 on 10 June 2024.

The Water Resources Reform and Development Act of 2014 (WRRDA 2014) stipulates:

SEC. 3017. REHABILITATION OF EXISTING LEVEES.

(a) IN GENERAL – The Secretary shall carry out measures that address consolidation, settlement, subsidence, sea level rise, and new datum to restore Federally authorized hurricane and storm damage reduction projects that were constructed as of the date of enactment of this Act to the authorized levels of protection of the projects if the Secretary determines the necessary work is technically feasible, environmentally acceptable, and economically justified.

(b) LIMITATION. – This section shall only apply to those projects for which the executed project partnership agreement provides that the non-Federal interest is not required to perform future measures to restore the project to the authorized level of protection of the project to account for subsidence and sea-level rise as part of the operation, maintenance, repair, replacement, and rehabilitation responsibilities.

(e) TERMINATION OF AUTHORITY – The authority of the Secretary under this subsection terminates on the date that is 10 years after the date of enactment of this Act.

The Bipartisan Budget Act of 2018 (Public Law 115-123) provided funding and limits the scope to the flood and storm damage reduction.

Work required for raising levee heights, modifying, or replacing flood walls, etc. would be cost shared in accordance with WRDA 1986, as amended, for Hurricane and Storm Damage Reduction projects. The Non-Federal Sponsor (NFS) will be responsible for the acquisition of all LERRD required for construction and operation and maintenance of the Project. The NFS will also provide an Authorization for Entry to any lands required for the Project, including any lands which are owned, claimed, or controlled by local or State Governmental entities.

2 RECOMMENDED PLAN

2.1 LOCATION AND DESCRIPTION

LPV is located in southeast Louisiana within the greater New Orleans metropolitan area on the east bank of the Mississippi River bound to the west by the Bonnet Carre Spillway; to the north by the south shore of Lake Pontchartrain; to the east by Lake Borgne and to the south by the Mississippi River. The location of the RP is shown on Figure 1 within St. Charles, Jefferson, Orleans, St. Bernard Parishes and Plaquemines Parish. Features for LPV currently include approximately 126.5 miles of levees and floodwalls: approximately 83 miles are armored perimeter levees and floodwalls and approximately 43.5 miles are interior levees and floodwalls.

Figure 1. Lake Pontchartrain and Vicinity Location

The location of the Sub-basins of the LPV Study area are St. Charles, Jefferson East Bank, Orleans East Bank, New Orleans East, and Chalmette Loop and is shown on Figure 2. These sub-basins are within St. Charles, Jefferson, Orleans, and St. Bernard Parishes.

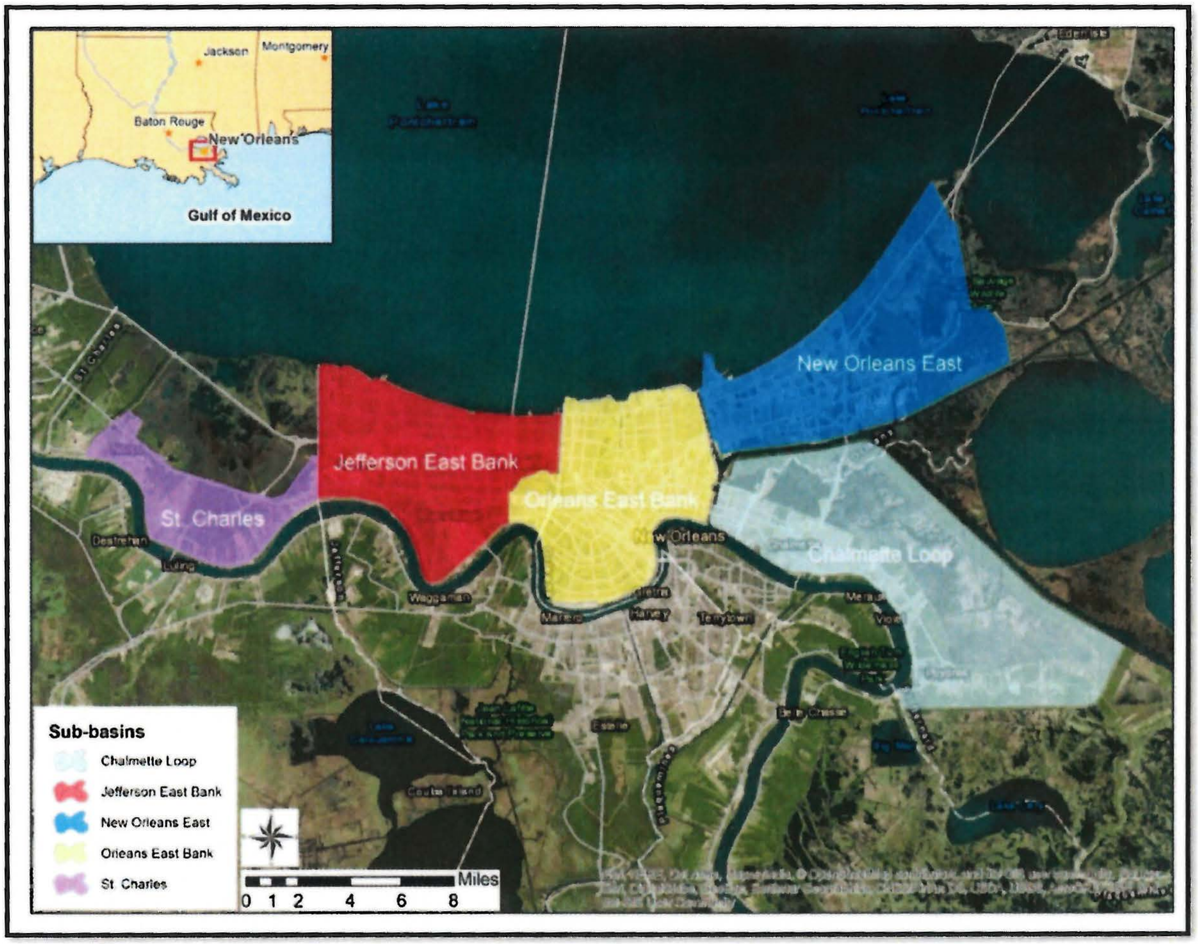


Figure 2. Sub-basins of the LPV Study Area

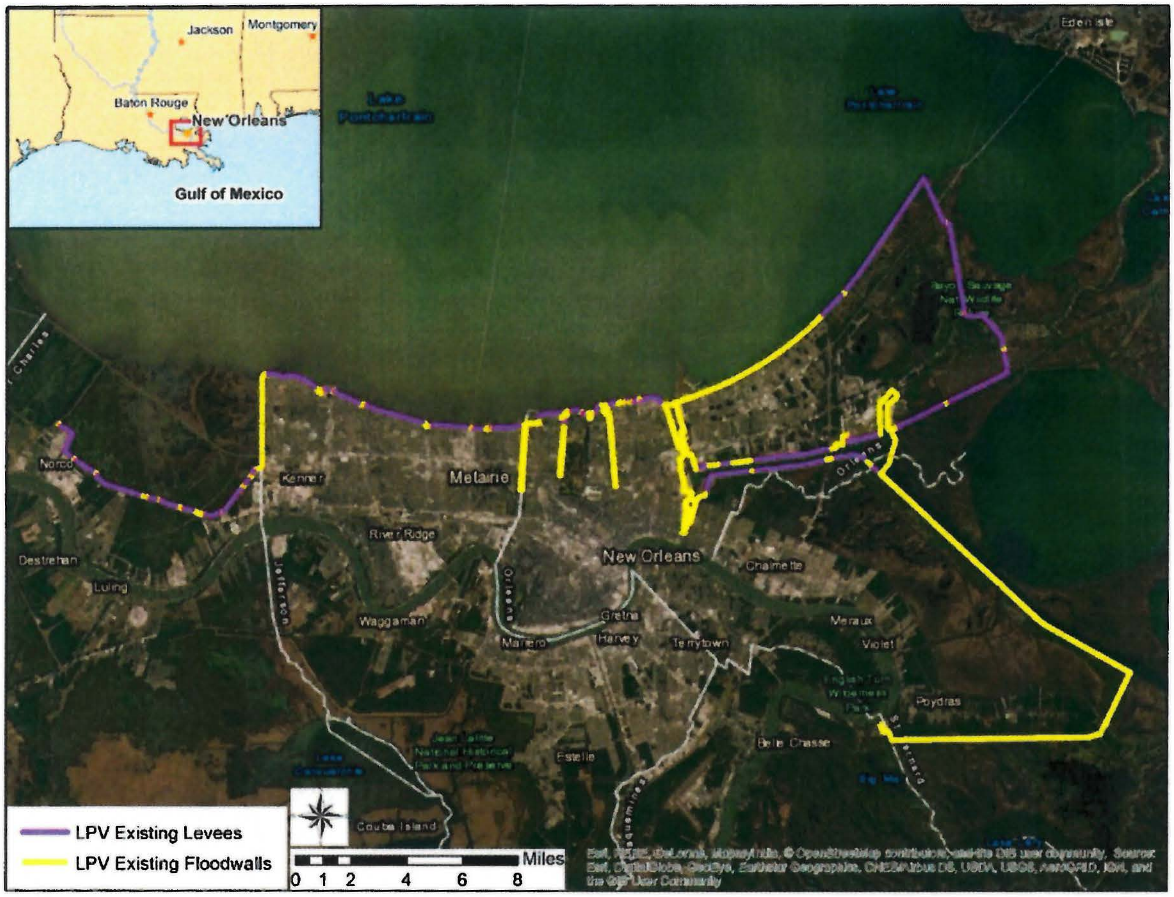


Figure 3. LPV Levees and Floodwalls

2.2RECOMMENDED PLAN DESCRIPTION

The RP for LPV is Alternative 2, system-wide levee lifts or floodwall replacement to the projected one percent annual exceedance probability (AEP) event through 2073 (end of 50-year analysis period), which would allow for Federal Emergency Management Agency (FEMA) levee certification for participation in the National Flood Insurance Program under the base flood elevation. RP and LPV Reaches are shown in Figure 4 below.

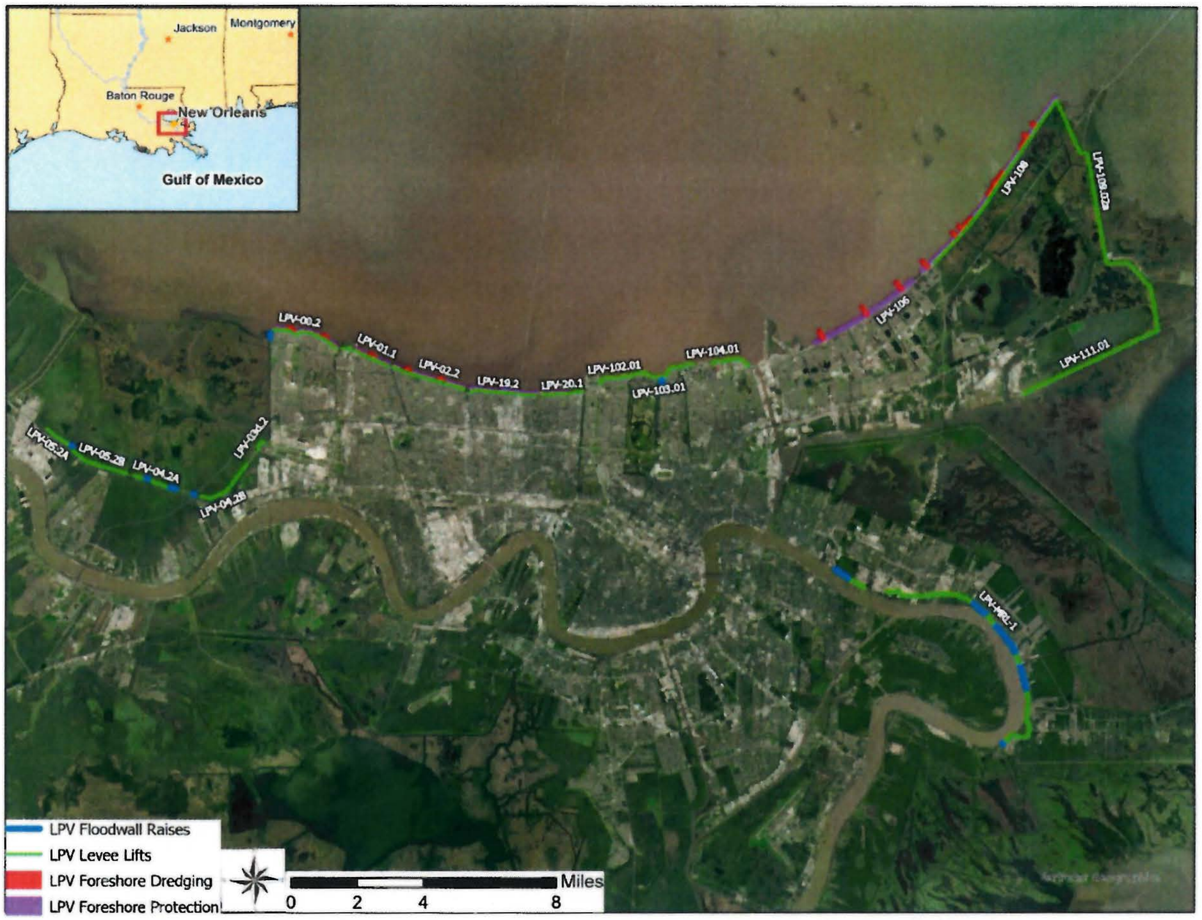


Figure 4. LPV Recommended Plan and Reaches

Project features consist of 50 miles of levee lifts along the existing levee alignment. In some reaches, levee lifts may need to occur more than once during the period of analysis. Additionally, the RP includes 3 miles of floodwall modifications and replacements along the existing alignment to be constructed. Mitigation is anticipated to be required to address potential impacts to habitat along the Mississippi River.

Construction of the RP would generally occur in the same footprint as the existing LPV project and Mississippi River Levees (MRL) on existing right-of-way (ROW). The exception is the area along the MRL between the existing crossover point and the new crossover point shown on Figure 2, as well as a small area along the Lake Pontchartrain lakefront to the west of the Seabrook floodgate. Additional acquisition and rights of way will be required in this area. Project implementation requirements for LERRD include approximately 7 acres for temporary road access, approximately 9 acres for temporary work areas, approximately 27 acres for perpetual levee easements, and approximately 177 acres for borrow.

The RP includes targeted areas of foreshore protection along Lake Pontchartrain. Water-based construction would be required for construction of the foreshore protection along the shore of Lake Pontchartrain, which will require limited dredging to provide access for equipment to deliver and place the stone protection. Dredging for material and for access channels would be within Lake Pontchartrain, a state-claimed water bottom; therefore, no estate would be necessary for dredging and material as the NFS is a state entity. These channels and stockpile areas would be brought back to original elevations subsequent to completion of construction activities. In addition, rock foreshore protection would be placed on top of existing foreshore protection in Lake Pontchartrain to bring the stone back up to the required elevation for proper levee protection. After construction, the stockpiled material would be returned to its original location. Stone for the foreshore protection would be commercially obtained and would not require the acquisition of LERRD.

The new design elevation will require areas of LPV levee co-location with the MRL along the Mississippi River. The current and estimated new crossover points can be seen in Figure 4.

Requirements for ROW will continue to be evaluated during Preconstruction, Engineering and Design (PED) to determine whether temporary or permanent easements are most advantageous to the Government.

Figure 5. Crossover Points on the Mississippi River Levee: Existing (red) and With-Project (yellow)

2.3RECOMMENDED PLAN REACH LOCATIONS

Table 1. Recommended Plan Reach Locations

Reach	Location	Parish
LPV-00.2	Jefferson Parish Lakefront Levee - West Return Canal at St. Charles Parish Line to Duncan Canal	Jefferson
LPV-01.1	Jefferson Parish Lakefront Levee - Duncan Canal to Elmwood Canal	Jefferson
LPV-02.2	Jefferson Parish Lakefront Levee - Elmwood Canal to Suburban Canal	Jefferson
LPV-03D.2	Airport Runway Levee	St. Charles
LPV-04.2	East of Bonne Carre Spillway and north of Highway 61, east of Cross Bayou Canal	St. Charles
LPV-05.2	East of Bonne Carre Spillway and north of Highway 61, west of Cross Bayou Canal	St. Charles
LPV-19.2	Jefferson Parish Lakefront Levee - Suburban Canal to Causeway Blvd.	Jefferson
LPV-20.1	Jefferson Parish Lakefront Levee - Causeway Blvd. to Lake Avenue Vicinity	Jefferson
LPV-102.01	Orleans Parish Lakefront Levee – West End Blvd. to Orleans Avenue Canal	Orleans
LPV-103.01	Orleans Parish Lakefront Levee – Orleans Avenue to London Avenue Canal	Orleans
LPV-104.01	Orleans Parish Lakefront Levee – London Avenue Canal to Inner Harbor Navigation Canal	Orleans
LPV-106.01	Orleans Parish Lakefront Levee – New Orleans Airport to Paris Avenue	Orleans
LPV-108.01	Orleans Parish Lakefront Levee – Paris Avenue to I-10	Orleans
LPV-109.02A	I-10 to Bayou Sauvage National Wildlife Refuge	Orleans
LPV-111.01	New Orleans East Back Levee CSX Railroad to Michoud Canal	Orleans
LPV-MRL-1	Mississippi River Floodwall	St. Bernard & Plaquemines

2.4LANDS, EASEMENTS, RIGHTS-OF-WAY, RELOCATIONS AND DISPOSAL (LERRD) TO BE ACQUIRED FROM PRIVATE LANDOWNERS FOR THE RECOMMENDED PLAN

Table 2. LERRD to be Acquired from Private Landowners for Recommended Plan

Reach	Estate	Acres	Description
01.1	Temporary Road Easement	1.15	Obtain easement from (2) private landowners
03D.2	Temporary Road Easement	3.44	Obtain easements from (2) private landowners
	Temporary Work Area Easement*	1.12	
05.2A	Temporary Road Easement	1.27	Obtain easements from (3) private landowners
	Temporary Work Area Easement*	.49	
05.2B	Temporary Road Easement	.27	Obtain easement from (1) private landowner
103.01	Temporary Road Easement	.13	Obtain easements from (6) private landowner
	Temporary Work Area Easement*	.82	
104.01	Temporary Work Area Easement*	3.97	Obtain easements from (5) private landowners
	Perpetual Levee Easement	.70	
109.02a	Temporary Work Area Easement*	.92	Obtain easement from (8) private landowners
111.01	Temporary Road Easement	.55	Obtain easements from private landowner(s)
	Temporary Work Area Easement*	1.85	
MRL-1	Perpetual Flood Protection Levee Easement	26.19	Obtain easements from (78) private landowners

Table 3. Total Acres to be Acquired from Private Landowners for Recommended Plan

Temp Road (Access)	Temp Work Area (Staging)	Perpetual Flood Protection Levee	Fee (Borrow)	Total Acres
6.81	9.17	26.89	176.90	219.77

2.5BORROW

Extended construction windows throughout the 50-year period of analysis would be required for implementation of multiple levee lifts associated with the project; therefore, a specific borrow source may no longer be available at time of construction. Accordingly, an analysis of borrow area impacts has been conducted for a "typical" borrow pit that could be chosen for use. This borrow information is provided for real estate cost estimate purposes and to show suitable habitats for borrow site alternatives throughout the Project areas exist as provided by U. S. Fish and Wildlife Service. This borrow source is located within haul distance acceptable for all LPV reaches.

Actual borrow sources would be identified during pre-construction engineering and design for each segment of project construction by reach and construction schedule to determine source and quantities at that time.

Requirements for borrow (location and quantity per lift) will continue to be evaluated during Preconstruction, Engineering and Design (PED) to determine whether temporary easement, perpetual easement, or fee estate would be most advantageous to the Government. At this time, it is projected that fee estate would be acquired for each lift's reaches/locations, as fee estate is required for borrow sites that would be used for future levee lifts. For any borrow sites that are required but not associated with future lifts, a standard Temporary Work Area Easement for Borrow may be acquired. Approximately 176.90 acres of Borrow would be sourced from crop lands in St. Charles Parish or one of the parishes within the RP. Borrow area acquisition requirements will continue to be evaluated. If a proposed borrow area contains upland bottomland hardwood forests or another significant resource that requires mitigation, a mitigation plan would be prepared in compliance with WRDA 1986, Section 906 (33 U.S.C. §2283). See Appendix A for construction schedule and estimated borrow quantity for each levee lift.

2.6 MITIGATION

Implementation of the RP includes flood side shifts to the existing Mississippi River Levees (MRL) that would extend beyond the existing rights-of-way (ROW) and the 15 foot "vegetation-free" zone from the toe of the levee. The flood side shifts would result in potential impacts to approximately 20.3 acres of bottomland hardwood-wet habitat along the co-located LPV and MRL. These impacts would be avoided to the maximum extent practicable but would be unavoidable in some locations due to avoidance of existing infrastructure. All other features of the recommended plan for LPV are not expected to require compensatory mitigation since those actions are proposed within the existing (previously disturbed) ROW.

The proposed action in this mitigation plan consists of purchasing mitigation bank credits to mitigate 12.12 AAHUs of BLH-Wet impacts. Since the proposed action consists of purchasing mitigation credits, CEMVN has concluded that there would be no new direct, indirect, or cumulative impacts to any relevant resources from that action. Any changes to the proposed mitigation plan would be fully evaluated in future NEPA documents.

This Project will not displace residential, business, or farms within the Project boundaries; therefore, the provisions under Title II of Public Law 91- 646, as amended, are not applicable.

The sponsor will not receive credit for lands previously purchased as an item of cooperation.

3 LERRD OWNED BY NON-FEDERAL SPONSOR

The non-federal sponsor for this study is the Coastal Protection and Restoration Authority Board of Louisiana (CPRAB), a state entity that is established, authorized, and empowered to carry out any and all functions necessary to serve as the single entity responsible for acquiring LERRD for this project. CPRAB is also to act as the local sponsor for construction, operation, and maintenance of the hurricane, storm damage reduction and flood control projects in areas under its jurisdiction, including the greater New Orleans and southeast Louisiana area. CPRAB is mandated to develop, implement, and enforce a comprehensive coastal protection and restoration Master Plan. The Feasibility Cost Share Agreement was executed on October 9, 2018.

The Non-Federal Sponsor does not own any lands within the Project area. However, rights-of-way for the existing Project are owned by the following agencies of the State of Louisiana which fall under the umbrella of Coastal Protection and Restoration Authority Board:

- The Pontchartrain Levee District in St. Charles Parish
- Southeast Louisiana Flood Protection Authority – East
- East Jefferson Levee District in Jefferson Parish
- Orleans Levee District in Orleans Parish
- Lake Borgne Levee District in St. Bernard Parish
- St. Bernard Port & Harbor Terminal District
- New Orleans Sewerage and Water Board in Orleans Parish

The rights owned by these agencies (existing right-of-way and new areas needed for the RP) consist of perpetual levee easements/servitudes and fee. These rights are sufficient for construction of the proposed improvements to Project features. No credit will be given for lands previously provided as an item of local cooperation. The NFS provides the Authorization for Entry or Grant of Particular Use (depending on agency) to USACE Real Estate. Real Estate Division certifies to Contracting Division that Right-of-Entry is available.

The sponsor currently has Operation, Maintenance, Repair, Replacement and Rehabilitation (OMRR&R) responsibilities associated with the existing system under an existing Project Partnership Agreement (PPA). A new PPA will be executed for the RP, which will continue those responsibilities into the future and they are expected remain largely unchanged until completion of the recommended plan, except as new reaches of co-located features are added during project construction. The sponsor will gradually accrue additional cost to annual OMRR&R for the new co-located reach along the Mississippi River. Upon project completion, the non-federal sponsor will also be required to maintain the authorized level of risk reduction to account for any future compaction, subsidence, or actual sea level rise as part of its OMRR&R responsibilities.

The cost sharing requirement for this project is 65% federal and 35% non-federal. In addition to cash, the sponsor is anticipated to receive work-in-kind credit for some design and construction work, as well as credit for LERRDs acquisition. The CPRAB has the financial capability to cost share the estimated implementation costs and are willing to sign the PPA at the appropriate time. The NFS's capability assessment is attached to the REP as Exhibit A. The NFS will not receive credit for LERRD previously acquired in the past or previously provided as an item of cooperation.

The following reaches within the Project area are owned by local government entities. Acreage for new right-of-way needed for each reach is approximate shown in Table 4 below.

Table 4. LERRD Owned by Local Government Entity

Reach	Requesting	From Local Entity	Approximate Acreage of New ROW Required
00.2	Authorization for Entry	Southwest Louisiana Flood Protection Authority East - East Jefferson Levee District	All within existing ROW
01.1	Authorization for Entry	City of Kenner	2 acres for temporary access
02.2	Authorization for Entry	Southwest Louisiana Flood Protection Authority East - East Jefferson Levee District	All within existing ROW
03D.2	Authorization for Entry	City of New Orleans	5 acres for temporary access and work areas
04.2	Authorization for Entry	Pontchartrain Levee District – St. Charles Parish	All within existing ROW
05.2	Authorization for Entry	Pontchartrain Levee District – St. Charles Parish	2 acres for temporary access and work areas
19.2	Authorization for Entry	Southeast Louisiana Flood Protection Authority East – East Jefferson Levee District	All within existing ROW
20.1	Authorization for Entry	Southeast Louisiana Flood Protection Authority East – East Jefferson Levee District	All within existing ROW
102.01	Authorization for Entry	Southeast Louisiana Flood Protection Authority East – Orleans Levee District	All within existing ROW
103.01	Authorization for Entry	Orleans Levee District	2 acres for temporary access and work areas
104.01	Grant of Particular Use (authorization)	University of New Orleans (state)	5 acres for levee and temporary work area

Reach	Requesting	From Local Entity	Approximate Acreage of New ROW Required
106.01	Authorization for Entry	Southeast Louisiana Flood Protection Authority East – Orleans Levee District	All within existing ROW
108.01	Authorization for Entry	Southeast Louisiana Flood Protection Authority East – Orleans Levee District	All within existing ROW
109.02A	Authorization for Entry	Southeast Louisiana Flood Protection Authority East – Orleans Levee District	1 acre for temporary work area
111.01	Authorization for Entry	Southeast Louisiana Flood Protection Authority East – Orleans Levee District	1 acre for temporary work area
LPV-MRL-1	Authorization for Entry	Lake Borgne Levee District	All within existing ROW
LPV-MRL-1	Authorization for Entry	St. Bernard Port & Harbor Terminal District	4 acres for levee and temporary work area

4 ESTATES

The following standard estates would be acquired from private landowners:

Temporary Road Easement

A non-exclusive and assignable, temporary easement and right-of-way in, on, over and across (the land described in Schedule A) (Tracts Nos.____,______and___) for the location, construction, operation, maintenance, alteration replacement of road(s) and appurtenances thereto; together with the right to trim, cut, fell and remove therefrom all trees, underbrush, obstructions and other vegetation, structures, or obstacles within the limits of the right-of-way; (reserving, however, to the owners, their heirs and assigns, the right to cross over or under the right-of-way as access to their adjoining land at the locations indicated in Schedule B); subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

Temporary Work Area Easement (borrow)

A temporary easement and right-of-way in, on, over and across (the land described in Schedule A) (Tracts Nos.______,______and___), for a period not to exceed

______, beginning with date possession of the land is granted to the United States, for use by the United States, its representatives, agents, and contractors as a borrow area, including the right to borrow and/or deposit fill, spoil and waste material thereon and to perform any other work necessary and incident to the construction of the__________Project, together with the right to trim, cut, fell and remove therefrom all trees, underbrush, obstructions, and any other vegetation, structures, or obstacles within the limits of the right-of-way; reserving, however, to the landowners, their heirs and assigns, all such rights and privileges as may be used without interfering with or abridging the rights and easement hereby acquired; subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

FEE EXCLUDING MINERALS (With Restriction on Use of the Surface) for borrow

The fee simple title to the land, subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines; excepting and excluding all (coal) (oil and gas), in and under said land and all appurtenant rights for the exploration, development, production and removal of said (coal) (oil and gas), but without the right to enter upon or over the surface of said land for the for the purpose of exploration, development, production and removal therefrom of said (coal) (oil and gas).

Temporary Work Area Easement (staging)

A temporary easement and right-of-way in, on, over and across (the land described in Schedule A) (Tracts Nos.______,______and___), for a period not to exceed

______, beginning with date possession of the land is granted to the United States, for use by the United States, its representatives, agents, and contractors as a work area, including the right to move, store and remove equipment and supplies, and erect and remove temporary structures on the land and to perform any other work necessary and incident to the construction of the_Project, together with the right to trim, cut, fell and remove therefrom all trees, underbrush, obstructions, and any other vegetation, structures, or obstacles within the limits of the right-of-way; reserving, however, to the landowners, their heirs and assigns, all such rights and privileges as may be used without interfering with or abridging the rights and easement hereby acquired; subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

Flood Protection Levee Easement

A perpetual and assignable right and easement in (the land described in Schedule A) (Tracts Nos.___,______and___) to construct, maintain, repair, operate, patrol and replace a flood protection levee and/or floodwall, including all appurtenances thereto; reserving, however, to the owners, their heirs and assigns, all such rights and privileges in the land as may be used without interfering with or abridging the rights and easement hereby acquired; subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

Requirements for ROW will continue to be evaluated during feasibility design to determine whether temporary or permanent easements are most advantageous to the Government.

5 EXISTING FEDERAL PROJECTS

The following Federal projects are fully or partially within the LERRD required for the LPV Project or are adjacent.

- **Lake Pontchartrain and Vicinity, Louisiana Project (LPV) and the Greater New Orleans Hurricane and Storm Damage Risk Reduction System (HSDRRS)** - LPV along with the West Bank and Vicinity, Louisiana Project are jointly referred to as being part of the Greater New Orleans HSDRRS. Following Hurricanes Katrina and Rita in 2005, the U. S. Army Corps of Engineers was authorized and funded to construct HSDRRS for southeast Louisiana. The Corps has strengthened the levees, floodwalls, gated structures and pump stations that form the 133-mile Greater New Orleans perimeter system, as well as improved approximately 70 miles of interior risk reduction structures. The Lake Pontchartrain and Vicinity (LPV) Project System (part of HSDRRS) will lift these existing levees or modify or replace existing floodwalls. Additional LERRD will be needed outside of existing ROW for the additional levee and floodwall footprint to extend ROW for access to the lifted levees and modified or replaced floodwalls.
- **Mississippi River and Tributaries (MR&T) or Mississippi River Levee (MRL)** - The MR&T was designed to reduce the risk of flood damage from high river flows. The reach of this levee along the Lake Pontchartrain and Vicinity has a higher profile for the river flooding than is required for hurricane surges. Therefore, although this levee provides a southern boundary for the LPV HSDRRS (LPV connects to the MRL at both the north and south end of the system), its operation and maintenance are funded and guided by separate authorities and guidance. At the time of this study the crossover points on the east bank, where LPV design height requirements exceed the MRL design elevations, is downstream of the study area. However, it will move upstream into the project area over the 50-year period of analysis. The Lake Pontchartrain and Vicinity (LPV) Project System will lift these existing levees or modify or replace existing floodwalls. Additional LERRD will be needed outside of existing ROW footprint to extend ROW for access to the lifted levees and modified or replaced floodwalls.
- **The Southeast Louisiana Project (SELA)** - SELA is a flood control project, authorized by Congress to improve the rainfall drainage systems in Orleans, Jefferson, and St. Tammany Parishes. On the East Bank, SELA is within a portion of the LPV Project area and focuses on improving existing and constructing new drainage channels and stormwater pump stations. These features impact the interior drainage flow that LPV gates and pump stations need to handle. CPRAB has been the non-federal sponsor of SELA projects since 2009. These features convey stormwater via pump stations across the LPV risk reduction perimeter. The LPV Project will lift existing levees or modify or replace existing floodwalls. Additional LERRD will be needed outside of existing ROW footprint to extend ROW for access to the lifted levees and modified or replaced floodwalls.

- **Inner Harbor Navigation Canal Lock** - USACE maintains and operates the navigation lock where the Inner Harbor Navigation Canal (IHNC) meets the Mississippi River. Although this lock provides a Mississippi River boundary closure of the LPV perimeter, just as the MRL referenced above, the lock was authorized and constructed for the purpose of navigation. The Seabrook Gate Closure, is between the IHNC and Lake Pontchartrain, separating LPVreaches 104.02 and 015.01, located just east of the New Orleans Lakefront Airport.
- **Inner Harbor Navigation Channel Surge Barrier** - The Inner Harbor Navigation Channel (IHNC) provides risk reduction for the 1% AEP event to a large portion of Orleans and St. Bernard parishes by reducing the risk of surge entering the GIWW/IHNC corridor from Lake Borgne and the Gulf of Mexico.
- **Seabrook Floodgate Complex** - The Seabrook Floodgate Complex, located at the north end of the IHNC, works in tandem with the IHNC Surge Barrier and consists of a 95-foot wide navigable sector gate and two 50-foot wide, non-navigable vertical lift gates with floodwall tie-ins on the east and west sides.
- **East Bonnet Carré Lower Guide Levee** - This includes a small portion of the East Bonnet Carre Lower Guide Levee, making a connection between Mississippi River Levee (MRL) and LPV alignments on the west side of the system.

There are also several Gulf Intracoastal Water Way (GIWW) locks which provide navigation connections to the Mississippi River and as such provide MR&T riverine flood risk reduction at those points. There are numerous complex structures, levees lining interior navigable and drainage retention areas, and interior drainage infrastructure situated within the LPV, WBV, and MRL perimeter alignments.

6 FEDERALLY OWNED LANDS

Sections of the following reaches have LERRD required for this Project within Federally owned land. A special use permit would be obtained by the NFS from these Federal agencies.

Table 2. LERRD within Federally Owned Lands

Reach	Owned by	Acres within Reach
05.2A	US Department of Transportation Right of way	1.27 (Temp Road) & .49 (Temp Work Area)
109.02a	Department of Interior, U. S. Fish & Wildlife Service (Bayou Sauvage National Wildlife Refuge)	8.29 (Temp Road and Temp Work Area)
109.02a	US Department of Transportation Right of way	.92 (Temp Work Area)

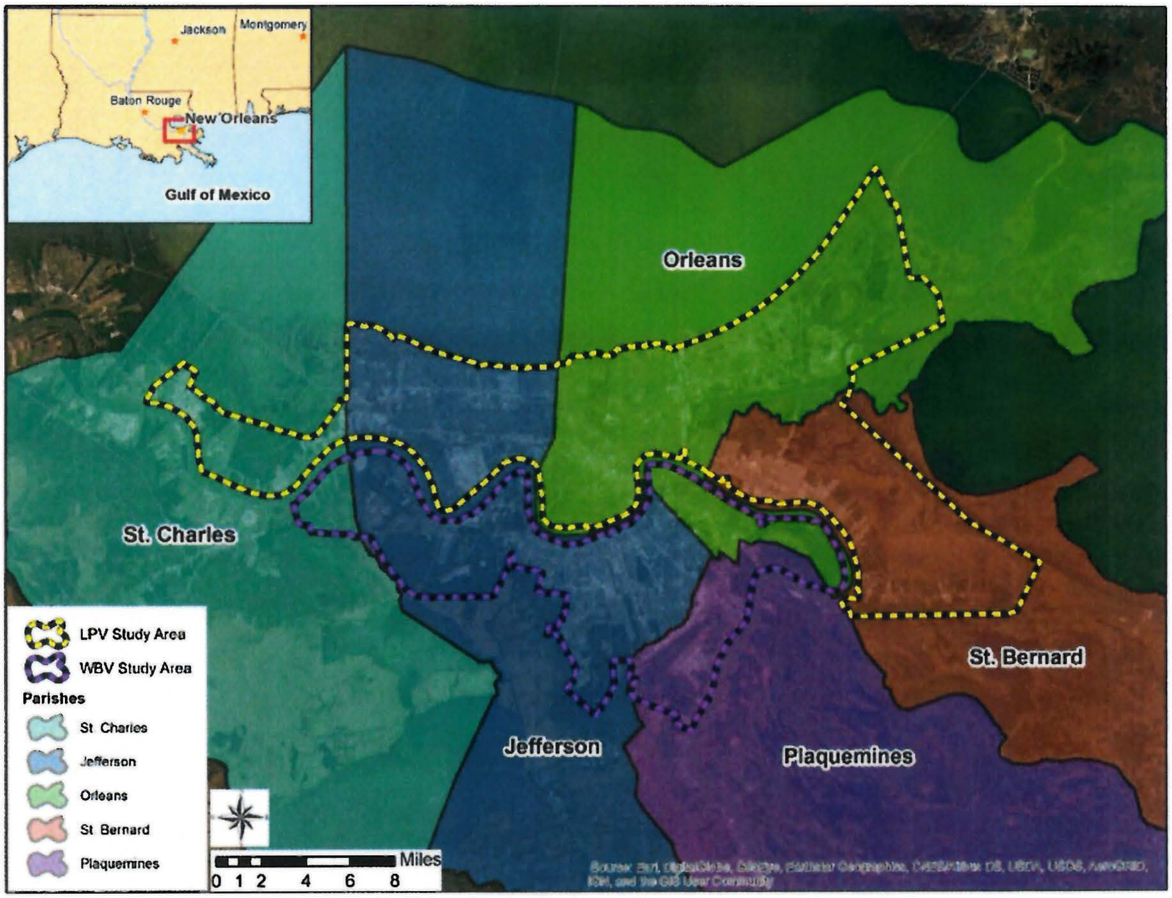
7 NAVIGATION SERVITUDE

The navigation servitude is the "dominant right of the Government under the Commerce Clause of the U.S. Constitution to use, control and regulate the navigable waters of the United States and the submerged lands thereunder for various commerce-related purposes including navigation and flood control. In tidal areas, the servitude extends to all lands below the mean high-water mark. In non-tidal areas, the servitude extends to all lands within the bed and banks of a navigable stream that lie below the ordinary high-water mark." This power is superior to any private property rights in the navigable waters themselves or in the underlying land. The Mississippi River is considered both a water bottom of the State of Louisiana and a navigable waterway of the United States.

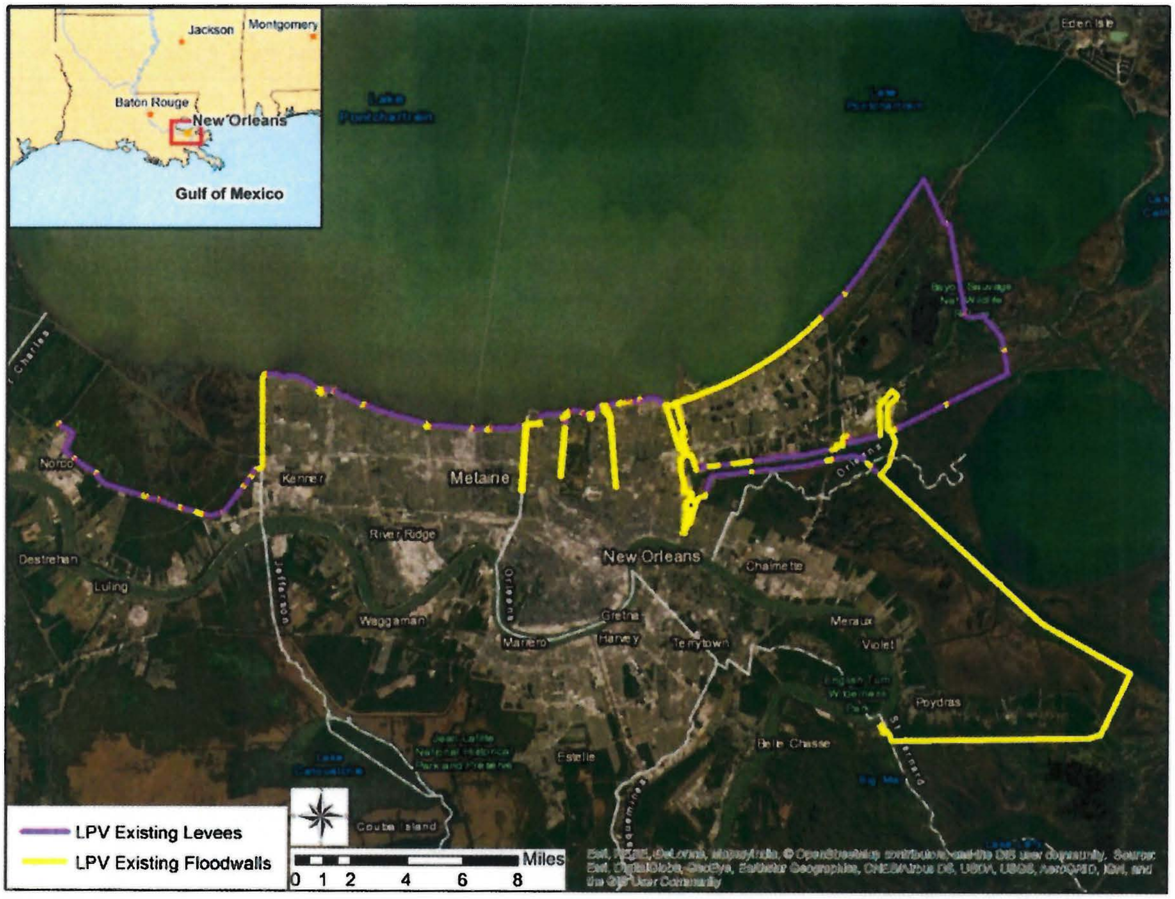
Areas of the LPV-MRL-1 Reach on the flood side shift would include areas within the Mississippi River below the ordinary high-water mark within the banks of the Mississippi River (navigable watercourse). The study is a flood control project. Therefore, this meets the first and second tests to determine availability of navigation servitude. As such, construction of Reach LPV-MRL-1 in the areas below the ordinary high-water mark can be accomplished under the Navigation Servitude. Per paragraph 12-7 of ER 405-1-12, "It is the policy of USACE to utilize the navigation servitude in all situations where available."

The Mississippi River is a state-claimed water bottom; therefore, the NFS has access for future O&M within these areas below the ordinary high-water mark within the banks of the Mississippi River.

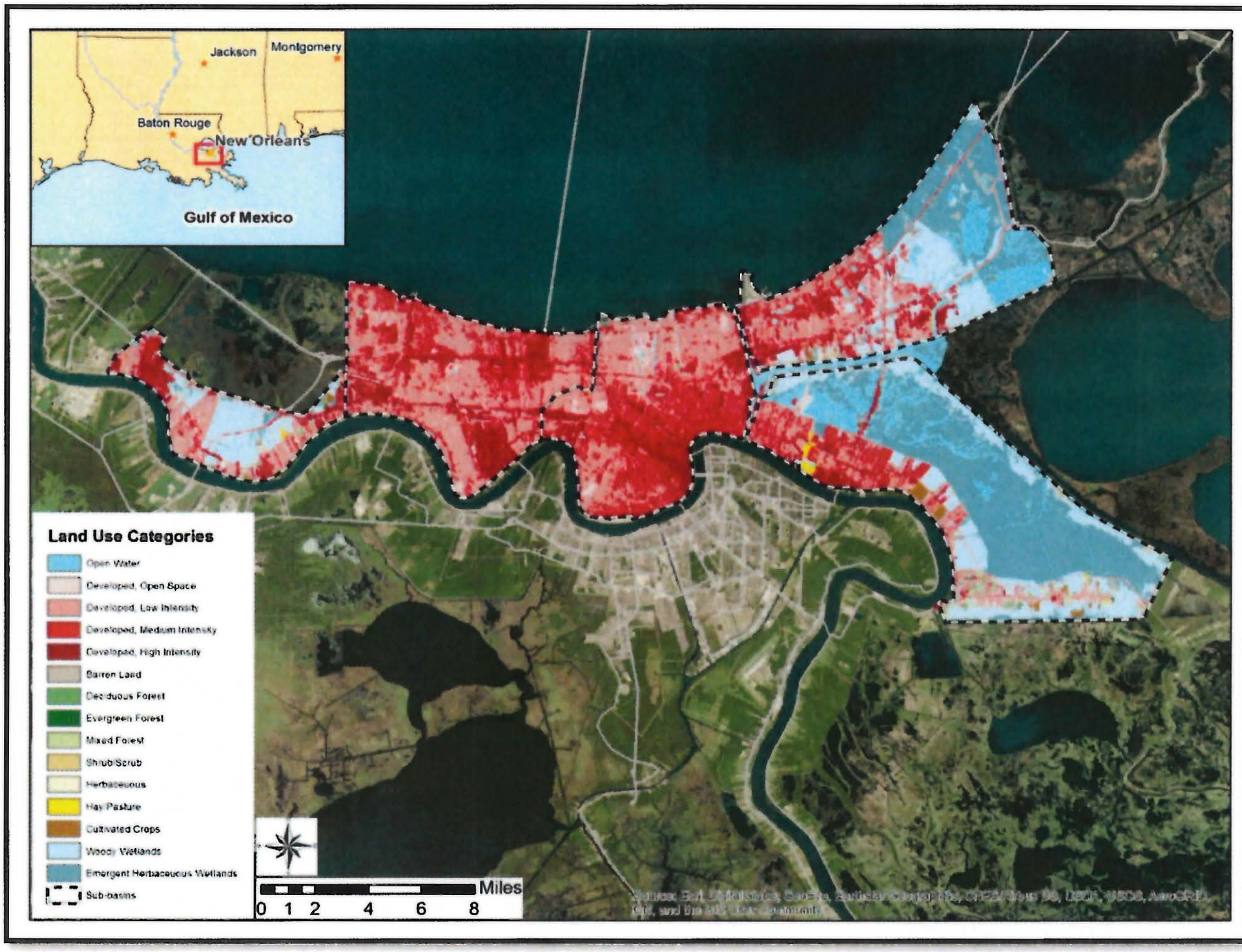
8 MAPS



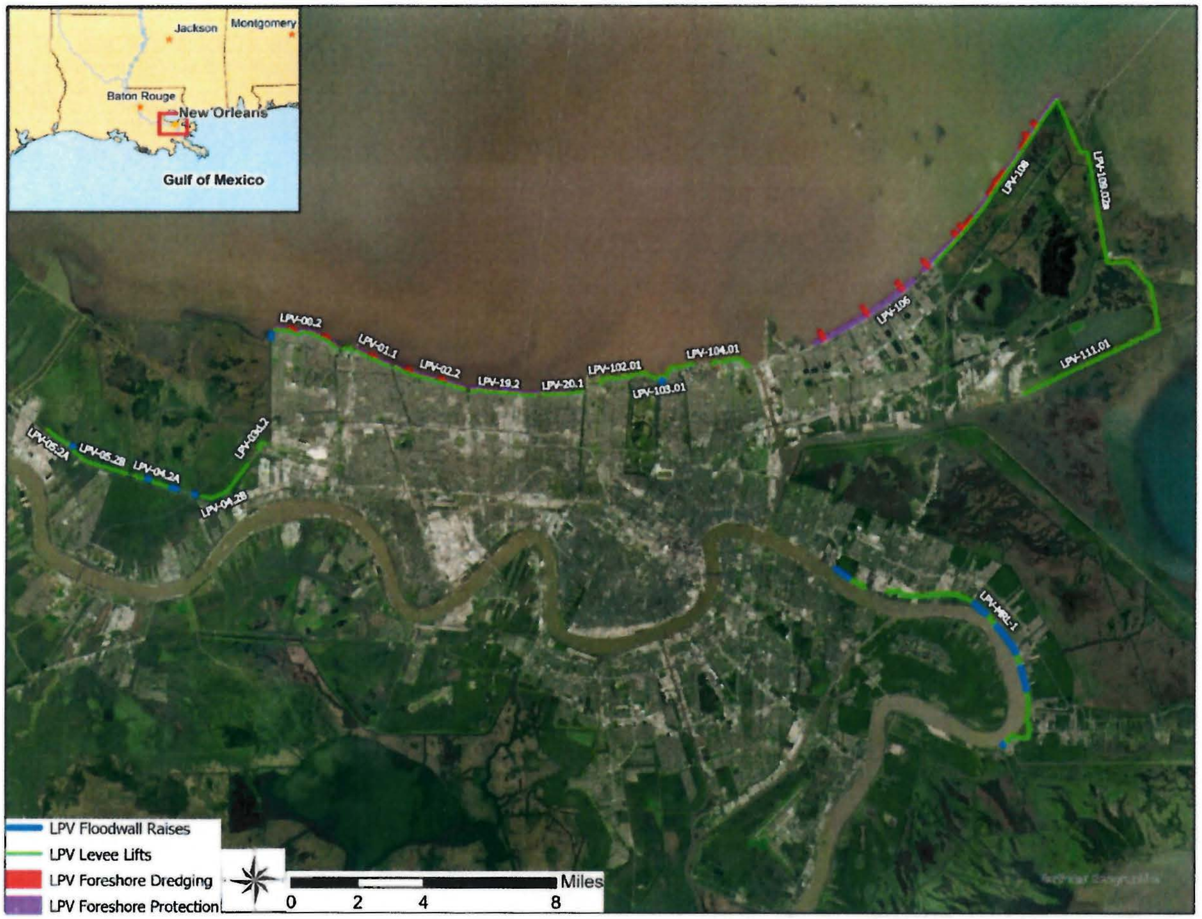
Map 1 – General Study Area



Map 2 – Existing LPV Levees and Floodwalls



Map 3 – Lake Pontchartrain and Vicinity Study Area Land Use Categories



Map 4 – Lake Pontchartrain and Vicinity Recommended Plan

Detailed maps showing tracts within each reach are not available and will be developed during PED.

9 INDUCED FLOODING

Based on the study's analysis, increasing the levee and floodwall heights may result in increased flood depths on areas exterior to the system.

For the future without-project condition, the preliminary modeling indicates that the 1% AEP event produces flood depths to elevations between 7.8 and 17.1 feet (NAVD88) in the areas to the north and east of the LPV system. For the with-project condition, preliminary modeling indicates that these 1% AEP flood depths may increase only in the area at the western end of the system and increased by depths less than six inches in most areas and up to one foot in areas immediately adjacent to the system. This area is largely undeveloped.

These flood depths and potential induced flooding conclusions will be confirmed or revised during the design phase with the updated ADCIRC model when the final system design heights are determined. At that time, a determination will be made regarding whether any significant induced flooding is reasonably anticipated, and the additional actions ~~are~~ needed to address any potential induced flooding.

10 SUMMARY OF REAL ESTATE COSTS

The estimated total cost of 01 Real Estate Costs for Recommended Plan for the LERRD required for the implementation of the Project is $8,573,000.00. This cost reflects real estate interest acquisition costs required for the construction of the Project as well as other costs associated with acquiring LERRD. These other costs include, but are not limited to, appraisals, surveys, title work, NFS oversite, and other administrative costs. Real estate interest acquisition costs include a 25 percent contingency (rounded) to account for any changes during Preconstruction, Engineering and Design.

The construction of the RP does not require the acquisition of residences, businesses, or farms, and therefore no relocations assistance benefits (P.L. 91-646) would be required.

Real Estate costs will not exceed 10% of total Project costs; therefore, a cost estimate was provided at this point of the study by the CEMVN, Appraisal Branch in lieu of a gross appraisal. Real estate interest acquisition costs include a 25% contingency (rounded) to account for any minor changes during Preconstruction, Engineering and Design.

The NFS will not receive credit for LERRD previously acquired in the past or previously provided as an item of cooperation.

The estimated total cost of 02 Relocations Costs for Facilities/Utilities (discussed in Appendix A, Section 5.1 Utility Relocations and cost reflected in Appendix I) is $0.00. Due to the existing MR&T project and previous facilities/utilities identified for MR&T, it is assumed the facilities/utilities listed in Section 16 below are allowed by permit; therefore, relocation cost would not be project cost. Facility/utility relocations would be at the expense of the facility/utility owner, not the NFS or the U S Government.

The Relocations Branch of Engineering at the New Orleans District researched public utilities and facilities located within the proposed project area through the National Pipeline Database and the State Online Natural Resources Information System (Louisiana Department of Natural Resources).

This REP does not include any real estate costs to acquire LERRD for Fish and Wildlife Mitigation, as it is anticipated the impacted wetlands would be offset through the purchase of mitigation bank credits.

11 P. L. 91-646 RELOATION ASSISTANCE BENEFITS

This Project will not displace residential, business, or farms within the Project boundaries; therefore, the provisions under Title II of Public Law 91-646, as amended, are not applicable.

12 MINERAL ACTIVITY/CROPS

Mineral activity within the right-of-way of the Project has been plugged and abandoned. Outstanding mineral rights held by third parties would not be acquired. If during design any mineral activity is identified, it will be avoided. There is no merchantable timber or row crop activity affected by this Project.

13 NON-FEDERAL SPONSOR CAPABILITY ASSESSMENT

An assessment of the non-Federal sponsor's legal and professional capability and experience to acquire and provide the LERRD for the construction, operation, and maintenance of the Project, including its condemnation authority and quick-take capability has been received and is included in this REP as Exhibit A.

Coastal Protection and Restoration Authority Board of Louisiana (CPRAB) has been involved on numerous other USACE projects. CPRAB has in-house staff with sufficient real estate acquisition experience to meet its responsibilities and is highly capable of performing the responsibilities of LERRD acquisition and management.

This NFS has the legal authority to acquire and hold title to real property for this project's purpose but does not directly have quick take authority. However, pursuant to Louisiana revised statutes (49:214.5.2 and 38:301.1), they may enter into an agreement to use the authority of a coastal area levee district or parish governing authority to use the quick take authority of those entities to acquire real property interests for project purposes.

14 ZONING ORDINANCES

No application or enactment of zoning ordinances has been proposed in lieu of, or to facilitate, acquisition in connection with the Project.

15 ACQUISITION SCHEDULE

The following schedule shows the tasks and duration for acquisition of the LERRD required for the Project, which will affect approximately one hundred five private landowners. This Study is anticipated to be constructed in four separate first year lifts (2024, 2025, 2040, and 2069). Acquisition schedule below is for each lift year's reaches only – not for all LERRD's required for the entire project.

Table 3. Acquisition Schedule

Task/Duration	Time Accumulation
Mapping (3 months)	3 months
Title (6 months); Appraisals (9 months)	12 months
Negotiations (24 months)	36 months
Closing (6 months); Condemnations (if necessary-12 months)	48 months
Issue Right of Entry, Right-of-Way (2 months)	50 months

16 FACILITY/UTILITY RELOCATIONS

This Project consists of straddle lift levees and modifying or replacing floodwalls over what was previously constructed. A description of the facilities / utilities and the identity of the owners are listed below for LPV-MRL-1, which is the reach between the old 2011 HSDRRS one percent crossover point and the new crossover point within Mississippi River & Tributaries footprint. Because all lifts would generally straddle the footprint of a previous lift, it is assumed that no utility relocations would be required. If relocation of any existing utility that crosses the levees as permitted is required, the utility would need to be lifted by and at the expense of, the utility owner at no cost to the Government.

The estimated total cost of 02 Relocations Costs for Facilities/Utilities (discussed in Appendix A, Section 5.1 Utility Relocations and cost reflected in Appendix I) is $0.00.

Any conclusion or categorization contained in this report that an item is a utility or facility relocation is preliminary only. CEMVN Relocations Branch will incorporate the relocations process towards compensability and coordinate with utility owners throughout the design and development of the Plans & Specification process for this RP. An attorney's compensability analysis and opinion of compensability for each of the impacted utilities and facilities will be completed during Preconstruction, Engineering and Design (PED). The Government will make a final determination of the relocations necessary for the construction, operation, or maintenance of the project after further analysis, and completion then approval of final attorney's opinion of compensability for each of the impacted utilities and facilities.

Table 7. Facilities / Utilities for LPV-MRL-1

Utility Owner		Width Thickness	Diameter	Action
Am Midstream		0.5	6”	Remain/not impeding
Bridgeline		0.5	22”	Owner to Relocate; fac/util permitted
Bridgeline		0.5	22”	Owner to Relocate
Tenneco		0.5	48”	Owner to Relocate
Boardwalk		0.5	12”	Owner to Relocate
Mobil		0.5	4”	Owner to Relocate
Mobil		0.5	4”	Owner to Relocate
Mobil		0.5	4”	Owner to Relocate
Energy Transfer		0.5	11”	Owner to Relocate
Tenneco		0.5	16”	Owner to Relocate
Tenneco		0.5	24”	Owner to Relocate
ExxonMobil		0.5	14”	Owner to Relocate
Gulf Liquids		0.5	12”	Owner to Relocate
Air Products		0.5	8”	Owner to Relocate
Air Products		0.5	12”	Owner to Relocate
Chalmette Refining		0.5	24”	Owner to Relocate
ExxonMobil		0.5	24”	Owner to Relocate
Air Products		0.5	12”	Owner to Relocate
Air Products		0.5	12”	Owner to Relocate
Entergy Overhead			Cable	Owner to relocate (Poles)
Williams Fiber 1.5			Cable	Owner to relocate (Poles)

17 HAZARDOUS, TOXIC RADIOACTIVE WASTE AND OTHER ENVIRONMENTAL CONSIDERATIONS

During the feasibility phase, an abridged Phase I Environmental Site Assessment (ESA) was conducted to determine the potential for HTRW problems which could impact or be impacted by potential features. This abridged Phase I ESA was conducted in the current HSDRRS levee and floodwall ROW. The risks of encountering HTRW in the Project area is low, and no impacts from HTRW are anticipated. Oil and gas wells within the project footprint are closed.

Generalized Borrow Areas: Should new borrow site excavation be needed, these sites would need environmental compliance to ensure that no recognized environmental conditions 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.

18 LANDOWNER ATTITUDE

Most of the LERRD required for this Project has been previously acquired or is owned by local/state/U. S. Government entities. Landowners within the MRL co-located reach are anticipated to be agreeable due to the Project improving the level of hurricane and storm damage risk reduction. The road and work area easements needed would be temporary; therefore, we do not expect opposition to this Project from landowners.

19 RISK NOTIFICATION

The NFS, Coastal Protection and Restoration Authority Board of Louisiana (CPRAB), has been given notification of the risks of acquiring real property interest prior to the Project Partnership Agreement, as the preliminary information in the feasibility study may change once completed. Premature acquisition may result in insufficient or excessive real property acreage, as well as additional expense and delay schedule to complete acquisition.

A copy of the letter discussion risk with early acquisition of real property interests in included in the REP as Exhibit B.

20 OTHER REAL ESTATE ISSUES

Other real estate issues that may be relevant to the Project will be further investigated during PED.

Date: March 2021, Revised July 13, 2021

Real Estate, New Orleans District

Prepared By:	Reviewed by:	Approved by:
FISCHER.PAMELA.MAURAS.1384865050 Digitally signed by FISCHER.PAMELA.MAURAS.1384865050 Date: 2021.07.13 17:12:26 -05'00'	VANCE-ORANGE.KAREN.ELAINE.1247763330 Digitally signed by VANCE-ORANGE.KAREN.ELAINE.1247763330 Date: 2021.07.14 10:51:42 -05'00'	GUTIERREZ.JUDITH.YRMA.1230839561 Digitally signed by GUTIERREZ.JUDITH.YRMA.1230839561 Date: 2021.07.15 18:02:52 -05'00'
Pamela M. Fischer Realty Specialist	Karen Vance-Orange Realty Specialist	JUDITH Y. GUTIERREZ Chief, Real Estate Division Real Estate Contracting Officer

Exhibit A – Capability Assessment

ASSESSMENT OF NON-FEDERAL SPONSOR'S
REAL ESTATE ACQUISITION CAPABILITY
Lake Pontchartrain and Vicinity and West Bank and Vicinity
General Re-evaluation Report with Integrated Environmental Assessment

COASTAL PROTECTION AND RESTORATION AUTHORITY (CPRA), IMPLEMENTATION ARM OF THE COASTAL PROTECTION AND RESTORATION AUTHORITY BOARD (CPRAB)

I. Legal Authority:

a. Does the sponsor have legal authority to acquire and hold title to real property for project purposes? **YES**

b. Does the sponsor have the power of eminent domain for this project? **Yes, however Louisiana Revised Statute 214.5.5 limits the power of eminent domain; it states that "*no full ownership interest in property shall be acquired for integrated coastal protection through any method by the state of Louisiana, the Coastal Protection and Restoration Authority, a levee district, a levee authority, a sponsoring authority, a political subdivision, or any other state, local, or federal entity, or their agents or employees, including but not limited to compensatory mitigation and ecosystem restoration purposes, unless such interest is voluntarily offered and agreed to in writing by owners with at least seventy-five percent ownership in the property or such entity seeking to acquire the property proves by clear and convincing evidence in a court of competent jurisdiction that a full ownership interest is the minimum interest necessary to carry out the purposes of integrated coastal protection for the specific project for which it is acquired.*" Furthermore, access rights, rights of use, servitudes, easements, or other property interests for coastal projection projects shall only be for fixed terms and shall not be acquired in perpetuity unless such acquisition is offered voluntarily by owners with at least seventy-five percent ownership in the property.**

c. Does the sponsor have "quick-take" authority for this project? **NO** CPRAB does not directly have quick take authority. However, pursuant to La. R.S. 49:214.5.2 and 38:301.1, CPRAB may enter into an agreement to use the authority of a coastal area levee district or parish governing authority to use the quick take authority of those entities to acquire real property interests for project purposes.

d. Are any of the lands/interests in land required for the project located outside the sponsor's political boundary? **NO**

e. Are any of the lands/interests in land required for the project owned by an entity whose property the sponsor cannot condemn? **See "b" above.**

II. Human Resource Requirements:

a. Will the sponsor's in-house staff require training to become familiar with the real estate requirements of Federal projects including P.L. 91-646, as amended? **NO**

b. If the answer to II.a. is "yes," has a reasonable plan been developed to provide such training? **N/A**

c. Does the sponsor's in-house staff have sufficient real estate acquisition experience to meet its responsibilities for the project? **YES**

d. Is the sponsor's projected in-house staffing level sufficient considering its other workload, if any, and the project schedule? **YES**

e. Can the sponsor obtain contractor support, if required in a timely fashion? **YES**

f. Will the sponsor likely request USACE assistance in acquiring real estate? **NO**

III. Other Project Variables:

a. Will the sponsor's staff be located within reasonable proximity to the project site? **YES**

b. Has the sponsor approved the project/real estate schedule/milestones? **YES**

IV. Overall Assessment:

a. Has the sponsor performed satisfactorily on other USACE projects? **YES**

b. With regard to this project, the sponsor is anticipated to be: (highly capable/fully capable/moderately capable/marginally capable/insufficiently capable). **The NFS is anticipated to be highly capable of acquiring the real estate interests required for the project.**

V. Coordination:

a. Has this assessment been coordinated with the sponsor? **YES**

b. Does the sponsor concur with this assessment? **YES**

Prepared by:

FISCHER.PAMELA.MAURAS.1384865050 Digitally signed by FISCHER.PAMELA.MAURAS.1384865050 Date: 2021.06.04 12:42:45 -05'00'

Pamela Fischer
Realty Specialist
US Army Corps of Engineers

Approved by:

David A. Peterson
General Counsel
Coastal Protection and Restoration Authority

Exhibit B – Risk Letter

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
7400 LEAKE AVENUE
NEW ORLEANS, LOUISIANA 70118

REPLY TO
ATTENTION OF

May 27, 2021

Real Estate Division

Mr. Kyle R. Kline, Jr, Chairman
Coastal Protection and Restoration
Authority Board
P. O. Box 44027
Baton Rouge, LA 70804-4027

Dear Mr. Kline:

The Lake Pontchartrain & Vicinity and West Bank & Vicinity, Greater New Orleans Hurricane Storm Damage Risk Reduction System, General Re-Evaluation Report (GRR) with integrated Environmental Impact Statement is scheduled to be completed soon. The report contains preliminary information, which may change once the detail design of the project is completed. For this reason, in accordance with Corps of Engineers Regulation 405-1-12, Chapter 12, dated May 1, 1998, we are hereby formally advising you of the risks associated with acquisition of real estate rights prior to signing of the Project Partnership Agreement (PPA) and receiving a request from our agency for right of entry for construction.

Should you decide to proceed with acquisition of realty interests needed for construction of the subject project prior to the government's request for commencement of acquisition of required right-of-way, the CPRAB will assume full and sole responsibility for any and all costs, responsibility, or liability arising out of such efforts. Generally, these risks include, but may not be limited to the following:

a. Congress may not appropriate funds to construct the proposed project;
b. The proposed project may otherwise not be funded or approved for construction;
c. A PPA mutually agreeable to the CPRAB and the government may not be executed and implemented;
d. The CPRAB may incur liability and expense by virtue of its ownership of contaminated lands, or interests therein, whether such liability should arise out of local, state or Federal laws or regulations, including liability arising out of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended;
e. The CPRAB may acquire interests or estates that are later determined by the Government to be inappropriate, insufficient, or otherwise not required for the

CEMVN-RE-E

project, thus incurring costs or expenses which may not be creditable under the provisions of Public Law 99-662 or the PPA; and

f. The CPRAB may initially acquire insufficient or excessive real property acreage which may result in additional negotiations and/or benefit payments under Public Law 91-646, as amended, as well as the payment of additional fair market value to affected landowners, which could have been avoided by delaying acquisition until the PPA execution and the government's notice to commence acquisition and performance of lands, easements, rights-of-way, relocation and disposal (LERRD).

Should you decide to proceed with acquisition of real estate interests, you are hereby notified that acquisition activities must conform to Public Law 91-646, The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended. The Uniform Act describes the rights of landowners impacted by a federally funded project and the responsibilities of government agencies performing acquisition of real estate interests for such projects. Furthermore, in order to ensure that you receive the maximum possible credit once the project alignment is finalized, we suggest that you send for our review the résumé and proposed fees of your intended contractors as well as the following real estate products once completed: ownership plat and legal descriptions, appraisal reports, title reports, proposed negotiated settlements, and relocations assistance payments, if applicable.

If you have questions regarding the acquisition and crediting process, please call Huey J. Marceaux, Chief Appraiser at (504) 862-1175 or Todd Klock, Chief, Local Sponsor Acquisition Branch at (504) 862-1920.

Sincerely,

GUTIERREZ.JUDITH.YRMA.1230839561 Digitally signed by GUTIERREZ.JUDITH.YRMA.1230839561 Date: 2021.05.28 06:54:09 -05'00'

Judith Y. Gutierrez
District Chief of Real Estate, New Orleans
Real Estate Contracting Officer

2021

Lake Pontchartrain & Vicinity GRR
Appendix G – Environmental Compliance

US Army Corps of Engineers
New Orleans District

U.S. Army Corps of Engineers, New Orleans District

Non-Federal Sponsor: Coastal Protection and Restoration Authority Board of Louisiana

March 2021

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LAKE PONTCHARTRAIN & VICINITY GRR
APPENDIX G – ENVIRONMENTAL COMPLIANCE

1 CLEAN WATER ACT COMPLIANCE

1.1 404(B)1 EVALUATION

1.1.1 INTRODUCTION

A. Purpose, Location, General Description, and Authority

The general purpose of the Lake Pontchartrain and Vicinity (LPV) General Re-Evaluation Report study with integrated Environmental Impact Statement (GRR-EIS) is to analyze alternatives to reduce hurricane and storm risk within the LPV study area.

The study area is located on the east bank of the Mississippi River south of Lake Pontchartrain within St. Charles, Jefferson, Orleans, and St. Bernard Parishes in southeast Louisiana (Figure 1). The western end of the study area abuts the Bonnet Carré spillway. The eastern end of the study area is located in the Bayou Sauvage National Wildlife Refuge and along the Mississippi River Gulf Outlet (MRGO). The study area includes the communities of New Orleans, Norco, Kenner, Elmwood, Metairie, Chalmette, Poydras, and St. Bernard. A full study area description is provided in Section 1.6 of the LPV GRR-EIS.

The study authority is provided in Section 1.3 of the LPV GRR-EIS.

Features included in the Recommended Plan requiring placement of fill in waters of the U.S. include foreshore rock protection at reaches LPV-00.2, 01.1, 02.2, 19.2, 20.1, 106, and 108 and associated dredging to allow construction access (Figures 2, 3, and 4) and expansion of Mississippi River levees (Figures 5 and 6).

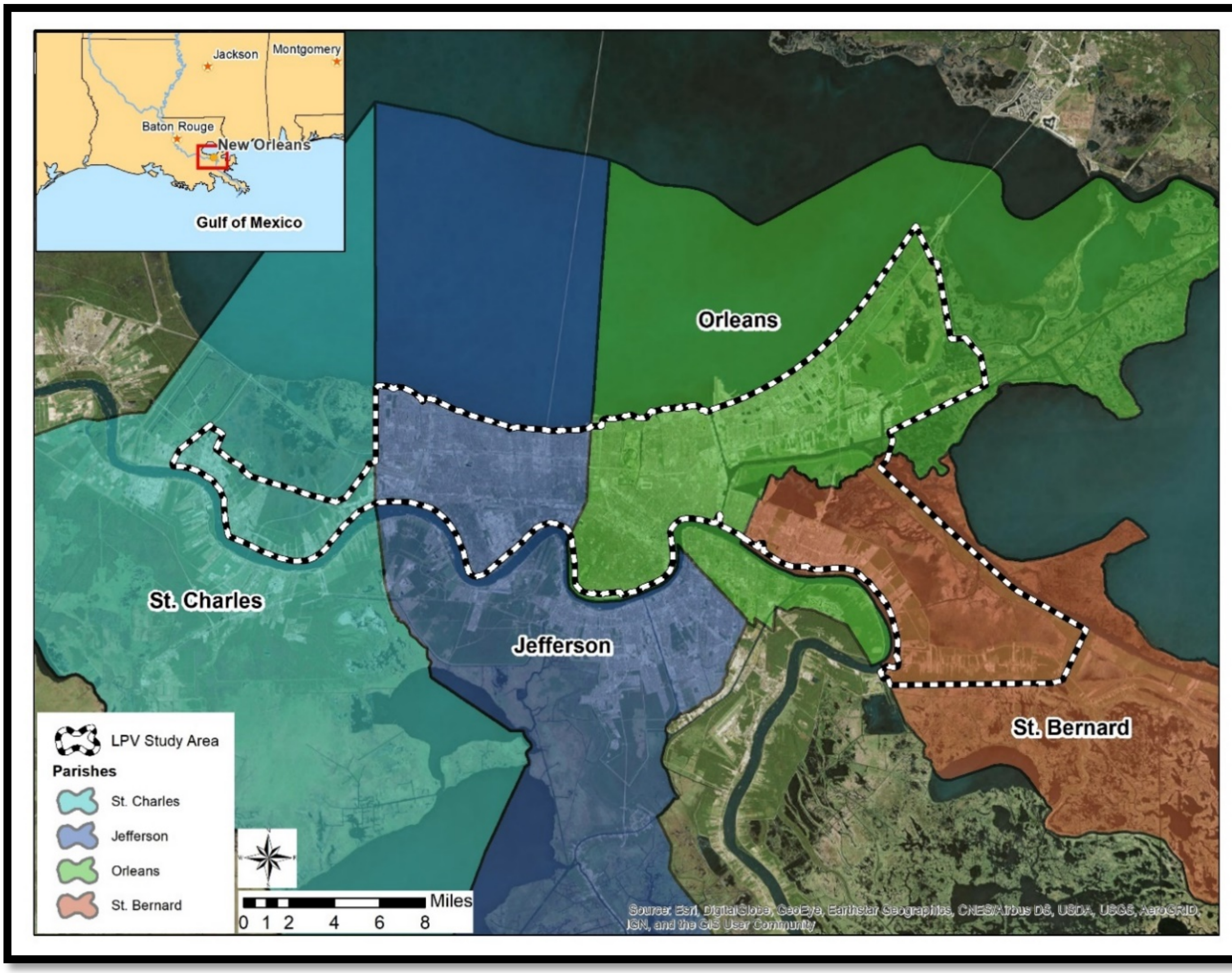

Figure 1. Lake Pontchartrain and Vicinity Study Area.

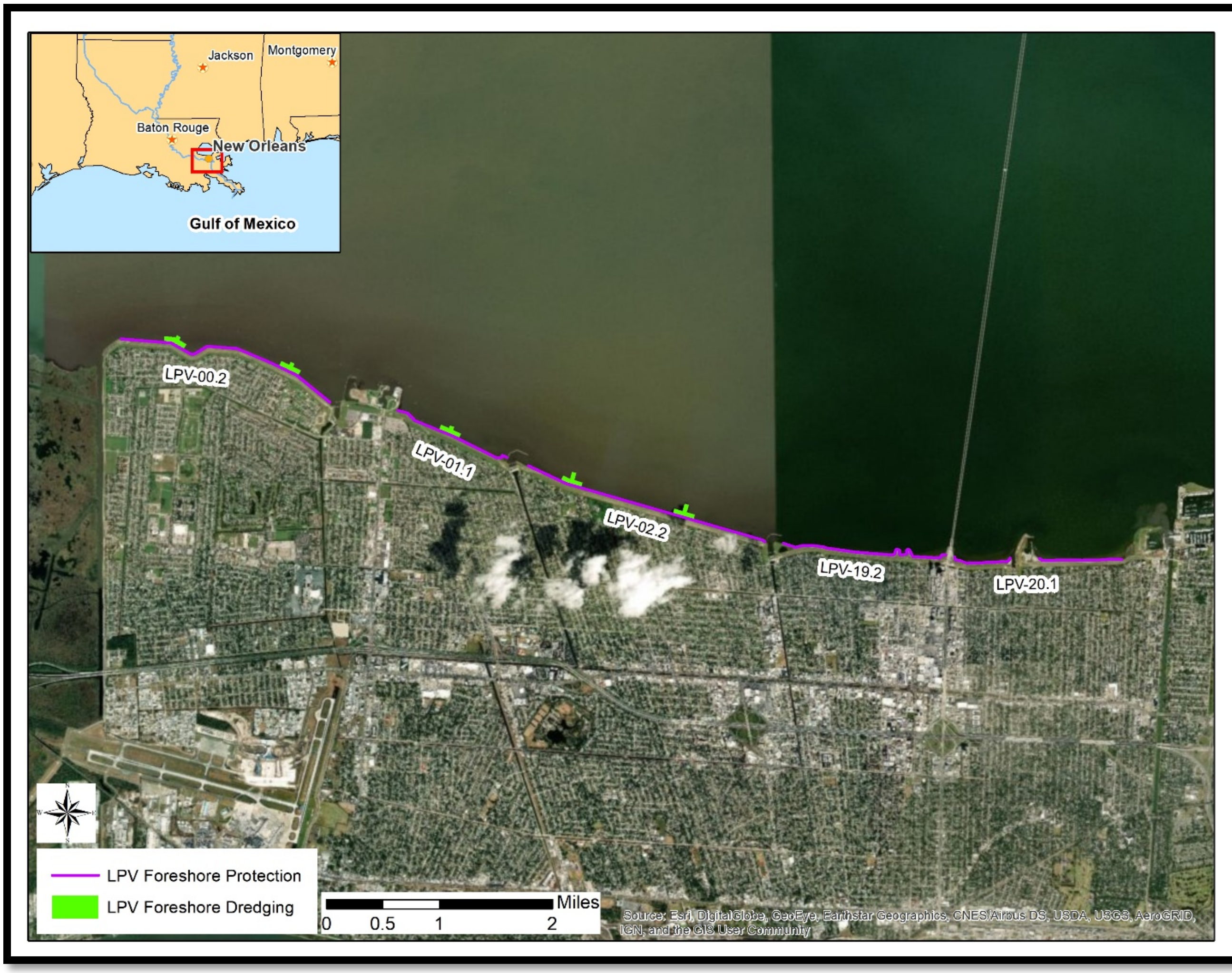

Figure 2. Foreshore protection placement and construction access dredging areas.

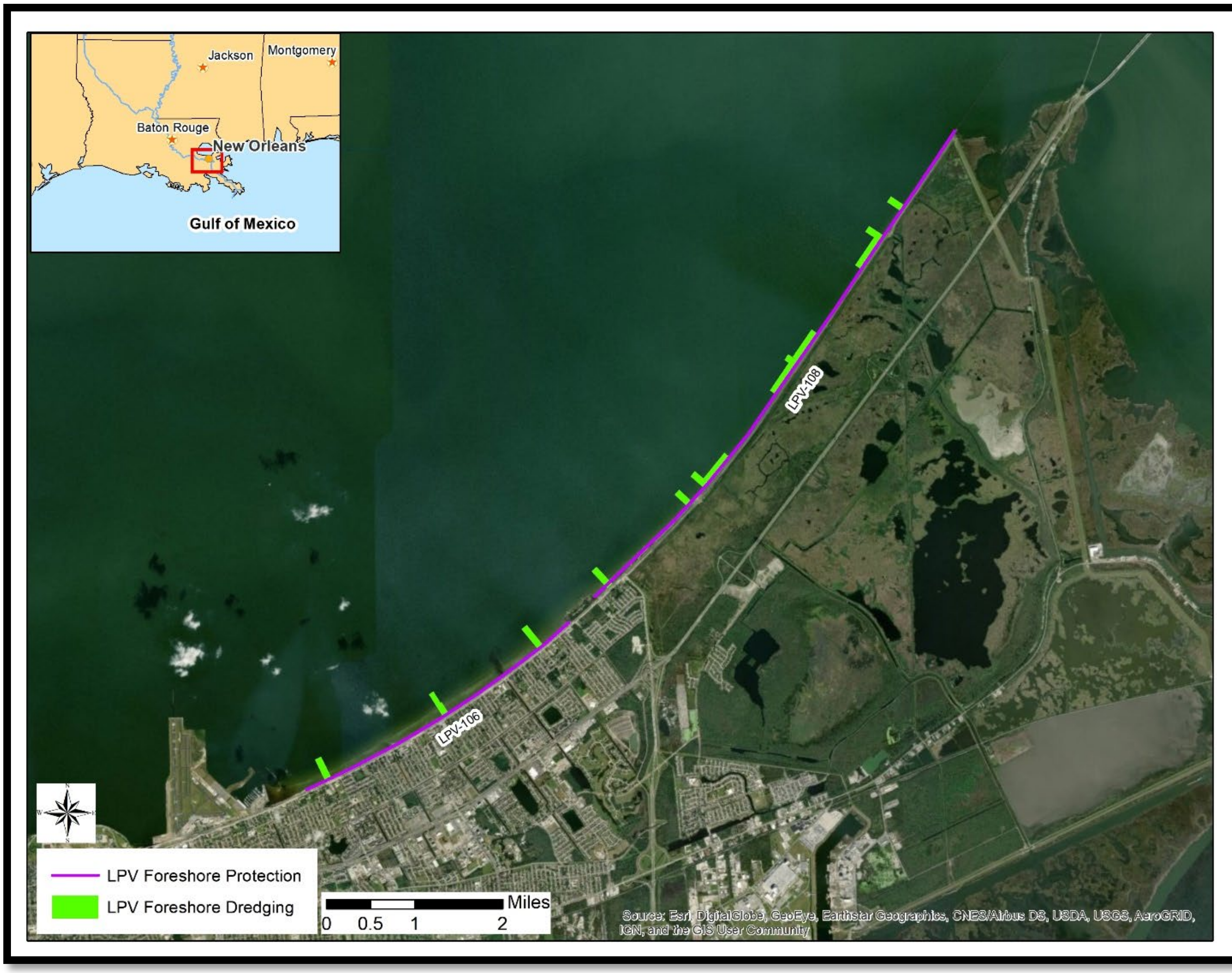

Figure 3. Foreshore protection placement and construction access dredging areas.

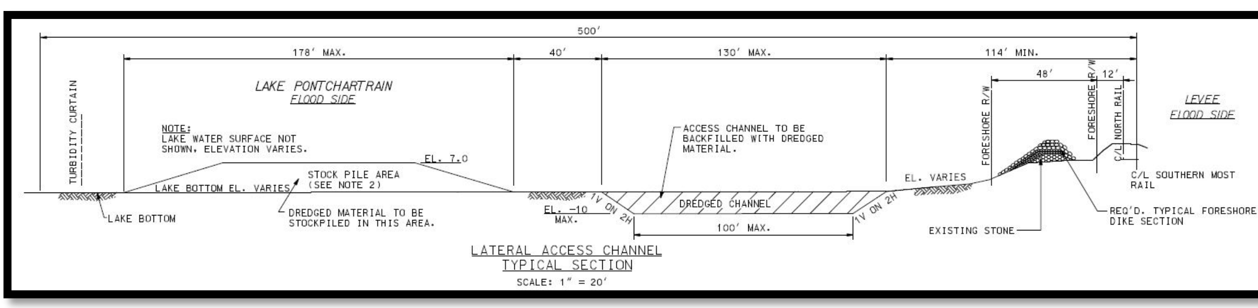

Figure 4. Typical section along Lake Pontchartrain shoreline.

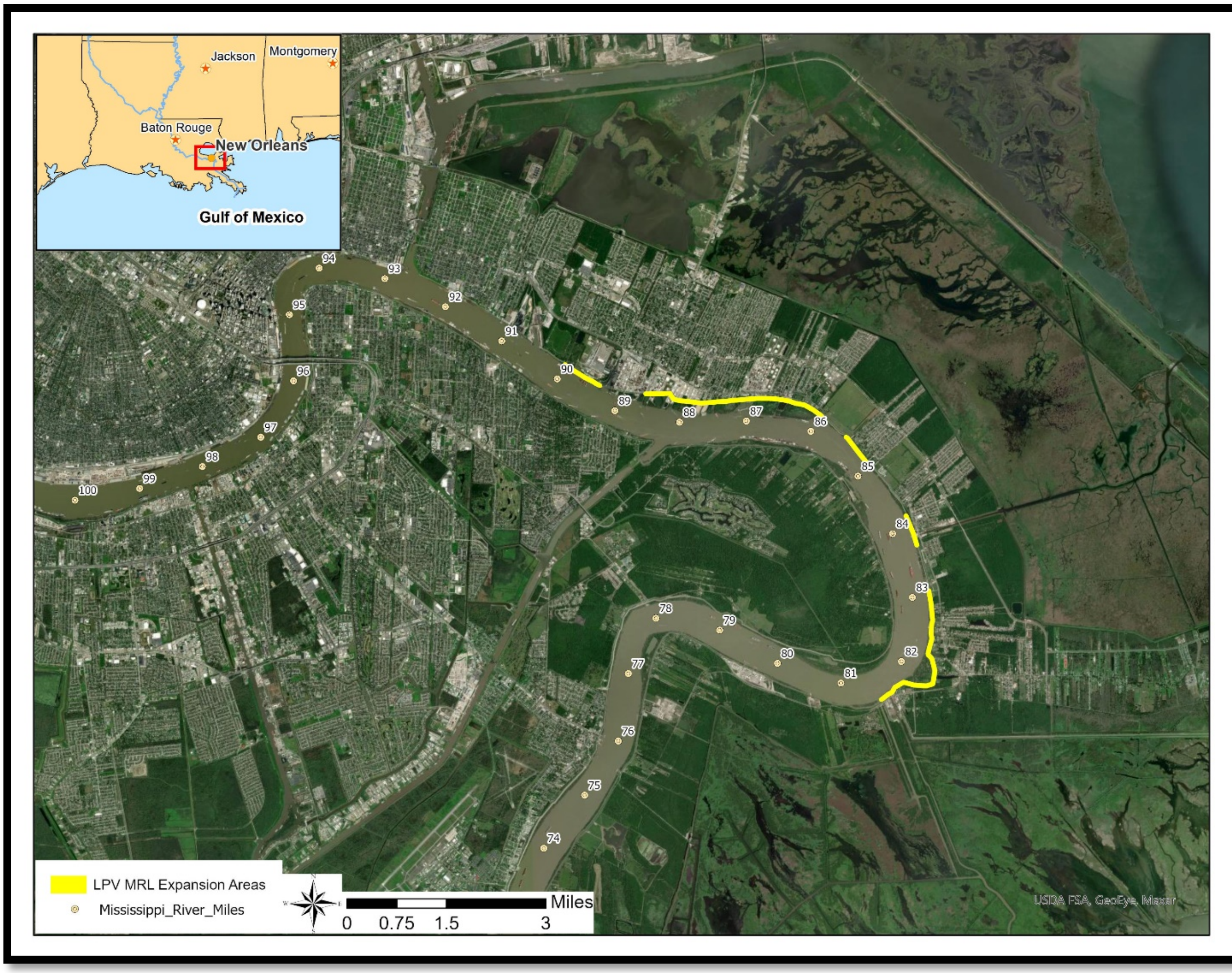

Figure 5. Mississippi River levee expansion areas.

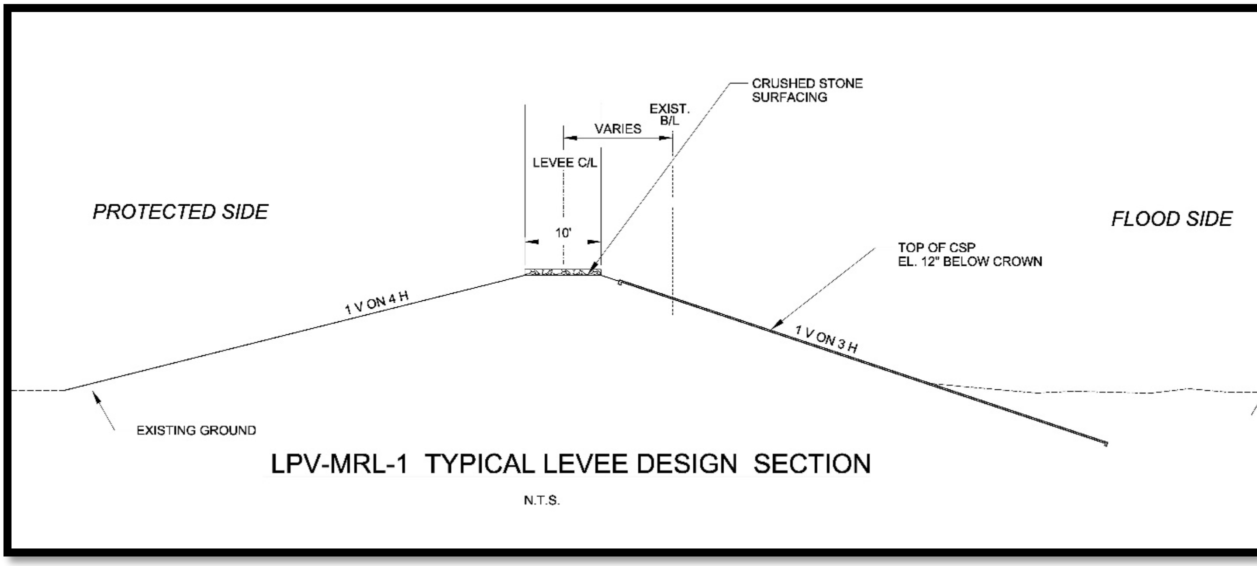

Figure 6. Typical Mississippi River levee design section.

B. General Description of Dredged and Fill Material.

(1) General Characteristics of Material.

Graded stone meeting the following specifications would be used for construction of foreshore protection.

Graded Stone Gradation	
Percent Lighter by Weight	**Limits of Stone Weight (lbs.)**
100	2200-900
50	930-440
15	460-130

Material dredged from the bottom of Lake Pontchartrain would consist of silty sand.

For the Mississippi River levee expansions, design estimates indicate an additional 25 feet would be required on the flood side for construction. These floodside levee shifts would impact approximately 20.27 acres of bottomland hardwood wet habitat. Figure 4 shows locations anticipated to be impacted by floodside levee shifts. Material required for levee lifts would be clean fill consisting of suitable clay material with the following requirements:

- Soils classified as fat or lean clays are allowed
- Soils with organic content greater than 9% 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% sand content

(2) Quantity of Material.

Graded stone in the following quantities would be used for construction of foreshore protection.

Reach	Quantity of Rock (cubic yards)
LPV-00.2	23,218
LPV-01.1	9,356
LPV-02.2	42,742
LPV-19.2	17,907
LPV-20.1	16,602
LPV-106	56,444
LPV-108	73,920

Material would be dredged from the bed of Lake Pontchartrain to provide construction access channels. Construction access channels would consist of parallel channels at the shoreline in areas where rock would be placed as well as perpendicular access channels to allow access to the shoreline channels (see Figure 2 and Figure 3). The dimensions required for barge access channels would be approximately -7 feet depth with 100-foot bottom width. Perpendicular access channels would begin at the elevation -7 ft contour of the lake and extend 400 to 1600 ft. Adjacent dredged material stockpile sites would be 150 ft wide. The total acreage of lake bottom impacted by dredging temporary construction access channels and associated temporary stockpiling would be 213 acres. A maximum of 2.4 million cubic yards of material would be dredged for construction access.

Approximately 2.9 million cubic yards of material would be needed for the levee lifts; however, only a small portion of this quantity would be placed in waters of the U.S. Exact quantities would not be determined until detailed designs are finalized during pre-construction engineering and design.

(3) Source of Material.

Graded stone used in the construction of foreshore protection would be sourced from any approved quarry capable of supplying stone meeting the quantity, quality, and rate requirements of the project.

Dredged material would be native material from the bed of Lake Pontchartrain.

Fill material for levee lifts would be sourced from any approved borrow location, which will be identified during the design phase of the project.

C. <u>Description of the Proposed Discharge Sites.</u>

(1) Location and Size.

Stone placement locations and sizes are as follows:

Reach	Acres
LPV-00.2	14.8
LPV-01.1	7.9
LPV-02.2	16.1
LPV-19.2	11.8
LPV-20.1	9.3
LPV-106	5.2
LPV-108	9.8

Dredged material placement locations and sizes are as follows:

Reach	Acres
LPV-00.2	13.2
LPV-01.1	6.5
LPV-02.2	14.6
LPV-19.2	0
LPV-20.1	0
LPV-106	40.9
LPV-108	137.3

The Mississippi River levee expansion discharge site consists of a 25-foot corridor totaling 20.27 acres on the flood side of the existing levee system approximately from Mississippi River mile 81.5 to 90 (Figure 4).

(2) Type of Habitat.

The proposed sites for rock placement lie along the south shore of Lake Pontchartrain. All of the proposed sites currently have foreshore protection. Lake Pontchartrain east of the causeway is critical habitat (approximately 195,000 acres) for the endangered Gulf sturgeon. Existing habitat consists of rock-filled open water shoreline habitat. Additional stone placement is required within the existing foreshore protection footprint to bring the stone back up to the required elevation for proper levee protection.

The proposed sites for dredging and temporary stockpiling of dredged material lie along the south shore of Lake Pontchartrain. Existing habitat consists of open water lake bottom and water column with some areas of submerged aquatic vegetation (SAV). Areas of Lake Pontchartrain east of the causeway are also critical habitat (approximately 195,000 acres) for Gulf sturgeon. The proposed Mississippi River levee expansion discharge sites consist of bottomland hardwood wet habitat adjacent to the existing Mississippi River levee system.

(3) Timing and Duration of Discharge.

The construction period would be determined by availability of funding, weather, materials, etc. Construction would be expected to last 1.5 to 2.5 years. See Chapter 10 of the LPV GRR-EIS for additional details on project implementation and schedule.

D. Description of Disposal Method.

Stone would be shipped by barge to the project area. Stone would be placed by crane-operated skip-pan, dragline bucket, clamshell, rock-bucket, hydraulic excavator, trackhoe, or other similar equipment. Dredging of construction access channels and placement of temporary stockpiles would be accomplished by bucket dredge. Fill material would be transported to the project area by dump truck. Excavators, bulldozers, and other typical construction equipment would be used at the project site.

1.1.2 FACTUAL DETERMINATIONS

A. Physical Substrate Determinations.

(1) Comparison to Existing Substrate and Fill.

Stone would be placed on top of existing stone foreshore protection that is of similar composition. Dredged material would be placed on top of existing lake bottom material that is of similar composition. Levee fill material would be placed on existing native bottomland hardwood soils along the flood side of existing Mississippi River levee. Major types of existing bottomland hardwood soils include Cancienne and Schriever soils, frequently flooded (https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm).

(2) Changes to Disposal Area Elevation.

Placement of foreshore protection would increase existing foreshore protection area elevations by approximately four feet. Construction access channels would increase lake depth by as much as 10 feet. Temporary stockpile areas would increase in elevation by as much as 10 feet. Construction access channels and temporary stockpile areas would be returned to pre-project elevations at project completion. Levee lift disposal locations would be lifted 1 to 2 feet on average.

(3) Migration of Fill.

Migration of the stone foreshore protection would be minimized by the size and nature of the material used. Migration of dredged material and temporary stockpiles would be minimized by the use of silt curtains and other best management practices. Migration of levee lift material would be minimized by use of best management practices during construction and by establishment of levee grasses after construction.

(4) Changes to Environmental Quality and Value.

The placement of stone foreshore protection would permanently convert aquatic habitat to terrestrial. The creation of temporary dredge material stockpile areas would temporarily convert aquatic habitat to terrestrial. The removal of this habitat represents a proportionately very small area (approximately 287 acres) of similar aquatic habitat within the expanse of Lake Pontchartrain, which has an area of over 400,000 acres. The dredging of access channels would temporarily displace and destroy the benthic organisms where the access channels and associated sediment stockpile areas would be located. Increased turbidity from access dredging could affect fish and other organisms. Flotation channels and stockpile areas would be brought to pre-construction lake bottom elevations upon project completion, which would minimize impacts to the lake bottom and re-establish fish habitat in the area.

The floodside shift levee lifts would permanently convert bottomland hardwood-wet habitat to a vegetation free zone along the toe of the levee alignment. The removal of this wetland habitat type is significant but would be compensated for through the purchase of mitigation bank credits (see Appendix K).

Most mobile species would avoid the areas temporarily impacted by dredging as well as shoreline areas that would be permanently lost due to filling. Impacts to less mobile benthic species from these activities likely would occur but would be temporary, with effects lasting until the areas stabilized. Once the proposed action is complete, sediment would settle, benthos would begin to repopulate the affected footprint, and fish and other mobile aquatic species would return.

(5) Actions to Minimize Impacts.

Water quality impacts would be minimized by the use of silt curtains and other best management practices at construction sites. Bottomland hardwood-wet impacts would be compensated for through the purchase of mitigation bank credits. Pre-construction surveys would be required to delineate existing submerged aquatic vegetation (SAV) in Lake Pontchartrain to facilitate avoidance of impacts. Pre-construction SAV surveys and avoidance of SAV impacts would be included in construction contract solicitation language.

B. Water Circulation, Fluctuation, and Salinity Determinations.

(1) Alteration of Current Patterns and Water Circulation.

Minor alterations to current patterns and water circulation patterns can be expected in areas of dredging and temporary stockpiling for the duration of construction activities. Current patterns and water circulation patterns are expected to return to pre-project conditions after completion of construction.

(2) Interference with Water Level Fluctuation.

Project features are designed to prevent coastal storm waters from overtopping project area levees during storm events. No other changes in water level fluctuation are anticipated with implementation of project features.

(3) Salinity Gradient Alteration.

No alterations of salinity gradients are anticipated with implementation of project features.

(4) Cumulative Effects on Water Quality.

Direct minor, short-term, construction-related impacts on water quality from construction activities may include decreased dissolved oxygen levels in the waters immediately surrounding the construction site, decreased clarity due to construction runoff and sedimentation and due to dredging and disposal activities, and increased water temperature due to increased suspended solids produced during construction that could absorb incident solar radiation. Temporary, minor water quality impacts could occur due to increased nutrient loading, miscellaneous debris, and accidental spills from construction equipment. Impacts would be localized and minimized through the use of silt curtains and other best management practices. After construction, conditions would be expected to stabilize and return to conditions similar to pre-construction.

(5) Changes to Environmental Quality and Value.

The temporary changes in water quality variables could have a negative impact on the environmental quality and value of the aquatic habitat in the immediate vicinity of construction activities. Impacts would temporarily displace organisms in construction areas. Most mobile species would avoid the areas temporarily impacted by construction activities. Once the proposed action is complete, fish and other mobile aquatic species would be expected to return. The area impacted by foreshore protection placement and associated dredging (approximately 287 acres) represents a proportionately very small area within the expanse of Lake Pontchartrain, which has an area of over 400,000 acres. Levee lifts would affect the quality and value of approximately 20.27 acres of bottomland hardwood-wet habitat. These impacts would be compensated for through the purchase of mitigation bank credits. Mitigation is outlined in the mitigation and monitoring plan associated with the GRR-EIS.

(6) Actions Taken to Minimize Impacts.

Impacts would be localized and minimized through the use of silt curtains and other best management practices and adherence to regulations governing stormwater runoff at construction sites. Flotation channels and stockpile areas would be brought to pre-construction lake bottom elevations upon project completion, thus avoiding potential creation of isolated anoxic areas in deep holes. Bottomland hardwood-wet impacts would be compensated for through the purchase of mitigation bank credits (See Appendix K).

C. <u>Suspended Particulate / Turbidity Determinations.</u>

(1) Alteration of Suspended Particulate Type and Concentration.

Background turbidity levels in both Lake Pontchartrain and the Mississippi River are highly variable. Lake Pontchartrain is a large estuarine embayment with circulation and wave energies that generally allow for rapid mixing and dilution, and the south shoreline experiences elevated turbidity and suspended sediment based on tropical events, normal weather and wind patterns, wave energy, opening of the Bonnet Carré Spillway, etc. The Mississippi River experiences highly variable turbidity levels primarily based on rainfall patterns in the watershed and resultant runoff.

Direct minor, short-term, construction-related impacts on turbidity are anticipated in the waters immediately surrounding the construction sites due to construction runoff and sedimentation and due to re-suspension of bottom sediments from dredging activities. Impacts would be localized and minimized through the use of silt curtains and other best management practices. After construction, conditions would be expected to stabilize and return to conditions similar to pre-construction.

(2) Particulate Plumes Associated with Discharge.

Particulate plumes would be limited to the immediate vicinity of the sites by the use of silt curtains and silt fencing.

(3) State Water Quality Standards.

Section 303(d) of the Clean Water Act (CWA) requires that states develop a list of waters that do not meet water quality standards and do not support their Designated Uses. Standards apply to pH, temperature, bacterial density, dissolved oxygen (DO), chloride concentration, sulfate concentration, metals and toxics concentrations, turbidity, color, and total dissolved solids (TDS). Established by the state, the Designated Use articulates the vision for the activities that each water resource can support. The Designated Use establishes the water quality management goals for the water body and determines the associated water quality standards to use to determine if the water body supports the Designated Use.

Designated Uses of Lake Pontchartrain include Primary Contact Recreation, Secondary Contact Recreation, and Fish and Wildlife Propagation. Designated Uses of the Mississippi River include Primary Contact Recreation, Secondary Contact Recreation, Fish and Wildlife Propagation, and Drinking Water Supply. All Designated Uses of Lake Pontchartrain and the Mississippi River are fully supported based on the 2018 Louisiana Water Quality Inventory Integrated Report.

No violations of state water quality standards are anticipated as a result of construction activities. State Water Quality Certification (WQC 201117-02) was obtained from the Louisiana Department of Environmental Quality on 15 December 2020.

(4) Changes to Environmental Quality and Value.

The temporary changes in water quality variables could have a negative impact on the environmental quality and value of the aquatic habitat in the immediate vicinity of construction activities. Impacts would temporarily displace organisms in construction areas. Most mobile species would avoid the areas temporarily impacted by construction activities. Once the proposed action is complete, fish and other mobile aquatic species would be expected to return. The area impacted by foreshore protection and associated dredging (approximately 287 acres) represents a proportionately very small area within the expanse of Lake Pontchartrain, which has an area of over 400,000 acres. Levee lifts would affect the quality and value of approximately 20.27 acres of bottomland hardwood-wet habitat. These impacts would be compensated for through the purchase of mitigation bank credits. Mitigation is outlined in the mitigation and monitoring plan associated with the GRR-EIS.

(5) Actions to Minimize Impacts.

Impacts would be localized and minimized through the use of silt curtains and other best management practices and adherence to regulations governing stormwater runoff at construction sites. Use of a clamshell dredge would minimize the introduction of suspended particulates. Flotation channels and stockpile areas would be brought to pre-construction lake bottom elevations upon project completion. Bottomland hardwood-wet impacts would be compensated for through mitigation.

D. <u>Contaminant Determinations.</u>

Clay to be used in levee construction is expected to be largely comprised of silica and alumina, with lesser amounts of ferric oxide, magnesia, and alkalis. Rock is likely to be limestone, a rock created by the slow compression of marine organisms under the weight of overlying rock and soil. Limestone is largely comprised of calcium carbonate with lesser amounts of dolomite, chemicals which can provide a carbonate buffer to surface waters, which can to some degree help to maintain a neutral to slightly basic pH favorable for aquatic life in south Louisiana waters. Clay and limestone are expected to be comprised of elements that commonly occur in the earth's crust and are not expected to be carriers of contaminants or negatively affect water quality.

U.S. Coast Guard spill reports (nrc.uscg.mil) for 2016-2020 were reviewed for the project area for the potential occurrence of chemical spills that may have contaminated project sediments. No such spills were discovered.

The mobilization of existing contaminants in sediments in the project area may suspend some pollutants, which include primarily trace metals and hydrophobic organic compounds. However, these contaminants are not expected to occur in such quantities that they would impair water quality or be harmful to humans, fish, or wildlife.

The most recent sampling and analysis of lake bottom sediments was conducted following hurricane Katrina in September/October 2005 (USGS 2007). Sediment chemistry data for samples collected in the vicinity of proposed flotation access channels reveals sediment contaminant levels are generally below probable effects freshwater sediment quality guidelines included in the National Oceanic and Atmospheric Administration screening quick reference tables (SQuiRTs; Buchman 2008). The average contaminant concentrations of all samples associated with a given levee reach were consistently below probable effects levels, suggesting releases of any contaminants in sediment during stockpiling and backfilling activities would likely have negligible and transient water quality impacts.

E. Aquatic Ecosystem and Organism Determinations.

(1) Effects on Fish, Crustaceans, Mollusks, and Other Aquatic Organisms in the Aquatic Food Web.

Impacts from construction activities may include direct mortality due to burial; injury or mortality due to increased turbidity (e.g. gill abrasion, clogging of feeding apparatus); modified behavior; and short-term displacement. Mobile organisms would likely leave the construction area and avoid construction-related disturbances. Sessile and slow-moving organisms would be more likely to suffer direct injury or mortality from material placement or dredging. A temporary loss of benthic invertebrates, a food source for Gulf sturgeon, would occur with the dredging of the construction access channels and the disposal of this material in adjacent stockpile sites. This would occur over a proportionately very small area (213 acres) within the expanse of Lake Pontchartrain (over 400,000 acres). Following construction, displaced organisms would be expected to return to and re-colonize the affected area.

(2) Effects on Special Aquatic Sites.

a. Sanctuaries and refuges. No direct impacts to sanctuaries or refuges are anticipated. Wildlife utilizing the Bayou Sauvage National Wildlife Refuge may experience some minor disturbance due to construction-related noise.

b. Wetlands. Approximately 20.27 acres of bottomland hardwood-wet habitat would be impacted.

c. Mud Flats. No impacts to mud flats are anticipated.

d. Vegetated shallows. No impacts to vegetated shallows are anticipated. Submerged aquatic vegetation is limited along the south shore of Lake Pontchartrain. Construction access channels and associated stockpile areas would be located so as to avoid any potential impacts. Pre-construction surveys would be required to delineate existing SAV to facilitate avoidance of impacts. SAV surveys and avoidance of impacts would be included in construction contract solicitation language.

e. Coral reefs. No impacts to coral reefs are anticipated.

f. Riffle and pool complexes. No impacts to riffle and pool complexes are anticipated.

(3) Effects on Threatened and Endangered Species.

Federally-listed species potentially occurring in the vicinity of the proposed action include West Indian manatees, Gulf sturgeon, Pallid sturgeon, and five species of sea turtles. Gulf sturgeon critical habitat is also located in Lake Pontchartrain east of the causeway. The placement of foreshore protection would permanently impact 24.3 acres of Gulf sturgeon critical habitat. Dredging activities would temporarily impact another 178.2 acres of Gulf sturgeon critical habitat. Gulf sturgeon, manatee, and sea turtle protection measures, as recommended by USFWS and NOAA Fisheries during Endangered Species Act Section 7 consultation, would be implemented to minimize impacts to these species. With implementation of best management practices and protection measures, implementation of the proposed action is not likely to adversely affect any federally-listed species or designated critical habitat.

(4) Effects on Other Wildlife.

Other potentially-affected wildlife not already addressed would be likely to avoid construction activities and utilize other nearby areas of similar habitat.

(5) Actions to Minimize Impacts.

Impacts would be localized and minimized through the use of silt curtains and other best management practices and adherence to regulations governing stormwater runoff at construction sites. Flotation channels and stockpile areas would be brought to pre-construction lake bottom elevations upon project completion. Protection measures would be implemented to minimize impacts to federally-listed species. Bottomland hardwood-wet impacts would be compensated for through the purchase of mitigation bank credits.

F. Proposed Disposal Site Determinations.

Discussions pertaining to turbidity and suspended particulates are summarized under Section 2. C in this document. Contaminants were discussed previously under Section 2. D of this Evaluation. Disposal site mixing zones will be confined to the smallest practicable zone within each site. Implementation of the proposed project will have no significant adverse effects on municipal or private water supplies; recreational or commercial fisheries; water-related recreation or aesthetics; parks; national monuments; or other similar preserves. State Water Quality Certification (WQC 201117-02) was obtained from the Louisiana Department of Environmental Quality on 15 December 2020.

G. Determination of Cumulative Effects on the Aquatic Ecosystem.

Sections 7.3.3 (Cumulative Effects on Water Resources) and Section 7.4.3 (Cumulative Effects on Wetlands) of the GRR-EIS discuss the cumulative effects on the aquatic ecosystem. Overall, the proposed action in combination with all other regional construction projects would have moderate adverse cumulative impacts on water quality and wetland resources; however, the incremental impact from the proposed action would be less than significant for water quality, but significant for wetland resources. Impacts to wetland resources would be fully compensated for through the purchase of mitigation bank credits and would result in no net loss.

H. Determination of Secondary Effects on the Aquatic Ecosystem.

Implementation of project features could lead to an increase in the human population in the area protected by project features. An increase in population would likely be associated with an increase in stressors on aquatic resources in the area.

1.1.3 FINDINGS OF COMPLIANCE OR NON-COMPLIANCE WITH THE RESTRICTIONS ON DISCHARGE

A. Adaptation of Section 404(b)(1) Guidelines.

No significant adaptations of the guidelines were made relative to this evaluation.

B. Alternatives.

C. No practicable alternatives to the proposed discharges could be identified that would have less adverse impact on the aquatic ecosystem. Compliance with State Water Quality Standards.

Chemical constituents of the dredged material released during dredging and disposal operations are not expected to exceed Louisiana water quality standards. State Water Quality Certification (WQC 201117-02) was obtained from the Louisiana Department of Environmental Quality on 15 December 2020.

D. Compliance with Endangered Species Act.

The proposed action is compliant with the Endangered Species Act of 1973, as amended. The proposed action is not likely to adversely affect endangered or threatened species or their critical habitat. NMFS concurred with this determination via letter dated 23 April 2020. USFWS concurred with this determination via letter dated 10 December 2019 (see GRR-EIS Appendix G).

E. Evaluation of Extent of Degradation of the Waters of the United States.

The proposed activities would not result in significant adverse effects on human health and welfare, including municipal and private water supplies, recreation, and commercial fishing. The proposed activities would not significantly adversely affect plankton, fish, shellfish, wildlife, or special aquatic sites. The life stages of aquatic life and other wildlife would not be significantly adversely affected. Significant adverse effects on aquatic ecosystem diversity, productivity, and stability and on recreational, aesthetic, and economic values would not occur.

F. Appropriate and Practicable Steps Taken to Minimize Potential Adverse Impacts of the Discharge on the Aquatic Ecosystem**.**

The formulation of project plans and designs, evaluation of alternative plans, and development of operational scenarios have been conducted with the objective of minimizing potential adverse impacts to the aquatic environment. Water quality impacts would be localized and minimized through the use of silt curtains and other best management practices and adherence to regulations governing stormwater runoff at construction sites. Protection measures would be implemented to minimize impacts to federally-listed species. Pre-construction surveys in Lake Pontchartrain would be required to delineate existing SAV to facilitate avoidance of impacts. SAV pre-construction surveys and avoidance of SAV impacts would be included in construction contract solicitation language.

The proposed action is in compliance with requirements of the Clean Water Act Section 404(b)(1) guidelines. The proposed action would not significantly impact water quality.

On the basis of the Clean Water Act Section 404(b)(1) guidelines, the proposed disposal sites for the discharge of dredged or fill material are specified as complying with the guidelines with the inclusion of appropriate and practical conditions to minimize pollution and adverse effects to the aquatic ecosystem as described above.

EVALUATION RESPONSIBILITY

A. Evaluation Prepared By: Kip Runyon

B. Evaluation Review By: Eric Glisch

Date:____________________________ ____________________________________

Stephen Murphy
Colonel, U.S. Army
District Commander

1.2 401 WATER QUALITY CERTIFICATION APPLICATION LETTER

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

November 16, 2020

REPLY TO
ATTENTION OF

Regional Planning and Environmental
Division North

Scott Guilliams
Louisiana Dept. of Env. Quality
Administrator of Water Permits Div.
P.O. Box 4313
Baton Rouge, LA 70821-4313

Dear Mr. Guilliams:

An application for a State Water Quality Certificate prepared by the U.S. Army Corps of Engineers (USACE) for the Lake Pontchartrain and Vicinity, Louisiana General Re-evaluation Report with Integrated Environmental Impact Statement (EIS) is enclosed. The EIS is currently being finalized and will be provided to LDEQ for review. The USACE staff request that a water quality certification be completed, pursuant to Section 401 of the Clean Water Act of 1977, as amended (33 U.S.C., Section 1341).

The proposed project consists of levee lifts, floodwall modifications, foreshore protection, and construction access dredging. To the best of our knowledge, any dredge/fill material would be free of contaminants. Please provide the Public Notice for publication in the Times-Picayune/New Orleans Advocate. In addition to sending us the hard copy of your documents, we request that an e-mail with the public notice attached also be sent to kip.r.runyon@usace.army.mil.

Please address any comments or concerns to the attention of Mr. Kip Runyon; U.S. Army Corps of Engineers; Regional Planning and Environmental Division North; CEMVS-PD-P; 1222 Spruce Street, St. Louis, Missouri; (314) 331-8396; kip.r.runyon@usace.army.mil.

Sincerely,

JOHNSON.BRIAN.L
LOYD.1231330336

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Brian L. Johnson
Environmental Compliance Branch Chief
Regional Planning and Environmental Division North - St Louis
1222 Spruce St.
St. Louis, MO 63103
Brian.L.Johnson@usace.army.mil
314-331-8146
Enclosures

1.3 401 WATER QUALITY CERTIFICATION

JOHN BEL EDWARDS
GOVERNOR

CHUCK CARR BROWN, PH.D.
SECRETARY

State of Louisiana

DEPARTMENT OF ENVIRONMENTAL QUALITY
ENVIRONMENTAL SERVICES

DEC 15 2020

Mr. Kip Runyon
US Army Corps of Engineers
Regional Planning and Environmental Division North
CEMVS-PD-P
1222 Spruce Street
St. Louis, MO 63102

AI No.: 101235
Activity No.: CER20200008

RE: US Army Corps of Engineers – Lake Pontchartrain and Vicinity
Water Quality Certification WQC 201117-02
St. Charles, Orleans, and St. Bernard Parishes

Dear Mr. Runyon:

The Louisiana Department of Environmental Quality, Water Permits Division (LDEQ), has reviewed the application to dredge and place spoil and fill to construct levee lifts, floodwall modifications, foreshore protection, and construction access dredging located along the shore of Lake Pontchartrain in Kenner, Metairie, and New Orleans, and along the east bank of the Mississippi River in St. Charles, Orleans, and St. Bernard Parishes. .

The information provided in the application has been reviewed in terms of compliance with State Water Quality Standards, the approved Water Quality Management Plan and applicable state water laws, rules and regulations. LDEQ determined that the requirements for a Water Quality Certification have been met. LDEQ concludes that the deposit of spoil will not violate water quality standards as provided for in LAC 33:IX.Chapter 11. Therefore, LDEQ hereby issues US Army Corps of Engineers – Lake Pontchartrain and Vicinity Water Quality Certification, WQC 201117-02.

Should you have any questions concerning any part of this certification, please contact Elizabeth Hill at (225) 219-3225 or by email at elizabeth.hill@la.gov. Please reference Agency Interest (AI) number 101235 and Water Quality Certification 201117-02 on all future correspondence to this Department to ensure all correspondence regarding this project is properly filed into the Department's Electronic Document Management System.

Sincerely,

Scott Guilliams
Administrator
Water Permits Division

Attachment

c: IO-W

ec: Kip Runyon
kip.r.runyon@usace.army.mil

Post Office Box 4313 • Baton Rouge, Louisiana 70821-4313 • Phone 225-219-3181 • Fax 225-219-3309
www.deq.louisiana.gov

PUBLIC NOTICE TO RUN IN

THE ADVOCATE OF New Orleans

gnolegals@theadvocate.com
Phone: 225-388-0128

Contact: Josh Crowley

Notice is hereby given that US Army Corps of Engineers has applied for a 401 Water Quality Certification/Corps of Engineers 404 permit for the Lake Pontchartrain and Vicinity to dredge and place spoil and fill to construct levee lifts, floodwall modifications, foreshore protection, and construction access dredging located along the shore of Lake Pontchartrain in Kenner, Metairie, and New Orleans, and along the east bank of the Mississippi River in St. Charles, Orleans, and St. Bernard Parishes. The US Army Corps of Engineers has applied to the Louisiana Department of Environmental Quality, Office of Environmental Services for a Water Quality Certification in accordance with statutory authority contained in the LAC 33:IX.1507.A-E and provisions of Section 401 of the Clean Water Act.

Comments concerning this application can be filed with the Water Permits Division within ten days of this notice by referencing WQC 201117-02, AI 101235 to the following address:

Louisiana Department of Environmental Quality
Water Permits Division
P.O. Box 4313
Baton Rouge, LA 70821-4313
Attn: Elizabeth Hill

A copy of the application is available for inspection and review at the LDEQ Public Records Center, on the first floor of the Galvez Building, Room 127 at 602 North Fifth Street, Baton Rouge, LA 70802, from 8:00 a.m. to 4:30 p.m.

2 ENDANGERED SPECIES ACT COMPLIANCE

2.1 NATIONAL MARINE FISHERIES SERVICE CONSULTATION

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, ST. LOUIS DISTRICT
1222 SPRUCE STREET
ST. LOUIS, MISSOURI 63103-2833

REPLY TO ATTENTION OF:
Regional Planning and Environmental Division North
Environmental Compliance Section (CEMVP-PD-C)

23 April 2020

SUBJECT: Informal Endangered Species Act Section 7 Consultation for the Lake Pontchartrain and Vicinity, Louisiana General Re-evaluation Report

Mr. David Bernhart
Assistant Regional Administrator
Protected Resources Division
National Marine Fisheries Service
Southeastern Regional Office
263 13th Avenue South
St. Petersburg, FL 33701

Dear Mr. Bernhart:

The U.S. Army Corps of Engineers, New Orleans District (CEMVN), is preparing the Lake Pontchartrain and Vicinity (LPV), Louisiana General Re-evaluation Report with Integrated Environmental Impact Statement to re-evaluate the performance of the LPV system (Figure 1) given the combined effects of consolidation, settlement, subsidence, and sea level rise over time and to determine if additional actions are recommended to address the economic and life safety risks associated with flooding due to hurricanes and coastal storms. The following evaluates the potential impacts to threatened and endangered species associated with project features (Figure 2). The measures that have been identified as part of the proposed action include lifts to existing levees, raising of existing flood walls, placement of foreshore protection in existing foreshore protection locations, and construction access dredging for placement of foreshore protection.

The CEMVN has determined that the proposed project “may affect but is not likely to adversely affect” (NLAA) federally-listed species and their designated critical habitat, as described below, and is therefore requesting concurrence with our determinations pursuant to Section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. § 1536), and the consultation procedures at 50 C.F.R. Part 402.

Pursuant to our request for informal consultation, CEMVN is providing, enclosing, or otherwise identifying the following information:

- A description of the action to be considered;

- A description of the action area;
- A description of any listed species or designated critical habitat (DCH) that may be affected by the action; and
- An analysis of the potential routes of effect on any listed species or DCH.

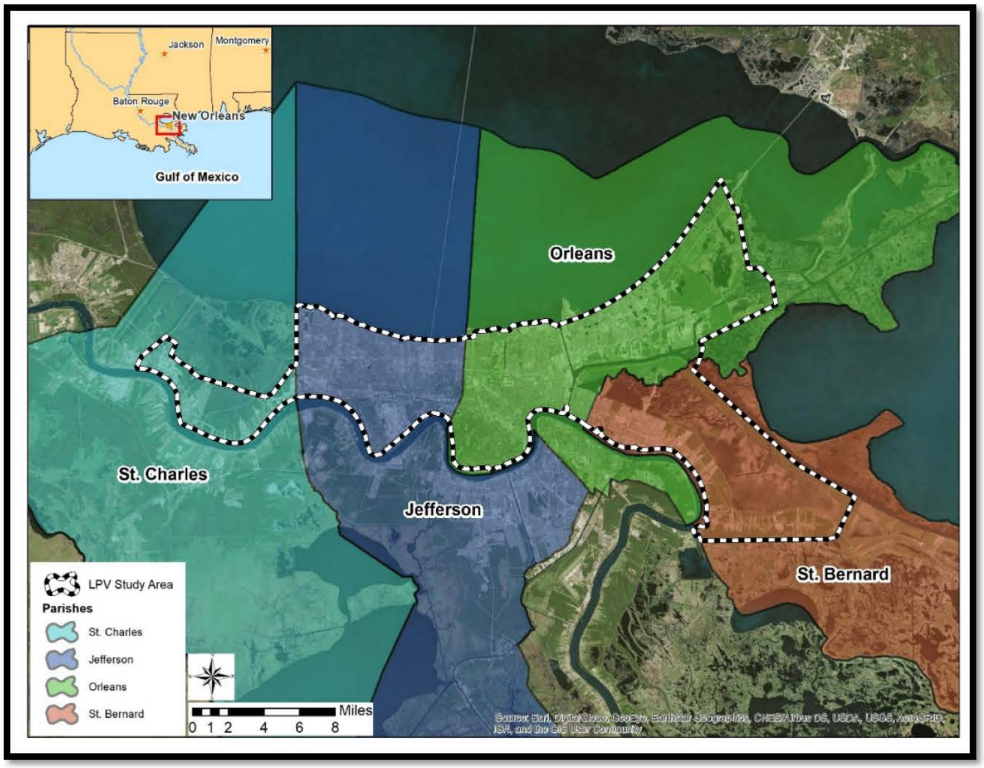

Figure 1. Study Area Location.

1. Proposed Action

Description of the Proposed Action. The LPV project includes features in four parishes (St. Charles, Jefferson, Orleans, and St. Bernard; Table 1; Figure 1) located in the greater New Orleans area on the east bank of the Mississippi River. Currently, LPV contains a total of approximately 126.5 miles of levees and floodwalls. There are approximately 83 miles of armored perimeter levees and floodwalls and approximately 43.5 miles of interior levees and floodwalls. The project is in a high-density residential and commercial area. The proposed action would include lifts to existing levees, raising of existing flood walls, placement of foreshore protection in existing foreshore protection locations along the shore of Lake Pontchartrain, and construction access dredging for placement of foreshore protection.

Table 1. General Project Location GPS coordinates

Latitude	Longitude
30.018746	-90.440070
30.160123	-89.868840
29.834949	-89.730662
29.892317	-90.426035

The proposed levee lifts would occur along the alignment of the existing levees. The proposed floodwall raises would occur within the existing floodwall footprints. The proposed levee lifts and floodwall raises are expected to be land-based construction, and, therefore, would have no effect to the listed species or their designated critical habitats and are not discussed further. The proposed foreshore protection would also be placed within the existing footprint of the foreshore protection along the Lake Pontchartrain shoreline. Construction of access channels and adjacent temporary stockpiling would be required to provide adequate depth for construction equipment to reach the Lake Pontchartrain shoreline. Construction access channels and adjacent stockpile locations would be returned to pre-construction elevations subsequent to construction completion. See Figure 2 for feature locations.

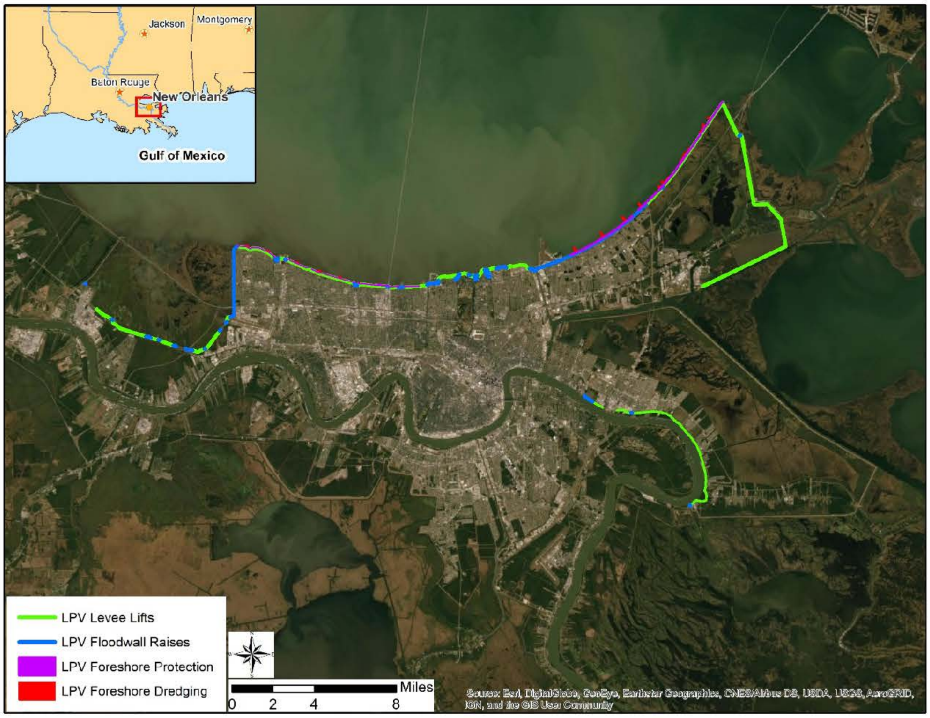

Figure 2. Proposed Action feature locations.

Construction Elements

Construction would not be expected to commence until 2021 at the earliest and would be dependent upon congressional authorization and appropriations.

Foreshore Protection Component

Placement of the stone foreshore protection along the shoreline of Lake Pontchartrain would result in filling approximately 75.1 acres of aquatic habitat (from 30.049726°, -90.276558° to 30.148304°, -89.880545°) less than 1 meter deep. Of this 75.1 acres, approximately 25.3 acres (from 30.020603°, -90.153520° to 30.148304°, -89.880545°) are in designated critical habitat for Gulf Sturgeon. However, the stone would be placed on the existing foreshore protection footprint to bring it back up to the required elevation. Stone would be transported by barge to the project area. Stone would be placed by crane-operated skip-pan, dragline bucket, clamshell, rock-bucket, hydraulic excavator, trackhoe, or other similar equipment.

Construction Access Channels and Stockpiling/Staging Components

One-time construction access channels (Table 2) and associated temporary stockpiling to construct the foreshore protection would impact approximately 212.5 acres of aquatic habitat. At this time, dredging is expected to occur via an excavator on a floating barge. This impact would be temporary. Construction of foreshore protection is expected to take a total of 1.5 to 2.5 years depending on availability of funding, weather, materials, etc. Following construction of the foreshore protection, the access channels would be returned to pre-project elevations. Construction details will be fully developed following feasibility level design efforts. If construction methods change during design of this project and affect listed species or their DCH differently than what is discussed, ESA consultation would resume. Material would be excavated from the bed of Lake Pontchartrain with an excavator on a floating barge. Construction access channels would consist of parallel channels at the shoreline in areas where rock would be placed as well as perpendicular access channels to allow access to the shoreline (see Figure 2 red areas; Table 2). The dimensions required for barge access channels would be approximately -7 feet depth with 100-foot bottom width. Perpendicular access channels would begin at the elevation -7-foot contour of the lake and extend 400 to 1600 ft. Adjacent stockpile sites would be 150 feet wide. Potential impacts to submersed aquatic vegetation (SAV) in Lake Pontchartrain would be avoided. Pre-construction surveys would be required to delineate existing SAV to facilitate avoidance of impacts.

Table 2. Location of Construction Access Channels

Latitude	Longitude
30.03104436	-90.21060933
30.02676673	-90.19403554
30.04925227	-90.26849909
30.037305	-90.2278472
30.04583439	-90.25178412
30.04433337	-90.00167255
30.05415271	-89.97916436
30.06567599	-89.96175883
30.07536598	-89.94847309
30.08825402	-89.93282626
30.0912732	-89.92971347
30.09318781	-89.92646739
30.11074678	-89.91200498
30.10779795	-89.91377535
30.11320849	-89.90942893
30.13148038	-89.89595406
30.12828218	-89.89731212
30.13637583	-89.89187744

b. Description of the Project Purpose. Southeast Louisiana, including the Greater New Orleans area, is generally characterized by weak soils, general subsidence, and the global incidence of sea level rise that will cause levees and floodwalls to require future lifts to sustain performance. The proposed action would provide the 1% level of risk reduction over the 50-year period of analysis.

c. Description of Minimization Measures.

1) To avoid and minimize impacts from proposed actions turbidity curtains would be employed during construction, which include:

- All turbidity curtains and other in-water equipment must be properly secured with materials that reduce the risk of entanglement and entrapment of protected species. Turbidity curtains likewise must be made of materials that reduce the risk of entanglement of marine species.
- In-water lines (rope, chain, and cable, including the lines to secure turbidity curtains) must be stiff, taut, and non-looping. Examples of such lines are heavy metal chains or heavy cables that do not readily loop and tangle. Flexible in-water lines, such as nylon rope or any lines that could loop or tangle, must be enclosed in a plastic or rubber sleeve/tube to add rigidity and prevent the line from looping and tangling. In all instances, no excess line is allowed in the water.
- Turbidity curtains and other in-water equipment must be placed in a manner that does not entrap species within the construction area.
- Position turbidity barriers in a way that does not block species' entry to or exit from designated critical habitat and other important habitats.

2) Dredging would occur only during May through September.

3) Pre-construction surveys would be conducted to delineate existing SAV to facilitate avoidance of impacts.

4) Additionally, in project areas the bucket drop procedure will be utilized. The bucket drop procedure was developed by the USFWS, which involves dropping the bucket into water and retrieving empty one time prior to starting work. After the bucket is dropped and retrieved, a one-minute no work period would be observed. During this no work period, personnel shall carefully observe the work area in an effort to visually detect Gulf Sturgeon. If sturgeons are sighted, no dredging should be initiated until they have left the work area. If the water turbidity makes such visual sightings impossible, work may proceed after the one-minute no work period. If more than fifteen minutes elapses with no dredging, then the empty bucket drop/retrieval process shall be performed again prior to work. The sea turtle construction conditions will also be applied to Gulf Sturgeon.

5) Furthermore, all construction personnel must watch for and avoid collision with listed species. All construction personnel would 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 Endangered Species Act of 1973. Vessel operators must avoid potential interactions and operate in accordance with the following protective measures:

- All vessels associated with the proposed construction project shall operate at "idle speed/no wake" at all times while operating in water depths where the draft of the vessel provides less than a 4-feet clearance from the bottom and in all depths after a protected species has been observed in and has departed the area.
- All vessels will follow marked channels and routes using the maximum water depth whenever possible.
- If a sea turtle is seen within 100 yards of the active daily construction/dredging operation or vessel movement, all appropriate precautions shall be implemented to ensure its protection. These precautions shall include cessation of operation of any moving

equipment closer than 50 feet of a sea turtle. Operation of any mechanical construction equipment shall cease immediately if a sea turtle is seen within a 50-foot radius of the equipment. Activities may not resume until the species has departed the project area of its own volition. Further, construction would be limited to daylight hours (7 am to 7 pm), which will assist construction workers in seeing listed species and, if present, avoiding interactions with them.

6) CEMVN would adhere to the Measures for Reducing Entrapment Risk to Protected Species[1] and the sea turtle construction conditions[2]. Siltation barriers would be made of materials in which sea turtles cannot become entangled, would be properly secured, and would be regularly monitored to avoid protected species entrapment. CEMVN will apply the constructions conditions to Gulf Sturgeon, as well.

2. Action Area: Physical and Biological Attributes

Pursuant to 50 C.F.R. § 402.02, the term *action area* is defined as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action." Accordingly, the action area typically includes the affected jurisdictional waters and other areas affected by the authorized work or structures within a reasonable distance. The ESA regulations recognize that, in some circumstances, the action area may extend beyond the limits of the Corps' regulatory jurisdiction.

For the purposes of this consultation, the CEMVN has defined the action area to include the immediate vicinity of the proposed project features as depicted in Figure 3 below. The action area includes portions of Lake Pontchartrain, Lake Borgne, and the Mississippi River as well as numerous bayous and canals in the Greater New Orleans area.

Foreshore Protection Action Area. Lake Pontchartrain is a large, brackish, shallow estuary, that support SAV, including wild celery (*Vallisneria americana*), widegongrass (*Ruppis maritima*), slender pondweed (*Potamogeton perfoliatus*), Eurasion milfoil (*Myriophyllum spicatum), and southern naiad* (*Najas guadalupensis*) (Duffy & Baltz,1998). Historically, SAV was abundant on all shores of Lake Pontchartrain; however, today isolated SAV beds exist on the south shore of Lake Pontchartrain. Potential impacts to SAV in Lake Pontchartrain would be avoided. Pre-construction surveys would be required to delineate existing SAV to facilitate avoidance of impacts.

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[1] NMFS. 2012. Measures for reducing entrapment risk to protected species, revised May 22, 2012. U.S. Department of Commerce. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Regional Office, Saint Petersburg, FL.

[2] NMFS. 2006. Sea turtle and smalltooth sawfish construction conditions, revised March 23, 2006. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries, Southeast Regional Office, Saint Petersburg, FL.

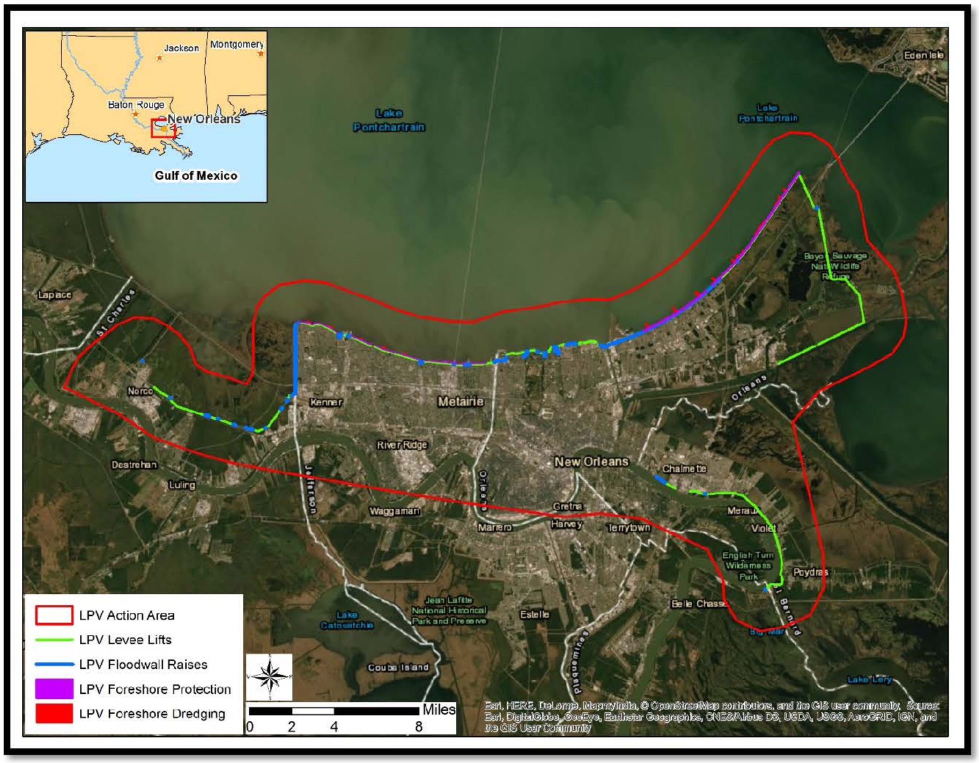

Figure 3. LPV Action Area.

3. AFFECTED SPECIES/HABITAT

Project activities have the potential to affect listed species, as shown in Table 3 below, and their DCH, as shown in Table 4.

Table 3. Species in the action area.

Species	ESA Listing Status	Listing Rule/Date	Most Recent recovery plan date	USACE Effect Determination (Species)*
Green sea turtle[3]	Threatened	81 FR 20057/ April 6, 2016	October 1991	NLAA
Kemp's ridley sea turtle	Endangered	35 FR 18319/ December 2, 1970	September 2011	NLAA
Leatherback sea turtle	Endangered	35 FR 8491/ June 2, 1970	April 1992	NLAA
Loggerhead sea turtle[4]	Threatened	76 FR 58868/ September 22, 2011	January 2009	NLAA
Hawksbill sea turtle	Endangered	35 FR 8491/ June 2, 1970	December 1993	NLAA
Gulf sturgeon	Threatened	56 FR 49653/ September 30, 1991	September 1995	NLAA

*NLAA = Not likely to adversely affect

Table 4. Designated Critical Habitat (DCH) in the action area.

Species	DCH in the Action Area	DCH Rule/Date	USACE Effect Determination (DCH)*
Gulf sturgeon	Unit 8	68 FR 13370/ March 19, 2003	NLAA

*NLAA = Not likely to adversely affect

4. Route(s) of Effect to Species

Effects to Sea Turtles

All five species of sea turtle have the potential to use Lake Pontchartrain as juvenile or adult foraging habitat. Effects to sea turtles include the risk of direct physical impact from access dredging, placement of foreshore protection, and other in-water construction activities. We

[3] North Atlantic and South Atlantic DPS

[4] Northwest Atlantic Ocean DPS

believe the risk of physical injury therefore the route of effect is discountable due to the species' ability to move away from the project site and into adjacent suitable habitat. Construction activities could potentially cause direct injury or mortality to sea turtles by equipment or propeller strikes. Additionally, implementation of the NMFS's *Sea Turtle and Smalltooth Sawfish Construction Conditions* will require all construction workers to observe in-water related activities for the presence of listed sea turtles.

Sea turtles may be entangled by in-water lines and other in-water equipment. However, we believe the route of effects to sea turtles from entanglement will be discountable because if any in-water lines (rope, chain, or cable etc.) will be utilized for buoy markers and lights they would be taught and non-looping.

Sea turtles might be adversely affected by their inability to access the project area for foraging, refuge, and/or nursery habitat, due to their avoidance of construction activities, and related noise. We have determined that these effects would be insignificant. The site does not contain any structure that could be used by sea turtles for shelter. Sea turtles may forage in the area but the size of the area from which animals will be excluded is relatively small in comparison to the available similar habitat nearby. In addition, any disturbances to listed species would be temporary, limited to approximately 160 days of in-water construction, after which the site conditions are expected to return to background levels and animals will be able to return.

Construction-related water quality impacts could affect the foraging ability of sea turtles, but these impacts would be minor and short-term and sea turtles could avoid the impacted areas. Water quality impacts are expected to be insignificant because they will be temporary and minimized by the use of turbidity curtains.

Section 7 Finding for listed Sea Turtles

Based on currently available historical and catch data; a review of current literature and studies; and with the employment of avoidance measures recommended through guidelines set up during coordination with NFMS; the CEMVN has determined that the actions as proposed, may affect, but are not likely to adversely affect the federally listed species of sea turtles.

Effects to Gulf sturgeon

Direct minor, short-term, impacts on water quality from construction activities may include decreased dissolved oxygen levels in the waters immediately surrounding the construction site, increased turbidity, and increased water body temperature due to increased suspended solids produced during construction that could absorb incident solar radiation. Temporary, minor water quality impacts could occur due to increased nutrient loading, miscellaneous debris, and accidental spills from construction equipment. Water quality impacts in the project area would be temporary during project construction and would be minimized by the movement of the tides and the use of silt curtains and other best management practices. Water quality in the project area would return to normal after construction completion. Water quality impacts are expected to be insignificant because they will be temporary and minimized by the use of silt curtains and other best management practices.

Gulf sturgeon may be physically injured if struck by construction equipment, vessels, or materials. This route of effect is discountable due to the ability of the species to move away from the project site if disturbed. Gulf sturgeon are mobile and are able to avoid construction noise, moving equipment, and placement or removal of materials during construction.

Gulf sturgeon may be physically injured if struck or entrained during dredging. This is extremely unlikely to occur due to the species' mobility and type of dredge used for this project; therefore, the route of effect is discountable. NMFS has previously determined in dredging Biological Opinions (e.g., (NMFS 2007)) that, while ocean-going hopper-type dredges may lethally entrain sturgeon, non-hopper type dredging methods, such as the excavator on a barge method proposed for this project, are slower and extremely unlikely to adversely affect Gulf sturgeon.

The construction activities and related construction noise may prevent or deter Gulf Sturgeon from entering the project area. However, we believe the effect to Gulf sturgeon from temporary avoidance from the project area due to construction activities including related noise, will be less than significant. The size of the area which animals will avoid is relatively small in comparison to the available similar habitat nearby, which Gulf sturgeon will be able to use during construction. Disturbances and loss of habitat access will be temporary, limited to approximately 160 days of in-water construction. After the project is complete, Gulf sturgeon will be able to return to the project area.

We believe the effect to Gulf Sturgeon from potential loss of foraging habitat due to access dredging and placement of foreshore protection will be insignificant. Gulf sturgeon are opportunistic feeders that forage over large areas and will be able to locate prey beyond the small construction access channel footprint (approximately 212.5 acres). Also, impacts to foraging resources from access dredging are temporary since benthic invertebrate populations in dredged areas have been observed to recover in 3-24 months after dredging (Culter and Mahadevan 1982; Saloman et al. 1982; and Wilber et al. 2007).

5. Route(s) of Effect to Critical Habitat

The project is located in critical habitat unit 8. The essential features/primary constituent elements (PCEs) are present in Unit 8 and are those habitat components that support feeding, resting, sheltering, migration, and physical features necessary for maintaining the natural processes that support those habitat components. The following are the primary constituent elements for Gulf sturgeon critical habitat that are present and CEMVN's response on how the proposed action for LPV in critical habitat would affect these elements. Only three of the four PCEs are likely to be affected. The CEMVN has determined the proposed action (access dredging and foreshore protection) is "Not Likely to Adversely Affect" Gulf sturgeon critical habitat based on these responses for the three PCEs.

1) Abundant prey items, such as amphipods, lancelets, polychaetes, gastropods, ghost shrimp, isopods, molluscs and/or crustaceans, within estuarine and marine habitats and substrates for sub-adult and adult life stages.

    Dredging may remove substrates containing sturgeon prey items (PCE 1). USACE believes the effect to PCE 1 from access dredging and temporary stockpiling would be insignificant since the estimated impact is relatively small (212.5 acres) and prey items will still be present in the areas outside the dredging and stockpiling footprint.

Effects to PCE 1 are also expected to be temporary and short-term in nature, consisting of a temporary loss of benthic invertebrate populations in the dredged areas. Observed rates of benthic community recovery after dredging range from 3-24 months (Culter and Mahadevan 1982; Saloman et al. 1982; Wilber et al. 2007). Therefore, we believe the effect to PCE1 would be insignificant.

2) Water quality including temperature, salinity, pH, hardness, turbidity, oxygen content, and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages.

Localized and temporary reductions in water quality (PCE 2) through increased turbidity may result from the installation, repair, replacement, or removal of shoreline stabilization structures. We believe the effect to PCE 2 from localized and temporary turbidity due to shoreline stabilization structures will be insignificant because:

Turbidity curtains will be used to contain turbidity. The effect to PCE 2 from any small amount of turbidity that may escape will be insignificant.

Effects to temperature, salinity, pH, hardness, oxygen content, and other chemical characteristics of the water quality PCE are not expected to result from the installation of shoreline stabilization structures. Therefore, there is no effect to these aspects of PCE 2 from localized and temporary turbidity due to shoreline stabilization structures.

3) Sediment quality including texture and other chemical characteristics necessary for normal behavior, growth, and viability of all life stages.

We believe the effect to PCE 3 from access dredging and placement of foreshore protection will be insignificant. The sediments disturbed would be returned to their original location upon project completion. The removal of sediments from the access channels would not impact the texture and other chemical characteristics necessary for Gulf sturgeon life stages because the sediment type (silty sand) would not change with the depth of the material being removed. Therefore, no permanent alteration of habitat composition would occur within the action area.

Section 7 Finding for Gulf Sturgeon and Gulf Sturgeon Critical Habitat

Based on currently available historical and catch data; a review of current literature and studies; and with the employment of avoidance measures recommended through guidelines set up during coordination with NMFS; the CEMVN has determined that the proposed action for LPV study is “Not Likely to Adversely Affect” the Gulf sturgeon or Gulf sturgeon critical habitat.

6. DETERMINATION

The CEMVN has reviewed the proposed project for its impacts to federally listed species and their DCH. Based on currently available, historical and catch data; a review of current literature and studies; and with the employment of avoidance measures recommended through guidelines set up during coordination with NMFS; including the sea turtle construction conditions, the CEMVN has concluded the project may affect but is not likely to adversely affect the species and DCH listed in Tables 3 and 4. This analysis was prepared based on the best scientific and commercial data available.

The CEMVN is requesting NMFS written concurrence with these determinations. The CEMVN appreciates your cooperation in completing this informal section 7 consultation by concurring with the effect determination(s) in a timely manner. If NMFS disagrees with the effect determination(s) and requests formal Section 7 consultation, please contact the below referenced Environmental Manager to discuss suggested modifications to the action to avoid potential adverse effects and NMFS' additional information needs. The CEMVN will continue to coordinate with NMFS office via email to provide the requested information and, if warranted, a revised effects determination.

If you have questions, please contact the Environmental Manager, Kip Runyon, at 314-331-8396 or kip.r.runyon@usace.army.mil.

The Record of Decision (ROD) will not be signed and no contract for construction nor construction will begin until this ESA consultation is complete with your agency (50 C.F.R. § 402.12(b)(2)).

Sincerely,

JOHNSON.BRIAN.LLOYD.1231330336 Digitally signed by JOHNSON.BRIAN.LLOYD.1231330336 Date: 2020.04.23 09:30:46 -05'00'

Brian Johnson
Chief, Environmental Compliance Branch
Regional Planning and Environmental Division North

Literature Cited

Culter, J. K., and S. K. Mahadevan. 1982. Long-term effects of beach nourishment on the benthic fauna of Panama City Beach, Florida. Mote Marine Laboratory, Sarasota, FL., Miscellaneous Report No. 82-2, Fort Belvoir, Va.

Duffy, K.C., and D.M. Baltz. 1998. Comparison of fish assemblages associated with native and exotic submerged macrophytes in the Lake Pontchartrain estuary, USA. Journal of Experimental Marine Biology and Ecology 223(2): 199-221.

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NMFS. 2012. Measures for reducing entrapment risk to protected species, revised May 22, 2012. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Regional Office, Saint Petersburg, FL.

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2.2 NMFS RESPONSE LETTER

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701-5505
https://www.fisheries.noaa.gov/region/southeast

4/23/20

F/SER31:LW
SERO-2019-03590

Chief, Environmental Compliance Branch
Regional Planning and Environmental Division North
Environmental Compliance Section (CEMVP-PD-C)
St. Louis District Corps of Engineers
Department of the Army
1222 Spruce St.
St. Louis, Missouri, 63103-2833

Ref.: U.S. Army Corps of Engineers, New Orleans District, Construction and Dredging, St. Charles, Jefferson, Orleans, and St. Bernard Parishes, Louisiana – EXPEDITED TRACK

Dear Mr. Johnson

This letter responds to your April 23, 2020, request pursuant to Section 7 of the Endangered Species Act (ESA) for consultation with the National Marine Fisheries Service (NMFS) on the subject action.

We reviewed the action agency's consultation request document and related materials. Based on our knowledge, expertise, and the action agency's materials, we concur with the action agency's conclusions that the proposed action is not likely to adversely affect the NMFS ESA-listed species and/or designated critical habitat. This concludes your consultation responsibilities under the ESA for species and/or designated critical habitat under NMFS's purview. Reinitiation of consultation is required and shall be requested by the action agency or by NMFS where discretionary Federal involvement or control over the action has been retained or is authorized by law and: (a) take occurs; (b) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered in this consultation; (c) the action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not previously considered in this consultation; or (d) if a new species is listed or critical habitat designated that may be affected by the action.

We look forward to further cooperation with you on other projects to ensure the conservation of our threatened and endangered marine species and designated critical habitat. If you have any questions on this consultation, please contact Laura Wright, Consultation Biologist, at (727) 209-5977 or by email at Laura.Wright@noaa.gov.

Sincerely,

WUNDERLICH.MARY.JANE.1400345488
Digitally signed by WUNDERLICH.MARY.JANE.1400345488
Date: 2020.04.23 17:09:45 -04'00'

for David Bernhart
Assistant Regional Administrator
for Protected Resources

File: 1514-22.f.7

2.3 U.S. FISH AND WILDLIFE SERVICE CONSULTATION

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, ST. LOUIS DISTRICT
1222 SPRUCE STREET
ST. LOUIS, MISSOURI 63103-2833

REPLY TO ATTENTION OF:
Regional Planning and Environmental Division North
Environmental Compliance Section (CEMVP-PD-C)

2 December 2019

SUBJECT: Informal Endangered Species Act Section 7 Consultation for the Lake Pontchartrain and Vicinity, Louisiana General Re-evaluation Report

Mr. Joseph A. Ranson
Field Supervisor
Louisiana Ecological Services Office
U.S. Fish and Wildlife Service
200 Dulles Drive
Lafayette, Louisiana 70506

Dear Mr. Ranson,

The U.S. Army Corps of Engineers, New Orleans District (CEMVN), is preparing the Lake Pontchartrain and Vicinity (LPV), Louisiana, General Re-evaluation Report to re-evaluate the performance of the LPV system (Figure 1) given the combined effects of consolidation, settlement, subsidence, and sea level rise over time, and determine if additional actions are recommended to address the economic and life safety risks associated with flooding due to hurricanes and coastal storms. The following evaluates the potential impacts to threatened and endangered species associated with project features (Figure 2). The measures that have been identified as part of the proposed action include lifts to existing levees, raising of existing flood walls, placement of foreshore protection in existing foreshore protection locations, and construction access dredging for placement of foreshore protection.

The CEMVN has determined that the proposed project may affect but is not likely to adversely affect (NLAA) federally-listed species and their designated critical habitat, as described below, and is therefore requesting concurrence with our determinations pursuant to Section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. § 1536), and the consultation procedures at 50 C.F.R. Part 402.

Pursuant to our request for informal consultation, CEMVN is providing, enclosing, or otherwise identifying the following information:

- A description of the action to be considered;
- A description of the action area;
- A description of any listed species or designated critical habitat (DCH) that may be affected by the action; and

- An analysis of the potential routes of effect on any listed species or DCH

The CEMVN has reviewed the proposed project for its impacts to federally listed species. The CEMVN has concluded the project may affect but is not likely to adversely affect the West Indian manatee and pallid sturgeon. Gulf Sturgeon and five species of sea turtle also have potential to occur in the project area. CEMVN has requested the National Marine Fisheries Service to review and concur with the determination of not likely to adversely affect for those species. No West Indian manatee or pallid sturgeon designated critical habitat exists within the study area. This analysis was prepared based on the best scientific and commercial data available.

The CEMVN is requesting U.S. Fish and Wildlife Service (USFWS) written concurrence with these determinations. The CEMVN appreciates your cooperation in completing this informal section 7 consultation by concurring with the effect determinations in a timely manner. If USFWS disagrees with the effect determinations and requests formal Section 7 consultation, please contact the below-referenced Environmental Manager to discuss suggested modifications to the action to avoid potential adverse effects and additional information needs. The CEMVN will continue to coordinate with the USFWS via email to provide the requested information and, if warranted, a revised effects determination.

If you have questions, please contact the Environmental Manager, Kip Runyon, at 314-331-8396 or kip.r.runyon@usace.army.mil.

Sincerely,

Brian Johnson
Chief, Environmental Compliance Branch
Regional Planning and Environmental Division North

Endangered Species Act consultation

PROPOSED ACTION

Description of the Project Purpose

Southeast Louisiana, including the Greater New Orleans area, is generally characterized by weak soils, general subsidence, and the global incidence of sea level rise that will cause levees and floodwalls to require future lifts to sustain performance. The proposed project purpose would be to provide the 1% level of risk reduction over the 50-year period of analysis within the Lake Pontchartrain and Vicinity study area (Figure 1).

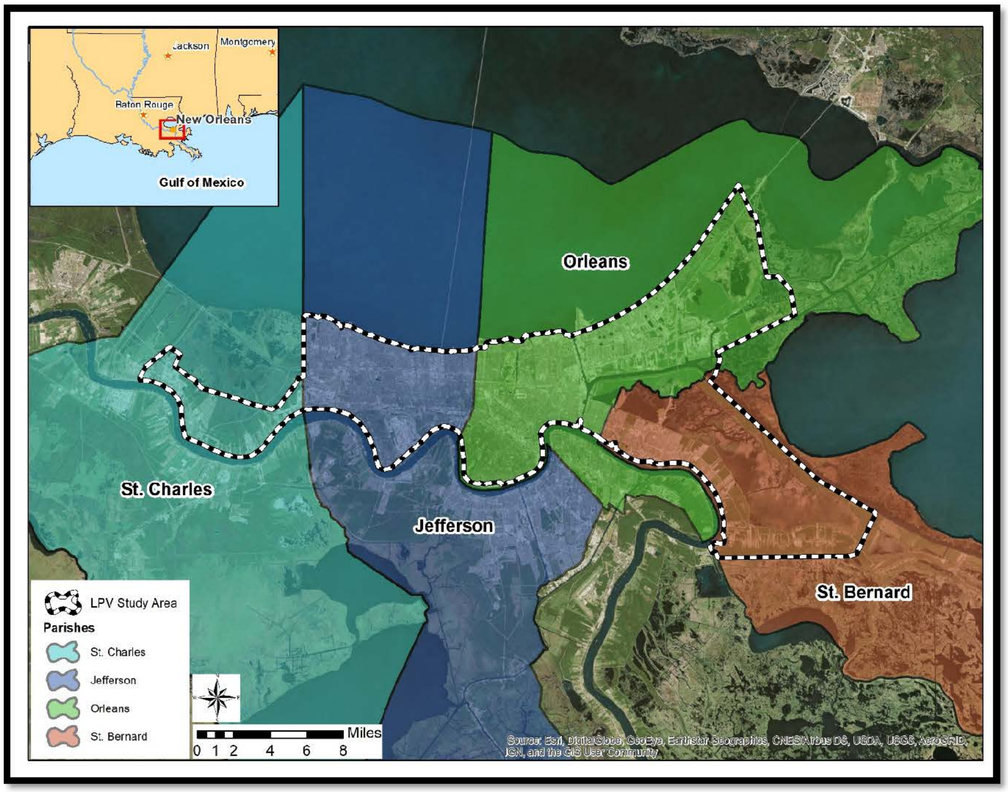


Figure 1. Study area location.

Action Area. For the purposes of this consultation, the CEMVN has defined the action area to include the immediate vicinity of the proposed project features as depicted in Figure 2 below. The action area includes portions of Lake Pontchartrain, Lake Borgne, and the Mississippi River as well as numerous bayous and canals in the Greater New Orleans area.

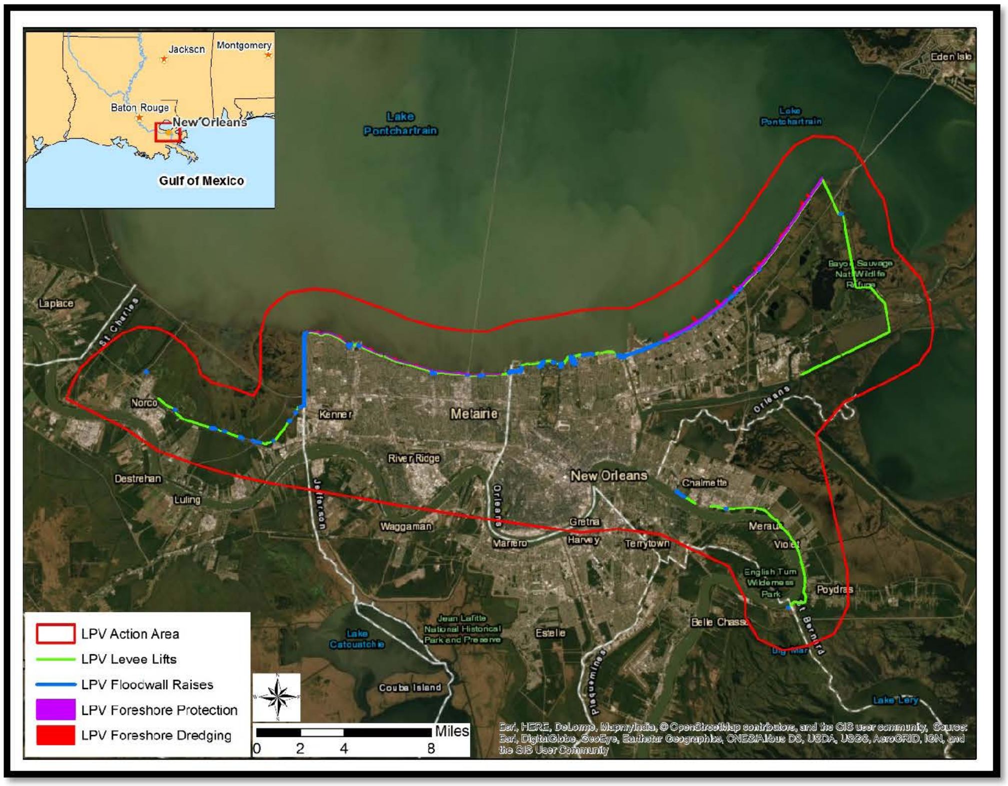


Figure 2. LPV Action Area and features.

Description of the Proposed Action. The LPV project includes features in four parishes (St. Charles, Jefferson, Orleans, and St. Bernard) located in the greater New Orleans area on the east bank of the Mississippi River. Currently, LPV contains a total of approximately 126.5 miles of levees and floodwalls. There are approximately 83 miles of armored perimeter levees and floodwalls and approximately 43.5 miles of interior levees and floodwalls. The project is in a high-density residential and commercial area. The proposed action would include lifts to existing levees, raising of existing flood walls, placement of foreshore protection in existing foreshore protection locations along the shore of Lake Pontchartrain, and construction access dredging for placement of foreshore protection.

The proposed floodwall increases would occur within the existing floodwall footprints. The proposed foreshore protection would also be placed within the existing footprint of the foreshore protection along the Lake Pontchartrain shoreline. Construction access dredging and adjacent temporary stockpiling would be required to provide adequate depth for construction equipment to reach the Lake Pontchartrain shoreline. Construction access channels and adjacent stockpile locations would be returned to pre-construction elevations subsequent to construction completion. Most of the proposed levee lifts would occur along the alignment of the existing levees. However, for the Mississippi River levee expansions, initial design estimates indicate an additional 25 feet would be required on the flood side for construction. These floodside levee shifts would impact approximately 26.9 acres of bottomland hardwood-wet habitat. The exact quantity of fill, acres, and locations would be refined through feasibility level of design.

Construction would not be expected to commence until 2021 at the earliest and would be dependent upon congressional authorization and appropriations. Levee lifts would be conducted in multiple lifts over the course of the 50-year period of analysis. Lift schedules would vary by location and by the corresponding rates of subsidence. Floodwall lifts would only occur once per location but the timing would vary.

MEASURES TAKEN TO MINIMIZE IMPACTS TO LISTED SPECIES

The following conservation measures shall be implemented to avoid and minimize impacts to listed species:

- Silt curtains and other best management practices would be employed during construction
- Manatee protection measures would be followed

AFFECTED SPECIES AND HABITAT

The CEMVN requested the official species list via the ECOS-IPaC website (http://ecos.fws.gov/ipac/), dated 23 September 2019. USFWS provided a list of federally threatened and endangered species that could potentially be found in the study area (St. Charles, Jefferson, Orleans, and St. Bernard Parishes). The species, federal protection status and habitat can be found in Table 1. No critical habitat for these species has been designated in the study area. The CEMVN is consulting with the NMFS for potential effects on Gulf Sturgeon and sea turtles and further analysis is not included here.

Table 1. Federally listed species potentially occurring in the action area

Species	Status	Listing Rule/ Date	Habitat	Potential to Occur in the Study Area
MAMMALS				
West Indian manatee (*Trichechus manatus*)	Threatened	82 FR 16668/ April 5, 2017	Freshwater, brackish, and saltwater warm water environments. Large, slow-moving rivers, river mouths, and shallow coastal areas	Lakes Pontchartrain and Borgne, Bayou Dupre, Bayou Bienvenue, GIWW, and IHNC
FISHES				

Pallid Sturgeon (Scaphirhynchus albus)	Endangered	55 FR 36641 36647/ September 6, 1990	Large river obligate fish inhabiting the Missouri and Mississippi rivers and some tributaries	Mississippi River

ROUTES OF EFFECT TO SPECIES

The following section includes a status description of each species and how it might be affected by project elements as well as the determination of effects for each species. The effects determination took into account implementation of the conservation measures listed above.

West Indian Manatee

Status. The West Indian Manatee is listed as threatened under the Endangered Species Act. The manatee is also protected at the Federal level under the Marine Mammal Protection Act of 1972. Manatees are herbivores found in marine, brackish, and freshwater environments. They prefer large, slow-moving rivers, river mouths, and shallow coastal areas. The manatee often rests suspended just below the water's surface with only the snout above water. Historically, manatees were hunted for their flesh, bones, and hide. Hunting is thought to be largely responsible for the initial decline of this species; however, hunting is no longer allowed. Today, the greatest threat is collisions with boats and loss of warm water habitat. Flood gates and canal locks can kill manatees either by crushing them or drowning them[1].

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, Brantley, Mickal, & Shively, 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 & Taylor, 2005).

Effects Determination. Direct minor, short-term, impacts on water quality from construction activities in Lake Pontchartrain may include increased turbidity and increased water body temperature due to increased suspended solids produced during construction that could absorb incident solar radiation. Temporary, minor water quality impacts could occur due to increased nutrient loading, miscellaneous debris, and accidental spills from construction equipment. Water quality impacts in the project area would be temporary during project construction and would be minimized by the movement of the tides and the use of silt curtains and other best management practices. Water quality in the project area would return to normal after construction completion. Water quality impacts are expected to be insignificant because they

[1] USFWS (2008). West Indian Manatee Fact Sheet. USFWS. Available online at https://www.fws.gov/endangered/esa-library/pdf/manatee.pdf Accessed online 5 September 2019.

will be temporary and minimized by the use of silt curtains and other best management practices.

In an effort to avoid impacts to manatees that may possibly use the project area during project construction, manatee protection measures would be implemented. These measures include, but are not limited to, reducing vessel traffic speed, posting signs of the potential presence of manatees, and halting construction activities in the event a manatee is observed in the area.

We conclude the proposed Lake Pontchartrain and Vicinity project may affect, but is not likely to adversely affect, West Indian manatee.

Pallid Sturgeon

Status. Pallid sturgeon are a federally listed endangered large river fish species that is found in the Mississippi River. They are bottom dwelling, slow growing fish that feed primarily on small fish and immature aquatic insects. Their preferred habitat has a diversity of depths and velocities formed by braided channels, sand bars, sand flats and gravel bars of large rivers. The riverine habitat for the pallid sturgeon has been altered due to impoundment, channelization, and environmental contamination leading to species decline[2].

Photo by South Dakota Game, Fish and Parks; Sam Stukel

Effects Determination. Minor, short-term adverse effects from implementing the proposed project are anticipated. The proposed actions along the Mississippi River are not expected to directly affect the pallid sturgeon due to the use of land-based construction. Less than significant direct impacts to the bottomland hardwood habitat adjacent to the Mississippi River levees are anticipated at this time. The proposed activities may result in indirect, temporary short-term effects due to increases in turbidity during construction; however, best management practices would be implemented to reduce impacts to water quality and would result in less than significant impacts.

We conclude the proposed Lake Pontchartrain and Vicinity project may affect, but is not likely to adversely affect, pallid sturgeon.

[2] USFWS (2019). Pallid Sturgeon Fact Sheet. USFWS. Available online at https://www.fws.gov/midwest/endangered/fishes/PallidSturgeon/palld_fc.html Accessed 5 September 2019.

Prepared By:
Kip Runyon
Environmental Planning
U.S. Army Corps of Engineers
Regional Planning and Environmental Division North
1222 Spruce Street
St. Louis, MO 63103

Works Cited

Abadie, S., Brantley, C., Mickal, S., & Shively, S. (2000). Distribution of the Manatee (Trichechus manatus) in the Lake Pontchartrain Estuarine System. *Basics of the Basin Research Symposium.*

Powell, J., & Taylor, C. (2005). Newsletter of the IUCN/SSC Sirenia Specialist Group. Number 44.

2.4 USFWS RESPONSE LETTER

United States Department of the Interior

FISH AND WILDLIFE SERVICE
200 Dulles Drive
Lafayette, Louisiana 70506

December 10, 2019

Colonel Stephen Murphy
District Commander
U.S. Army Corps of Engineers
7400 Leake Avenue
New Orleans, LA 701118-3651

Dear Colonel Murphy;

Please reference your December 2, 2019, Threatened and Endangered Consultation letter, in which the U.S. Army Corps of Engineers (USACE) determined that the proposed Lake Pontchartrain and Vicinity (LPV), Reevaluation Study may affect but is not likely to adversely affect the threatened West Indian manatee and pallid sturgeon as a result of improved flood risk reduction measures. This letter is transmitted under the authority of the Endangered Species Act (ESA) of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.).

USACE has determined that possible impacts to the West Indian manatee would be short-term, and minor. To further minimize the possibility of those potential impacts to that species, the USACE would also implement manatee protection measures during project construction. Accordingly, the Fish and Wildlife Service (Service) concurs with the USACE's determination.

The USACE also determined that the proposed action may affect but is not likely to adversely affect the pallid sturgeon. Best management practices would be implemented to further reduce short-term impacts to water quality which would result in minimal impacts to the pallid sturgeon. Accordingly, the Service concurs with the USACE's determination that the proposed action would not adversely affect the pallid sturgeon.

No further consultation for the proposed action will be necessary for manatees and pallid sturgeon, unless: 1) the scope or location of the proposed project changes in a manner that the potential effects to listed species or designated critical habitat exceed those discussed in the draft EA; 2) new information reveals that the action may adversely affect listed species or designated critical habitat; or 3) a new species is listed or critical habitat designated. Additional consultation as a result of any of the above conditions or for changes not covered in this consultation should occur before changes are made and or finalized.

The Service appreciates the USACE's continued cooperation in the conservation of threatened and endangered species

Should you or your staff have any questions, or if you would like to meet with us regarding the content of this letter, please contact Hannah Sprinkle (337-291-3121).

Sincerely,

Joseph A. Ranson
Field Supervisor
Louisiana Ecological Services Office

cc: NMFS, St. Petersburg, FL
Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA

2.5 OFFICAL SPECIES LIST: 26 OCT 2020

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Louisiana Ecological Services Field Office
200 Dulles Drive
Lafayette, LA 70506
Phone: (337) 291-3100 Fax: (337) 291-3139

In Reply Refer To: October 26, 2020
Consultation Code: 04EL1000-2019-SLI-0612
Event Code: 04EL1000-2021-E-00491
Project Name: Lake Pontchartrain and Vicinity General Re-Evaluation Report

Subject: Updated list of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

***Due to the Louisiana Governor's mandatory quarantine order for the coronavirus (COVID-19), and in order to keep our staff and the public safe, we are unable to accept or respond in a timely manner to consultation request or project review/concurrence that we receive through the U.S. Mail. Please submit your request electronically to lafayette@fws.gov or call 337-291-3100.**

The enclosed species list identifies threatened, endangered and candidate species, as well as designated and proposed critical habitat that may occur within the boundary of your proposed project and may be affected by your proposed project. The Fish and Wildlife Service (Service) is providing this list under section 7 (c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*). Changes in this species list may occur due to new information from updated surveys, changes in species habitat, new listed species and other factors. Because of these possible changes, feel free to contact our office (337/291-3126) for more information or assistance regarding impacts to federally listed species. The Service recommends visiting the ECOS-IPaC site or the Louisiana Ecological Services website (www.fws.gov/lafayette) at regular intervals during project planning and implementation for updated species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the habitats upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of Federal trust resources and to determine whether projects may affect Federally listed species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected (e.g. adverse, beneficial, insignificant or discountable) by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF or by contacting our office at the number above.

Bald eagles have recovered and were removed from the List of Endangered and Threatened Species as of August 8, 2007. Although no longer listed, please be aware that bald eagles are protected under the Bald and Golden Eagle Protection Act (BGEPA) (16 U.S.C. 668 *et seq.*). The Service developed the National Bald Eagle Management (NBEM) Guidelines to provide landowners, land managers, and others with information and recommendations to minimize potential project impacts to bald eagles, particularly where such impacts may constitute "disturbance," which is prohibited by the BGEPA. A copy of the NBEM Guidelines is available at: http://www.fws.gov/southeast/es/baldeagle/NationalBaldEagleManagementGuidelines.pdf. Those guidelines recommend: (1) maintaining a specified distance between the activity and the nest (buffer area); (2) maintaining natural areas (preferably forested) between the activity and nest trees (landscape buffers); and (3) avoiding certain activities during the breeding season. On-site personnel should be informed of the possible presence of nesting bald eagles within the project boundary, and should identify, avoid, and immediately report any such nests to this office. If a bald eagle nest occurs or is discovered within or adjacent to the proposed project area, then an evaluation must be performed to determine whether the project is likely to disturb nesting bald eagles. That evaluation may be conducted on-line at: http://www.fws.gov/southeast/es/baldeagle. Following completion of the evaluation, that website will provide a determination of whether additional consultation is necessary. The Division of Migratory Birds for the Southeast Region of the Service (phone: 404/679-7051, e-mail: SEmigratorybirds@fws.gov) has the lead role in conducting any necessary consultation. Should you need further assistance interpreting the guidelines or performing an on-line project evaluation, please contact this office.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g. cellular, digital television, radio and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm ; http://www.towerkill.com; and http://fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

Activities that involve State-designated scenic streams and/or wetlands are regulated by the Louisiana Department of Wildlife and Fisheries and the U.S. Army Corps of Engineers, respectively. We, therefore, recommend that you contact those agencies to determine their interest in proposed projects in these areas.

Activities that would be located within a National Wildlife Refuge are regulated by the refuge staff. We, therefore, recommend that you contact them to determine their interest in proposed projects in these areas.

Additional information on Federal trust species in Louisiana can be obtained from the Louisiana Ecological Services website at: www.fws.gov/lafayette or by calling 337/291-3100.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Louisiana Ecological Services Field Office
200 Dulles Drive
Lafayette, LA 70506
(337) 291-3100

Project Summary

Consultation Code: 04EL1000-2019-SLI-0612

Event Code: 04EL1000-2021-E-00491

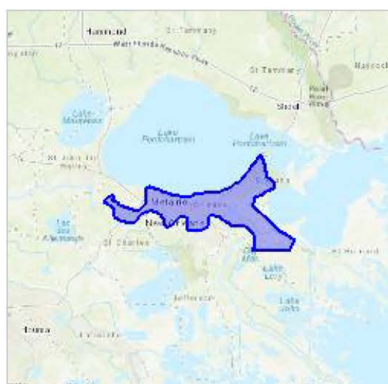
Project Name: Lake Pontchartrain and Vicinity General Re-Evaluation Report

Project Type: STREAM / WATERBODY / CANALS / LEVEES / DIKES

Project Description: The U.S. Army Corps of Engineers, New Orleans District (CEMVN), is preparing the Lake Pontchartrain and Vicinity (LPV), Louisiana General Re-evaluation Report to re-evaluate the performance of the LPV system given the combined effects of consolidation, settlement, subsidence, and sea level rise over time, and determine if additional actions are recommended to sustain the current 1% level of risk reduction for coastal storms. The measures that have been identified as part of the proposed action include lifts to existing levees, raising of existing flood walls, placement of foreshore protection in existing foreshore protection locations, and construction access dredging for placement of foreshore protection.

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/30.000621499999465N90.09144511498975W



Counties: Jefferson, LA | Orleans, LA | Plaquemines, LA | St. Bernard, LA | St. Charles, LA

Endangered Species Act Species

There is a total of 3 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

---

1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
West Indian Manatee *Trichechus manatus* There is **final** critical habitat for this species. Your location is outside the critical habitat. ***This species is also protected by the Marine Mammal Protection Act, and may have additional consultation requirements.*** Species profile: https://ecos.fws.gov/ecp/species/4469	Threatened

Fishes

NAME	STATUS
Atlantic Sturgeon (gulf Subspecies) *Acipenser oxyrinchus (=oxyrhynchus) desotoi* There is **final** critical habitat for this species. Your location overlaps the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/651	Threatened
Pallid Sturgeon *Scaphirhynchus albus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/7162	Endangered

Critical habitats

There is 1 critical habitat wholly or partially within your project area under this office's jurisdiction.

NAME	STATUS
Atlantic Sturgeon (gulf Subspecies) *Acipenser oxyrinchus (=oxyrhynchus) desotoi* https://ecos.fws.gov/ecp/species/651#crithab	Final

3 FISH AND WILDLIFE COORDINATION ACT REPORTS

3.1 DRAFT FISH AND WILDLIFE COORDINATION ACT REPORT 30 OCTOBER 2019

United States Department of the Interior

FISH AND WILDLIFE SERVICE
200 Dulles Drive
Lafayette, Louisiana 70506

October 30, 2019

Colonel Stephen Murphy
District Commander
U.S. Army Corps of Engineers
7400 Leake Avenue
New Orleans, LA 701118-3651

Dear Colonel Murphy;

Please reference the Lake Pontchartrain and Vicinity Hurricane Storm Damage and Risk Reduction Re-evaluation (LPV). Attached is the draft Fish and Wildlife Coordination Act (FWCA) Report which addresses project-associated impacts to forested habitats and estuarine marsh for activities associated with restoring existing levees to an authorized level of hurricane protection.

Levee lifts will be required to offset expected consolidation, settlement, subsidence and sea level rise. This report will evaluate impacts associated with raising and widening existing levee footprints and provides recommendations to minimize and/or mitigate project impacts on those resources. This report does not constitute the 2(b) report of the Fish and Wildlife Service (Service). This report has been provided to the National Marine Fisheries Service (NMFS) and the Louisiana Department of Wildlife and Fisheries (LDWF) for comment; their comments will be incorporated into our final report.

INTRODUCTION

This draft Fish and Wildlife Coordination Act (FWCA) Report of the Fish and Wildlife Service (Service) addresses project-associated impacts to forested habitats and estuarine marsh by the Corps of Engineers' (Corps) for activities associated with implementation of the Hurricane and Storm Damage Risk Reduction System (HSDRRS), Lake Pontchartrain and Vicinity (LPV) Project. Our findings and recommendations are presented in accordance with the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) and have been developed on the basis of surveys and analyses of project impacts and potential improvement of mitigation areas for fish and wildlife resources. This draft report does not constitute the final report of the Secretary of the Interior as required by Section 2(b) of that Act. This draft FWCA provides additional comments in accordance with provisions of the Endangered Species Act (ESA) of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.), the Bald and Golden Eagle Protection Act (BGEPA) (54 Stat. 250, as amended, 16 U.S.C. 668a-d), the Migratory Bird

Treaty Act (MBTA) (40 Stat. 755, as amended; 16 U.S.C. 703 et seq.), and the National Environmental Policy Act (NEPA) of 1969 (83 Stat. 852; 42 U.S.C. 4321 et seq.). The Service has provided copies of this report to the National Marine Fisheries Service (NMFS) and the Louisiana Department of Wildlife and Fisheries (LDWF), and their comments will be incorporated into the final report.

The Water Resources Reform and Development Act of 2014 authorized USACE to carry out measures needed to address consolidation, settlement, and sea level rise if the necessary work is determined to be technically feasible, environmentally acceptable, and economically justified. The Bipartisan Budget Act of 2018 provided appropriations to conduct the General Re-evaluation Report necessary to inform this determination.

At the current stage of planning the USACE has preliminarily identified impacts to fish and wildlife resources. As planning and impact assessments continue to be refined, assessment of those impacts and mitigation needs will need to be revised accordingly.

Study Area

The portion of the New Orleans Metropolitan Area known as the East Bank extends from eastern St. Charles Parish to southern St. Bernard Parish along the left descending bank of the Mississippi River. It includes the communities of Norco, Destrehan, Kenner, Harahan, Metairie, New Orleans, Chalmette, Arabi, Meraux, Violet, Poydras, Caernarvon and St. Bernard. The Mississippi River Levee (MRL) protects this area from high river levels. The Lake Pontchartrain and Vicinity (LPV) HSDRRS connects to the MRL at both the north and south end of the system.

The HSDRRS includes risk reduction features in nine sub-basins; five sub-basins are located in LPV (St. Charles, East Jefferson, Orleans Metro, New Orleans East). In this context a sub-basin is the geographic area protected by a specific component of HSDRRS and are independent hydrologic units. 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 (MR&T) Project.

Habitat types in the project area include forested wetlands [i.e., bottomland hardwoods (BLH) and/or swamps], non-wet BLH, marsh, open water, and developed areas. Due to urban development and a forced-drainage system, the hydrology of most of the forested habitat within the levee system has been altered. The forced-drainage system has been in operation for many years, and subsidence is evident throughout the areas enclosed by levees.

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

Essential Fish Habitat

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

Coastal wetlands also provide nursery and foraging habitat that supports economically important marine fishery species such as spotted seatrout, sand seatrout, southern flounder, Atlantic croaker, spot, Gulf menhaden, striped mullet, anchovies, and blue crab. Some of these species serve as prey for other fish species managed under the Magnuson-Stevens Act by the GMFMC (e.g., mackerels, snappers, and groupers) and highly migratory species managed by NMFS (e.g., billfishes and sharks). Where tidally-influenced waters designated as EFH are converted to a non-tidal elevation, loss of EFH would result. Should EFH be impacted, those losses should be quantified and presented in the Corps' report. Close coordination with the NMFS is recommended because mitigation for those impacts is necessary.

Endangered and Threatened Species

To aid the Corps in complying with their proactive consultation responsibilities under the Endangered Species Act (ESA), the Service provided a list of threatened and endangered species and their critical habitats within the Service's Planning Aid Report dated April 29, 2019.

The Service provides the following additional information and guidance on best management practices (BMPs) for construction of the project.

The threatened West Indian manatee (*Trichechus manatus*) is known to regularly occur in Lakes Pontchartrain and Maurepas and their associated coastal waters and streams, however, manatee occurrences in southeastern Louisiana appear to be increasing. Based on data maintained by the Louisiana Natural Heritage Program (LNHP), over 80 percent of reported manatee sightings (1999-2011) in Louisiana have occurred from the months of June through December, mostly while the average water temperature is warm. Cold weather and outbreaks of red tide may adversely affect these animals. However, human activity is the primary cause for declines in species number due to collisions with boats and barges, entrapment in flood control structures, poaching, habitat loss, and pollution.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Further consultation with this office will be necessary if the proposed action may directly or indirectly affect the Atlantic sturgeon. In addition, should the proposed action involve federal implementation, funding, or a federal permit and directly or indirectly affects designated critical habitat, further consultation with this office or the NMFS will be necessary. As part of the critical habitat designation, the Service and NMFS consultation responsibility was divided by project location and Federal action agency. In riverine waters, the Service is responsible for all consultations regarding Atlantic sturgeon and critical habitat, while in marine waters the NMFS is responsible for consultation. For estuarine waters, the Service is responsible for consultations with the Department of Transportation (DOT), the Environmental Protection Agency (EPA), the U.S. Coast Guard (USCG), and the Federal Emergency Management Agency (FEMA). All other Federal agencies should consult with the NMFS office (Ms. Cathy Tortorici at 727.209.5953).

Migratory Birds

The Migratory Bird Treaty Act (MBTA) (40 Stat. 755, as amended; 16 U.S.C. 703 et seq.) and the Bald and Golden Eagle Protection Act (BGEPA) (54 Stat. 250, as amended, 16 U.S.C. 668a-d) offer protection to many bird species within the project area including colonial nesting birds, osprey, and the bald eagle (*Haliaeetus leucocephalus*). We continue to recommend that a qualified biologist inspect proposed work sites for the presence of undocumented colonial nesting colonies during the nesting season (e.g. February through September depending on the species). If colonies exist, work should not be conducted within 1,000 feet of the colony during the nesting season.

On-site personnel should also be informed of the possible presence of nesting bald eagles and ospreys within the project boundary, and should identify, avoid, and immediately report any such nests to this office. If a bald eagle nest is located within 660 feet of the proposed activities, the Corps should complete an on-line evaluation (http://www.fws.gov/southeast/birds/Eagle/tamain.html) to determine potential disturbance to nesting bald eagles and any protective measures necessary. A copy of that evaluation should be provided to this office. If assistance is needed in completing the evaluation please contact this office.

Public/Protected Lands

Lands within public ownership/oversight impacted by the LPV project include the Jean Lafitte National Historic Park and Preserve (JLNHPP), Chalmette National Cemetery managed by the National Park Service (NPS) and the Bayou Sauvage National Wildlife Refuge Preserve managed by the Service.

PROJECT IMPACTS AND MITIGATION

Project impacts resulted primarily from levee ROWs expansion and construction of levees, borrows pits, floodwalls, navigable floodgates, and associated features. Development is ongoing within the hurricane protection levees; therefore, the Service has assumed that, for this specific project, project-induced development was insignificant. However, the Corps is continuing to refine projects plans; therefore, proposed habitat impacts cannot be finalized at this time. Impacts to wet bottomland hardwoods within the batture and adjacent to the MRL levee have been tentatively identified. Assessment of the value of those areas and their mitigation needs will be presented in our final report. Borrow sites have not been identified in this planning phase but will be identified during detailed planning efforts. Impacts and mitigation associated with those borrow sites will be identified in subsequent NEPA documents. Additional Service recommendations may be provided in supplemental reports as those plans are more fully developed.

Habitat Assessments

Wetland impacts are anticipated to be minimal due to the use of existing levee and floodwall rights-of-way and avoidance of bottomland hardwood habitat in selection of borrow areas.

To quantify impacts and mitigation needs, the Wetland Value Assessment (WVA) will be utilized. Any proposed change in impacts, mitigation features or plans should be coordinated in advance with the Service, NMFS, LDWF, EPA and LDNR.

ALTERNATIVE EVALUATION PROCESS

Six alternatives and one no action alternative were qualitatively evaluated and screened based on preliminary hydrology and hydraulics (H&H), life safety risk, and economic damages information.

The initial array of alternatives includes:

- No Action Alternative
- Alternative 1: System Levee Lifts to the Projected 1% Event at 2057
- Alternative 2: System Levee Lifts to the Projected 1% Event at 2073
- Alternative 3: System Levee Lifts at 2073 that Maximize Benefits
- Alternative 4: Selective Levee Lifts
- Alternative 5: Non-Structural
- Alternative 6: Sponsor Plan

Alternative 2 achieves the greatest net benefits and is thus the National Economic Development (NED) plan and the Tentatively Selected Plan (TSP) for LPV. The second alternative focuses on the 1% event at the 2073 time period. LPV authorization is for protection against 1% event and Federal Emergency Management Agency (FEMA) levee certification for participation in the National Flood Insurance Program under the base flood elevation at the time of construction. 2073 is the end of the studies' 50-year period of analysis.

FISH AND WILDLIFE CONSERVATION MEASURES

The Service's Mitigation Policy (Federal Register, Volume 46, No. 15, January 23, 1981) identifies four resource categories that are used to ensure that the level of mitigation recommended by Service biologists will be consistent with the fish and wildlife resource values involved. Considering the high value of forested wetlands for fish and wildlife and the relative scarcity of that habitat type, that habitat type is designated as Resource Category 2, the mitigation goal for which is no net loss of in-kind habitat value. The scrub-shrub and dry bottomland hardwood habitat that may be impacted, however, is placed in Resource Category 3 due to their reduced value to wildlife, fisheries and degraded wetland functions. The mitigation goal for Resource Category 3 habitats is no net loss of habitat value.

The study assumes that existing borrow areas will continue to be used and additional borrow areas will be identified and utilized by other projects, both Federal and non-Federal. This may lead to a reduced availability of future borrow sites which avoid sensitive environmental areas. While this may occur, the study team has no way to predict the potential reduction in available borrow sites and, therefore, has assumed that sensitive environmental areas can be avoided. Identification of future borrow locations should follow guidance provided in Appendix A. Mitigation for those impacts should be coordinated with all natural resource agencies.

SERVICE POSITION AND RECOMMENDATIONS

We do not oppose the Corps' plan to implement alternative 2 for the LPV HSDRRS provided that the following fish and wildlife conservation recommendations are incorporated into future project planning and implementation efforts:

1. Impacts to Essential Fish Habitat (EFH) should be avoided and minimized to the greatest extent possible. Because impacts to designated EFH habitat may need to be mitigated the Corps should coordinate with the NMFS regarding this need.

2. To the greatest extent possible, situate final flood protection features so that impacts to wetlands and non-wet bottomland hardwoods are avoided or minimized.

3. Avoid adverse impacts of bald eagle nesting locations and wading bird colonies through careful design of 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.

4. The Service recommends that the USACE contact the Service for additional consultation if: 1) the scope or location of the proposed project is changed significantly, 2) new information reveals that the action may affect listed species or designated critical habitat; 3) the action is modified in a manner that causes effects to listed species or designated critical habitat; or 4) a new species is listed or critical habitat designated. Additional consultation as a result of any of the above conditions or for changes not covered in this consultation should occur before changes are made and or finalized.

5. Further detailed planning of project features (e.g., Design Documentation Report, Engineering Documentation Report, Plans and Specifications, Water Control Plans, or other similar documents) should be coordinated with the Service, NMFS, LDWF, EPA and 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.

6. 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. In addition all mitigation proposed to occur on public lands should be coordinated with the respective land managing agency. Points of contacts for the agencies potentially impacted by project features are: National Park Service (NPS), contact Superintendent Chuck Hunt, (504) 589-3882 extension 137 (Charles_Hunt@nps.gov) or Chief of Resource Management Guy Hughes (504) 589-3882 extension 128, (Guy_Hughes@nps.gov) and for Bayou Sauvage NWR, the following people should be coordinated with; Shelly Stiaes, (Shelly_Stiaes@fws.gov) Refuge Manager, Barret Fortier (Barret_Fortier@fws.gov) Southeast Refuges Complex Biologist and Neil Lalonde (Neil_Lalonde@fws.gov) Southeast Refuge Complex Supervisor. The telephone number for the Southeast Refuge Complex is (985)882-2000.

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

8. The Corps should maintain full responsibility for all mitigation projects until the projects are found to be fully compliant with success and performance requirements.

9. The Corps should fully compensate for any unavoidable losses of wetland habitat or non-wet bottomland hardwoods caused by project features.

10. Borrow sites should be designed to avoid and minimize impacts to fish and wildlife habitat; in the event new borrow sites are identified, guidelines for borrow site selection are found in Appendix A.

11. Identified impacts shall have a fully defined mitigation plan that is included in the integrated National Environmental Policy Act document. The mitigation plan should be developed, including locations and AAHUs vetted through the natural resource agencies. Existing mitigation banks and existing credits released by Corps Regulatory Branch should be considered in accordance with Department of the Army, Corps of Engineers Compensatory Mitigation for Losses of Aquatic Resources; Final Rule (33 CFR Parts 325 and 332).

12. 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.

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

14. The Corps should finalize mitigation plans and proceed to mitigation construction so that it will be concurrent with project construction. If construction is not concurrent with mitigation implementation then revising the impact and mitigation period-of-analysis to reflect additional temporal losses will be required

We will continue to work closely with your staff to ensure that fish and wildlife resources are conserved. If you require further assistance in this matter, please contact Hannah Sprinkle (337-291-3121).

Sincerely,

Joseph A. Ranson
Field Supervisor
Louisiana Ecological Services Office

Appendix A

Borrow Site Prioritization Criteria

Where multiple alternative borrow areas exists, use of those alternative sites should be prioritized in the following order: existing commercial pits, upland sources, previously disturbed/manipulated wetlands within a levee system, and low-quality wetlands outside a levee system. The Service supports the use of such protocols to avoid and minimize impacts to wetlands and bottomland hardwoods within project areas. Avoidance and minimization of those impacts helps to provide consistency with restoration strategies and compliments the authorized hurricane protection efforts. Such consistency is also required by Section 303(d)(1) of the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA).
Accordingly, the Service recommends that prior to utilizing borrow sites every effort should be made to reduce impacts by using sheetpile and/or floodwalls to increase levee heights wherever feasible. In addition, the Service recommends that the following protocol be adopted and utilized to identify borrow sources in descending order of priority:

1. Permitted commercial sources, authorized borrow sources for which environmental clearance and mitigation have been completed, or non-functional levees after newly constructed adjacent levees are providing equal protection.
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., Chinese tallow-trees) or non-forested wetlands (e.g., wet pastures), excluding marshes;
   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., Chinese tallow-trees) or non-forested wetlands (e.g., wet pastures), excluding marshes;
   c) disturbed wetlands (e.g., hydrologically altered, artificially impounded).

Notwithstanding this protocol, the location, size and configuration of borrow sites within the landscape is also critically important. Coastal ridges, natural levee flanks and other geographic features that provide forested/wetland habitats and/or potential barriers to hurricane surges should not be utilized as borrow sources, especially where such uses would diminish the natural functions and values of those landscape features.
To assist in expediting the identification of borrow sites, the Service recommends that immediately after the initial identification of a new borrow site the Corps should initiate informal consultation with the Service regarding potential impacts to federally listed threatened or endangered species. To aid you in complying with those proactive consultation responsibilities, the Service has provided (in the above letter) a list of threatened and endangered species and their critical habitats within the project area.

3.2 FINAL FISH AND WILDLIFE COORDINATION ACT REPORT 14 JANUARY 2021

United States Department of the Interior

FISH AND WILDLIFE SERVICE
200 Dulles Drive
Lafayette, Louisiana 70506

January 14, 2021

Colonel Stephen Murphy
District Commander
U.S. Army Corps of Engineers
7400 Leake Avenue
New Orleans, LA 701118-3651

Dear Colonel Murphy:

Please reference the Lake Pontchartrain and Vicinity Hurricane Storm Damage and Risk Reduction General Re-evaluation (LPV) study. This Fish and Wildlife Coordination Act (FWCA) report addresses project-associated impacts to forested habitats for activities associated with restoring existing levees to an authorized level of hurricane protection.

Levee lifts will be required to offset expected consolidation, settlement, subsidence and sea level rise. This report will evaluate impacts associated with raising and widening existing levee footprints and provides recommendations to minimize and/or mitigate project impacts on those resources. This report constitutes the 2(b) report of the Fish and Wildlife Service (Service). This report has been provided to the National Marine Fisheries Service (NMFS) and the Louisiana Department of Wildlife and Fisheries (LDWF) for comment; their comments were incorporated into our final report.

INTRODUCTION

This FWCA report addresses project-associated impacts to forested habitats determined by U.S. Army Corps of Engineers (USACE) activities associated with implementation of the Hurricane and Storm Damage Risk Reduction System (HSDRRS), Lake Pontchartrain and Vicinity (LPV) Project. Our findings and recommendations are presented in accordance with the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) and have been developed on the basis of surveys and analyses of project impacts and potential improvement of mitigation areas for fish and wildlife resources. This report constitutes the final report of the Secretary of the Interior as required by Section 2(b) of that Act. This FWCA provides additional comments in accordance with provisions of the Endangered Species Act (ESA) of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.), the Bald and Golden Eagle Protection Act (BGEPA) (54 Stat. 250, as amended, 16 U.S.C. 668a-d), the Migratory Bird Treaty Act (MBTA) (40 Stat. 755, as amended; 16 U.S.C. 703 et seq.), and the National Environmental Policy Act (NEPA) of 1969 (83 Stat. 852; 42 U.S.C. 4321 et seq.).

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Study Area

The portion of the New Orleans Metropolitan Area known as the East Bank extends from eastern St. Charles Parish to southern St. Bernard Parish along the left descending bank of the Mississippi River. It includes the communities of Norco, Destrehan, Kenner, Harahan, Metairie, New Orleans, Chalmette, Arabi, Meraux, Violet, Poydras, Caernarvon and St. Bernard

The HSDRRS includes risk reduction features in nine sub-basins; five sub-basins are located in LPV (St. Charles, East Jefferson, Orleans Metro, New Orleans East). In this context a sub-basin is the geographic area protected by a specific component of HSDRRS and are independent hydrologic units. All of the sub-basins, except for the New Orleans East sub-basin, are located along the Mississippi River.

Habitat types in the project area include forested wetlands [i.e., bottomland hardwoods (BLH) and/or swamps], non-wet BLH, marsh, open water, and developed areas. Due to urban development and a forced-drainage system, the hydrology of most of the forested habitat within the levee system has been altered. The forced-drainage system has been in operation for many years, and subsidence is evident throughout the areas enclosed by levees.

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

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FR 76216). NMFS administers EFH regulations. Categories of EFH in the project area include estuarine waters, estuarine emergent wetlands and mud, sand, and shell water bottoms.

Coastal wetlands also provide nursery and foraging habitat that supports economically important marine fishery species such as spotted seatrout, sand seatrout, southern flounder, Atlantic croaker, spot, Gulf menhaden, striped mullet, anchovies, and blue crab. Some of these species serve as prey for other fish species managed under the Magnuson-Stevens Act by the GMFMC (e.g., mackerels, snappers, and groupers) and highly migratory species managed by NMFS (e.g., billfishes and sharks). Where tidally-influenced waters designated as EFH are converted to a non-tidal elevation, loss of EFH would result. Should EFH be impacted, those losses should be quantified and presented in the Corps' report. Close coordination with the NMFS is recommended because mitigation for those impacts is necessary.

Endangered and Threatened Species

To aid the Corps in complying with their proactive consultation responsibilities under the Endangered Species Act (ESA), the Service provided a list of threatened and endangered species and their critical habitats within the Service's Planning Aid Report dated on April 24, 2019.

Threatened species that may occur in coastal waters of the project vicinity are the West Indian manatee (*Trichechus manatus*) and the Atlantic sturgeon (*Acipenser oxyrhynchus desotoi*). For additional information and guidance on best management practices (BMPs) refer to Appendix A.

Migratory Birds

The Migratory Bird Treaty Act (MBTA) (40 Stat. 755, as amended; 16 U.S.C. 703 et seq.) and the Bald and Golden Eagle Protection Act (BGEPA) (54 Stat. 250, as amended, 16 U.S.C. 668a-d) offer protection to many bird species within the project area including colonial nesting birds, osprey, and the bald eagle (*Haliaeetus leucocephalus*). To avoid adverse impacts of bald eagle nesting locations and wading bird colonies, careful design of project features and timing of construction should be considered. We continue to recommend that a qualified biologist inspect proposed work sites for the presence of undocumented colonial nesting colonies during the nesting season (e.g. February through September depending on the species). If colonies exist, work should not be conducted within 1,000 feet of the colony during the nesting season. The development of an abatement plan to avoid impacts to nesting colonies can be developed in coordination with the Service.

On-site personnel should also be informed of the possible presence of nesting bald eagles and ospreys within the project boundary, and should identify, avoid, and immediately report any such nests to this office. If a bald eagle nest is located within 660 feet of the proposed activities, the Corps should complete an on-line evaluation (http://www.fws.gov/southeast/birds/Eagle/tamain.html) to determine potential disturbance to nesting bald eagles and any protective measures necessary. A copy of that evaluation should be provided to this office. If assistance is needed in completing the evaluation please contact this office.

Public/Protected Lands

Lands within public ownership/oversight impacted by the LPV project include the Jean Lafitte National Historic Park and Preserve (JLNHPP), Chalmette National Cemetery managed by the National Park Service (NPS) and the Bayou Sauvage National Wildlife Refuge managed by the Service.

PROJECT IMPACTS AND MITIGATION

Project impacts to wet bottomland hardwood (BLH) habitat were identified resulting primarily from levee ROWs expansion and construction of levees, borrows pits, floodwalls, navigable floodgates, and associated features. Impacts should be avoided to the maximum extent practicable but will be unavoidable in some locations. Borrow sites have not been identified in this planning phase but will be identified during detailed planning efforts. Impacts and mitigation associated with those borrow sites will be identified in subsequent NEPA documents. Additional Service recommendations may be provided in supplemental reports as those plans are more fully developed (See Appendix B for Borrow Site Criteria).

Habitat Assessments

Wetland Value Assessment (WVA)
Evaluations of resources were conducted using the WVA methodology. Implementation of the WVA requires that habitat quality and quantity (acreage) are measured for baseline conditions, and predicted for future without-project and future with-project conditions. Each WVA model utilizes an assemblage of variables considered important to the suitability of that habitat type to support a diversity of fish and wildlife species. The WVA provides a quantitative estimate of project-related impacts to fish and wildlife resources. Although, the WVA may not include every environmental or behavioral variable that could affect fish and wildlife habitat usage, it is widely acknowledged to provide a cost-effective means of assessing restoration measures in coastal wetland communities.

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

The product of an HSI value and the acreage of available habitat for a given target year is known as the Habitat Unit (HU) and is the basic unit for measuring project effects on fish and wildlife habitat. HUs are annualized over the project life to determine the Average Annual Habitat Units (AAHUs) available for each habitat type. The change (increase or decrease) in AAHUs for each future with-project scenario, compared to future without-project conditions, provides a measure of anticipated impacts. A net gain in AAHUs indicates that the project is beneficial to the fish and wildlife community within that habitat type; a net loss of AAHUs indicates that the project would adversely impact fish and wildlife resources.

The USACE-certified Wetland Value Assessment (WVA) Bottomland Hardwood Model (version 1.2) as well as the Hurricane and Storm Risk Reduction System (HSDRRS) for BLH [LPV & WBV] Mitigation Assumption Guide (Revised/Updated: 3 March 2012) were used to evaluate impacts. Target Years (TY) were set as follow: 0, 1, 20 and 50.

Impacts of Selected Plan
As a result of the COVID-19 pandemic, field work and site visits were not permitted for Service employees. The USACE agreed to aid the Service in field data collection and performed site visits on September 27, 2020. Overall impacts will be permanent; habitat destruction as a result of the clearing would result in loss of BLH habitat and those losses should be mitigated for. Project implementation would result in the direct loss of approximately 20.27 acres of BLH and -12.12 AAHUs.

For more details on the WVAs refer to the Project Information Sheet (PIS) found in Appendix C.

ALTERNATIVE EVALUATION PROCESS

Six alternatives and one no action alternative were qualitatively evaluated and screened based on preliminary hydrology and hydraulics (H&H), life safety risk, and economic damages information.

The initial array of alternatives includes:

- No Action Alternative
- Alternative 1: System Levee Lifts to the Projected 1% Event at 2057
- Alternative 2: System Levee Lifts to the Projected 1% Event at 2073
- Alternative 3: System Levee Lifts at 2073 that Maximize Benefits
- Alternative 4: Selective Levee Lifts
- Alternative 5: Non-Structural
- Alternative 6: Sponsor Plan

Alternative 2 achieves the greatest net benefits and is thus the National Economic Development (NED) plan and the Tentatively Selected Plan (TSP) for LPV. The second alternative focuses on the 1% event at the 2073 time period. LPV authorization provides protection against 1% event and enables Federal Emergency Management Agency (FEMA) levee certification for participation in the National Flood Insurance Program under the base flood elevation at the time of construction. 2073 is the end of the studies' 50-year period of analysis.

FISH AND WILDLIFE CONSERVATION MEASURES

The Service's Mitigation Policy (Federal Register, Volume 46, No. 15, January 23, 1981) identifies four resource categories that are used to ensure that the level of mitigation recommended by Service biologists will be consistent with the fish and wildlife resource values involved. Considering the high value of forested wetlands for fish and wildlife and the relative scarcity of that habitat type, that habitat type is designated as Resource Category 2, the mitigation goal for which is no net loss of in-kind habitat value. The scrub-shrub and dry bottomland hardwood habitat that may be impacted, however, is placed in Resource Category 3 due to their reduced value to wildlife, fisheries and degraded wetland functions. The mitigation goal for Resource Category 3 habitats is no net loss of habitat value.

The study assumes that existing borrow areas will continue to be used and additional borrow areas will be identified and utilized by other projects, both Federal and non-Federal. This may lead to a reduced availability of future borrow sites which avoid sensitive environmental areas. While this may occur, the study team has no way to predict the potential reduction in available borrow sites and, therefore, has assumed that sensitive environmental areas can be avoided. Identification of future borrow locations should follow guidance provided in Appendix B Mitigation for those impacts should be coordinated with all natural resource agencies.

SERVICE POSITION AND RECOMMENDATIONS

We do not oppose the Corps' plan to implement alternative 2 for the LPV HSDRRS provided that the following fish and wildlife conservation recommendations are incorporated into future project planning and implementation efforts:

1. Impacts to Essential Fish Habitat (EFH) shall be avoided and minimized to the greatest extent possible. Because impacts to designated EFH habitat may need to be mitigated the Corps shall coordinate with the NMFS regarding this need.

2. To the greatest extent possible, situate final flood protection features so that impacts to wetlands and non-wet bottomland hardwoods are avoided or minimized.

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

4. The Service recommends that the USACE contact the Service for additional consultation if: 1) the scope or location of the proposed project is changed significantly, 2) new information reveals that the action may affect listed species or designated critical habitat; 3) the action is modified in a manner that causes effects to listed species or designated critical habitat; or 4) a new species is listed or critical habitat designated. Additional consultation as a result of any of the above conditions or for changes not covered in this consultation should occur before changes are made and or finalized.

5. Further detailed planning of project features (e.g., Design Documentation Report, Engineering Documentation Report, Plans and Specifications, Water Control

Plans, or other similar documents) shall be coordinated with the Service, NMFS, LDWF, 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.

6. The Corps shall 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. In addition all mitigation proposed to occur on public lands should be coordinated with the respective land managing agency. Points of contacts for the agencies potentially impacted by project features are: National Park Service (NPS), contact Superintendent Chuck Hunt, (504) 589-3882 extension 137 (Charles_Hunt@nps.gov) or Chief of Resource Management Guy Hughes (504) 589-3882 extension 128, (Guy_Hughes@nps.gov) and for Bayou Sauvage NWR, the following people should be coordinated with; Shelly Stiaes, (Shelly_Stiaes@fws.gov) Refuge Manager, Barret Fortier (Barret_Fortier@fws.gov) Southeast Refuges Complex Biologist and Neil Lalonde (Neil_Lalonde@fws.gov) Southeast Refuge Complex Supervisor. The telephone number for the Southeast Refuge Complex is (985)882-2000.

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

8. The Corps shall maintain full responsibility for all mitigation projects until the projects are found to be fully compliant with success and performance requirements.

9. The Corps shall fully compensate for any unavoidable losses of wetland habitat or non-wet bottomland hardwoods caused by project features.

10. Borrow sites shall be designed to avoid and minimize impacts to fish and wildlife habitat; in the event new borrow sites are identified, guidelines for borrow site selection found in Appendix B should be followed.

11. Identified impacts shall have a fully defined mitigation plan that is included in the integrated National Environmental Policy Act document. The mitigation plan should be developed, including locations and AAHUs vetted through the natural resource agencies. Only existing mitigation banks and existing credits released by Corps Regulatory Branch may be considered.

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

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

14. The Corps shall finalize mitigation plans and proceed to mitigation construction so that it will be concurrent with project construction. If construction is not concurrent with mitigation implementation then revising the impact and mitigation period-of-analysis to reflect additional temporal losses will be required

We will continue to work closely with your staff to ensure that fish and wildlife resources are conserved. If you require further assistance in this matter, please contact Hannah Sprinkle (337-291-3121).

Sincerely,

Joseph A. Ranson
Field Supervisor
Louisiana Ecological Services Office

Appendix A

West Indian manatee

The threatened West Indian manatee (*Trichechus manatus*) is known to regularly occur in Lakes Pontchartrain and Maurepas and their associated coastal waters and streams. It also can be found less regularly in other Louisiana coastal areas, most likely while the average water temperature is warm. Based on data maintained by the Louisiana Natural Heritage Program (LNHP), over 80 percent of reported manatee sightings (1999-2011) in Louisiana have occurred from the months of June through December. Manatee occurrences in Louisiana appear to be increasing and they have been regularly reported in the Amite, Blind, Tchefuncte, and Tickfaw Rivers, and in canals within the adjacent coastal marshes of southeastern Louisiana. Manatees may also infrequently be observed in the Mississippi River and coastal areas of southwestern Louisiana. Cold weather and outbreaks of red tide may adversely affect these animals. However, human activity is the primary cause for declines in species number due to collisions with boats and barges, entrapment in flood control structures, poaching, habitat loss, and pollution.

During in-water work in areas that potentially support manatees all personnel associated with the project should be instructed about the potential presence of manatees, manatee speed zones, and the need to avoid collisions with and injury to manatees. All personnel should be advised that there are civil and criminal penalties for harming, harassing, or killing manatees, which are protected under the Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973. Additionally, personnel should be instructed not to attempt to feed or otherwise interact with the animal, although passively taking pictures or video would be acceptable.

- All on-site personnel are responsible for observing water-related activities for the presence of manatee(s). We recommend the following to minimize potential impacts to manatees in areas of their potential presence:

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

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

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

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

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

- To ensure manatees are not trapped due to construction of containment or water control structures, we recommend that the project area be surveyed prior to commencement of work activities. Should a manatee be observed within those areas, the contractor should immediately contact the Service's Louisiana Ecological Services Office (337-291-3100) and the Louisiana Department of Wildlife and Fisheries, Natural Heritage Program (225-765-2821).

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

Atlantic Sturgeon

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

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

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

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

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

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

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

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

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

Further consultation with this office will be necessary if the proposed action may directly or indirectly affect the Atlantic sturgeon. In addition, should the proposed action involve federal implementation, funding, or a federal permit and directly or indirectly affects designated critical habitat, further consultation with this office or the NMFS will be necessary. As part of the critical habitat designation, the Service and NMFS consultation responsibility was divided by project location and Federal action agency. In riverine waters, the Service is responsible for all consultations regarding Atlantic sturgeon and critical habitat, while in marine waters the NMFS is responsible for consultation. For estuarine waters, the Service is responsible for consultations with the Department of Transportation (DOT), the Environmental Protection Agency (EPA), the

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U.S. Coast Guard (USCG), and the Federal Emergency Management Agency (FEMA). All other Federal agencies should consult with the NMFS office (Ms. Cathy Tortorici at 301-427-8405).

Appendix B

Borrow Site Prioritization Criteria

Where multiple alternative borrow areas exists, use of those alternative sites should be prioritized in the following order: existing commercial pits, upland sources, previously disturbed/manipulated wetlands within a levee system, and low-quality wetlands outside a levee system. The Service supports the use of such protocols to avoid and minimize impacts to wetlands and bottomland hardwoods within project areas. Avoidance and minimization of those impacts helps to provide consistency with restoration strategies and compliments the authorized hurricane protection efforts. Such consistency is also required by Section 303(d) (1) of the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA).
Accordingly, the Service recommends that prior to utilizing borrow sites every effort should be made to reduce impacts by using sheetpile and/or floodwalls to increase levee heights wherever feasible. In addition, the Service recommends that the following protocol be adopted and utilized to identify borrow sources in descending order of priority:

1. Permitted commercial sources, authorized borrow sources for which environmental clearance and mitigation have been completed, or non-functional levees after newly constructed adjacent levees are providing equal protection.
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., Chinese tallow-trees) or non-forested wetlands (e.g., wet pastures), excluding marshes;
    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., Chinese tallow-trees) or non-forested wetlands (e.g., wet pastures), excluding marshes;
    c) disturbed wetlands (e.g., hydrologically altered, artificially impounded).

Notwithstanding this protocol, the location, size and configuration of borrow sites within the landscape is also critically important. Coastal ridges, natural levee flanks and other geographic features that provide forested/wetland habitats and/or potential barriers to hurricane surges should not be utilized as borrow sources, especially where such uses would diminish the natural functions and values of those landscape features.
To assist in expediting the identification of borrow sites, the Service recommends that immediately after the initial identification of a new borrow site the Corps should initiate informal consultation with the Service regarding potential impacts to federally listed threatened or endangered species. To aid you in complying with those proactive consultation responsibilities, the Service has provided (in the above letter) a list of threatened and endangered species and their critical habitats within the project area.

Appendix C

U.S. Fish and Wildlife Service, Ecological Services
200 Dulles Drive, Lafayette, LA 70506
(337) 291-3100, FAX (337) 291-3139

MEMORANDUM

DATE: October 15, 2020

TO: U.S. Army Corps of Engineers (NOD)

FROM: U.S. Fish and Wildlife Service (Service)

SUBJECT: Project Information Sheet for the Bottomland Hardwood Wetland Value Assessment (WVA) for the proposed Lake Pontchartrain and Vicinity Hurricane Storm Damage and Risk Reduction Re-evaluation (LPV).

Levee lifts will be required to offset expected consolidation, settlement, subsidence and sea level rise. The study area is located within the Mississippi River Deltaic Plain of the Lower Mississippi River Ecosystem. The LPV project includes features in four parishes (St. Charles, Jefferson, Orleans, and St. Bernard) located in the greater New Orleans area on the east bank of the Mississippi River.

Currently, LPV includes approximately a total of 126.5 miles of levees and floodwalls. There are approximately 83 miles of armored perimeter levees and floodwalls and approximately 43.5 miles of interior levees and floodwalls. The project reduces the risk of flooding due to a coastal storm with a 1% chance of being exceeded in any given year.
Approximately 20.27 Acres of bottomland hardwood is expected to be impacted from the proposed project.

The USACE-certified Wetland Value Assessment (WVA) Bottomland Hardwood Model (version 1.2) as well as the Hurricane and Storm Risk Reduction System (HSDRRS) for BLH mitigation [LPV & WBV]Mitigation Assumption Guide (Revised/Updated: 3 March 2012) were used to evaluate impacts. Target Years (TY) were set as follow: 0, 1, 20 and 50.

WVA models were previously performed for the proposed West Bank and Vicinity Hurricane Storm Damage and Risk Reduction Re-evaluation. This supplemental PIS addresses revised impacts associated with the clearing of BLH for levee improvement.

Project associated impacts:

LPV

Site	Acres	AAHUs
LPVMRL 1.1	1.88	-0.95
LPVMRL 1.2	8.44	-4.68
LPVMRL 1.3	1.51	-0.77
LPVMRL 1.4	1.44	-0.81
LPVMRL 1.5	7.00	-4.91
Total:	20.27	-12.12

Assumptions for all sites

As a result of the COVID-19 pandemic, field work and site visits were not permitted for Service employees. The USACE agreed to aid the Service in field data collection and perform site visits on September 27, 2020. Not all sites were able to be sampled. To account for this gap in data as well as to supplement and strengthen the current data set, field observations from March 2010 were also used.

Site	Old data set used:	New data set used:
LPVMRL 1.1	MRL-10	LPV-003
LPVMRL 1.2	MRL-10	LPV-003
LPVMRL 1.3	MRL-10	LPV-003
LPVMRL 1.4	MRL-11	LPV-002
LPVMRL 1.5	MRL-13	LPV-001

Variable V_1 – Tree Species Association

FWOP- All sites are expected to see a slight increase in tree species composition by TY20.

Class 1: Less than 25% of overstory canopy consists of mast or other edible-seed producing trees or more than 50% of soft mast present but no hard mast.
Class 2: 25% to 50% of overstory canopy consists of mast or other edible-seed producing trees, but hard mast producers constitute less than 10% of the canopy
Class 3: 25% to 50% of overstory canopy consists of mast or other edible-seed producing trees, and hard mast producers constitute more than 10% of the canopy.
Class 4: Greater than 50% of overstory canopy consists of mast or other edible-seed producing trees, but hard mast producers constitute less than 20% of the canopy.
Class 5: Greater than 50% of overstory canopy consists of mast or other edible-seed producing trees, and hard mast producers constitute more than 20% of the canopy.

FWP class levels were determined as follows for each TY:

Site	TY0-TY10	TY20-TY50
LPVMRL 1.1	Class 2	Class 3
LPVMRL 1.2	Class 2	Class 3
LPVMRL 1.3	Class 2	Class 3
LPVMRL 1.4	Class 2	Class 3
LPVMRL 1.5	Class 4	Class 5

FWP- Trees will be removed for construction of the proposed levee upgrade. Therefore, the lowest value for Tree Species Association (Class 1) was assigned to all sites and for the life of the project.

Variable V_2 – Stand Maturity
FWOP- When the average age of canopy-dominant and canopy-codominant trees is unknown, average tree diameter at breast height (dbh) can be used to determine the Suitability Index for this variable. Canopy-dominant and canopy co-dominant trees are those trees whose crown rises above or is an integral part of the stand's overstory. To account for gaps in the data as well as to supplement and strengthen the current data set, field observations from March 2010 and September 2020 were used. The dbh's gathered from the March 2010 field assessments were grown out 10 years and were then averaged with the September 2020 survey data resulting in a TY0 dbh. Increases in dbh's over time were then estimated using the bottomland hardwood growth calculator developed by the United States Forest Service (Putnam et al. 1960).*

FWP- All trees will be removed for construction of the proposed levee upgrade. We, therefore, assigned the lowest possible value for Stand Maturity (DBH = 0.01") for the life of the proposed project and for all sites.

Variable V_3 – Understory/Midstory
FWOP- Field data collected from the 2010 and 2020 were taken into account for this variable. Each site differed in understory/midstory% for TY0-TY10. HSDRSS assumptions were applied to all locations at TY20-TY50.

TY20-TY50 - Understory = 35% // Midstory = 30%

FWP- All understory and midstory vegetation will be removed for construction of the proposed levee upgrade. We, therefore, assigned the lowest possible value for percent of midstory and understory coverage (0%) for the life of the proposed project and for all sites.

Variable V_4 – Hydrology
All sites are located along the banks of the Mississippi River and are subjected to temporary flooding. Significant changes to the current hydrologic regime are not anticipated to change due to the proposed project and should remain constant for the life of the project and for all sites.

Flooding Duration= High and Flow/Exchange= Temporary.

Variable V_5 – Size of Contiguous Forested Area
FWOP- Corridors over 75 feet wide constitute a break in the forested area contiguity and are considered fragmented. Tracts >500 acres in size are optimal.

Class 1	0 to 5 acres
Class 2	5.1 to 20 acres
Class 3	20.1 to 100 acres
Class 4	100.1 to 500 acres
Class 5	> 500 acres

Sites varied in size of contiguous forested area. Some sites had optimal contiguity, offering higher quality habitat. While other sites lacked forested habitat and created a fragmented nature of the surrounding land cover. Conditions are assumed to remain constant throughout all target years.

FWOP conditions are as follows:

Site	Forest Size
LPVMRL 1.1	Class 1
LPVMRL 1.2	Class 3
LPVMRL 1.3	Class 1
LPVMRL 1.4	Class 3
LPVMRL 1.5	Class 4

*Sites were evaluated using information gathered from observations made during field assessments, and from computer-based GIS calculations and Google Earth imagery.

FWP- The proposed project area will be cleared, converting all of its forested area to dirt and mowed grass. Though adjacent forests will likely remain intact, they will not provide benefits to the proposed project site that are typically attributed to contiguous forested systems (because it is now mowed grass, and not forested). Accordingly, once the project is constructed, the project site will provide minimal to no benefits (Class 1) associated with forest contiguity.

Variable V_6 – Suitability and Traversability of Surrounding Land Uses
To measure the effects of surrounding land use, a 0.5 mile buffer was created around the perimeter of the site. Utilizing Google Earth imagery, and previous field data collected and processed through Arc GIS estimates were determined for land use. Existing conditions are not expected to change through the life of the project and will remain constant for the FWOP and FWP (see attached WVAs).

Suitability weighting factor:

Land Use	Weighting Factor		% of 0.5 mile circle		Weighted Percent
Bottomland hardwood, other forested areas, marsh habitat, etc.	1.0	X		=	
Abandoned agriculture, overgrown fields, dense cover, etc.	0.6	X		=	
Pasture, hayfields, etc.	0.4	X		=	
Active agriculture, open water	0.2	X		=	
Nonhabitat: linear, residential, commercial, industrial development, etc.	0.01	X		=	
					___ /100 = SI

Variable V_7 – Disturbance
The effect of disturbance is a factor of the average distance and the type of disturbance and therefore both are factored into the SI formula. Existing conditions are not expected to change through the life of the project and will remain constant for the FWOP and FWP.

Distance Class	Disturbance Type Class
Class 1. 0 to 50 ft.	**Class 1.** Constant/Major. (Major highways, industrial, commercial, major navigation.)
Class 2. 50.1 to 500 ft.	**Class 2.** Frequent/Moderate. (Residential development, moderately used roads, waterways commonly used by small to mid-sized boats).
Class 3. > 500 ft.	**Class 3.** Seasonal/Intermittent. (Agriculture, aquaculture.)
	Class 4. Insignificant. (Lightly Used roads and waterways, individual homes, levees, rights of way).

Disturbance Type:
LPVMRL 1.1: Distance Class 1 and Type Class 2
LPVMRL 1.2: Distance Class 1 and Type Class 2
LPVMRL 1.3: Distance Class 1 and Type Class 2
LPVMRL 1.4: Distance Class 1 and Type Class 2
LPVMRL 1.5: Distance Class 1 and Type Class 2

Work cited

*Putnam, J.A., G.M. Furnival, and J.S. McKnight. 1960. Management and inventory of southern hardwoods. Agricultural Handbook No. 181. U.S. Department of Agriculture, Forest Service publication. 102pp.

4 ESSENTIAL FISH HABITAT COMPLIANCE 7 FEB 2020

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701-5505
http://sero.nmfs.noaa.gov

February 7, 2020 F/SER46/CG:jbh
225/380-0078

Mr. Bradley Drouant, P.E.
U.S. Army Corps of Engineers, New Orleans District (CEMVN-PMO-L)
7400 Leake Avenue (Room 36)
New Orleans, Louisiana 701118

Dear Mr. Drouant:

NOAA's National Marine Fisheries Service (NMFS) has received the draft West Bank and Vicinity (WBV), Louisiana General Re-Evaluation Report with Integrated Environmental Impact Statement (WBV EIS), and the Lake Pontchartrain and Vicinity (LPV) Louisiana General Re-Evaluation Report with Integrated Environmental Impact Statement (LPV EIS); both dated December 8, 2019, provided by the U.S. Army Corps of Engineers, New Orleans District (USACE). The Tentatively Selected Plan (TSP) for the WBV project EIS consists of 52 miles of levee lift and 0.9 miles of floodwall modification and replacements, located along the west bank on the Mississippi River in the Greater New Orleans Area. The LPV TSP consists of 50 miles of levee lifts and 19 miles of floodwall modifications and replacements, located along the east bank on the Mississippi River in the Greater New Orleans Area. The two projects are to be constructed as-needed before the combined effects of consolidation, settlement, subsidence, and sea level rise reduce elevation below the required design elevations. The final reports are scheduled to be released in 2021. The USACE's initial determination is that the projects will not have a substantial adverse effect on essential fish habitat (EFH) and requests concurrence with this determination. The following is provided in accordance with provisions of the Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq.) and 600.920 of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act; P.L. 104-297).

Descriptions of EFH in the Project Areas
The NMFS agrees with the descriptions of essential fish habitat (EFH) and federally managed fishery resources described in Section 4.7 of the WBV EIS, and Section 4.9 of the draft LPV EIS. Detailed information on EFH for federally managed fishery species is provided in the 2005 generic amendment of the Fishery Management Plans for the Gulf of Mexico prepared by the Gulf of Mexico Fishery Management Council. The generic amendment was prepared as required by the Magnuson-Stevens Act; P.L. 104-297.

WBV EIS Discussion
Section 7.7 of the draft WBV EIS states negligible long-term direct construction-related impacts on fisheries and aquatic habitat are anticipated due to levee lifts and floodwall raises. Potential direct effect on fisheries would be associated with the placement of 5.6 acres of foreshore protection in reaches WBV-90 and WBV-12. Foreshore protection would be placed along the Gulf Intracoastal Waterway and Hero Canal to bring existing foreshore protection back up to the proper elevation. The placement of rock would be on top of existing rock and is therefore not expected to impact any wetland vegetation or EFH.

LPV EIS Discussion
Dredging of access channels, adjacent stockpiling, and placement of stone foreshore protection along the shore of Lake Pontchartrain would disturb 212.5 acres of lake bottom and would permanently impact 75.1 acres of shallow lake bottom habitat. Potential impacts to submerged aquatic vegetation (SAV) beds in Lake Pontchartrain would be avoided, through the utilization of pre-construction surveys that would be required to delineate existing SAV and facilitate avoidance of impacts. SAV surveys and avoidance of impacts would be included in construction contract solicitation language; therefore, impacts to EFH would be minimal given these measures.

With inclusion of the aforementioned SAV avoidance measures in the final LPV EIS, WBV EIS, and construction contract solicitation language; the NMFS does not object to the maintenance projects as proposed. This concludes the New Orleans District's responsibilities to meet the requirements of 50 CFR 600.920(k).

Thank you for the opportunity to provide comments on these projects. Related questions or comments should be directed to the attention of Craig Gothreaux at 5757 Corporate Boulevard, Baton Rouge, Louisiana 70808; he may also be reached by telephone at 225-380-0078, or by e-mail at Craig.Gothreaux@noaa.gov.

Sincerely,

Virginia M. Fay

Virginia M. Fay
Assistant Regional Administrator
Habitat Conservation Division

c:
USACE, Runyon, McCain
FWS, Walther
EPA, Gutierrez
LDWF, Balkum
LDNR, Morgan
F/SER46, Swafford, Howard
F/SER4, Dale
Files

5 COASTAL ZONE MANAGMENET ACT COMPLIANCE – CONSISTENCY DETERMINATION DECEMBER 2019

INTRODUCTION

Section 307 of the Coastal Zone Management Act of 1972, 16 U.S.C. 1451 et. seq. requires that "each federal agency conducting or supporting activities directly affecting the coastal zone shall conduct or support those activities in a manner which is, to the maximum extent practicable, consistent with approved state management programs." In accordance with Section 307, a Consistency Determination has been prepared for the proposed Lake Pontchartrain and Vicinity General Reevaluation Report. The USACE is preparing the study under the authority of Section 3017 of WRRDA 2014. Public Law 115-123 (Bipartisan Budget Act of 2018) funded the study as a new start. The proposed action is located in St. Charles, Jefferson, Orleans, and St. Bernard parishes in southeast Louisiana (Figure 1).

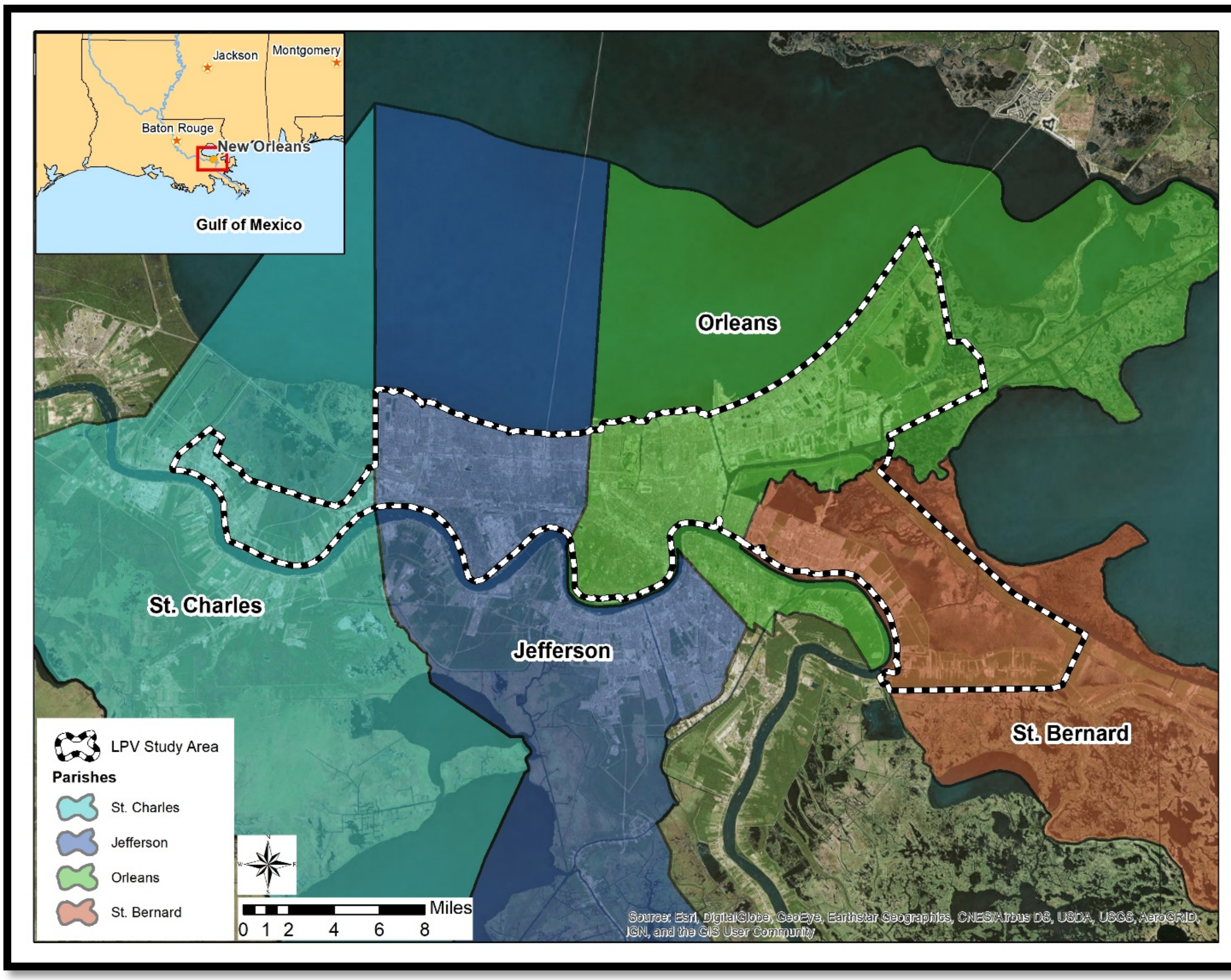


Figure 7. Location of the Study Area in relation to parishes.

PURPOSE OF AND NEED FOR THE PROPOSED ACTION

Southeast Louisiana, including the Greater New Orleans area, is generally characterized by weak soils, general subsidence, and the global incidence of sea level rise that will cause levees to require future lifts to sustain performance of the system. The project authority did not provide for future lifts. Absent future levee lifts to offset consolidation, settlement, subsidence, and sea level rise, risk to life and property in the Greater New Orleans area will progressively increase. The LPV study seeks to determine if the work necessary to sustain the 1% level of risk reduction is technically feasible, environmentally acceptable, and economically justified. A positive determination would make construction of future levee lifts eligible for future budget requests.

DESCRIPTION OF THE PROPOSED ACTION

The LPV project includes features in four parishes (St. Charles, Jefferson, Orleans, and St. Bernard) located in the greater New Orleans area on the east bank of the Mississippi River. Currently, LPV contains a total of approximately 126.5 miles of levees and floodwalls. There are approximately 83 miles of armored perimeter levees and floodwalls and approximately 43.5 miles of interior levees and floodwalls. The project is in a high-density residential and commercial area. The proposed action would include lifts to existing levees, raising of existing flood walls, placement of foreshore protection in existing foreshore protection locations along the shore of Lake Pontchartrain, and construction access dredging for placement of foreshore protection.

The proposed levee lifts would occur along the alignment of the existing levees. The proposed floodwall increases would occur within the existing floodwall footprints. The proposed foreshore protection would also be placed within the existing footprint of the foreshore protection along the Lake Pontchartrain shoreline. Construction access dredging and adjacent temporary stockpiling would be required to provide adequate depth for construction equipment to reach the Lake Pontchartrain shoreline. Construction access channels and adjacent stockpile locations would be returned to pre-construction elevations subsequent to construction completion. See Figure 2 for feature locations.

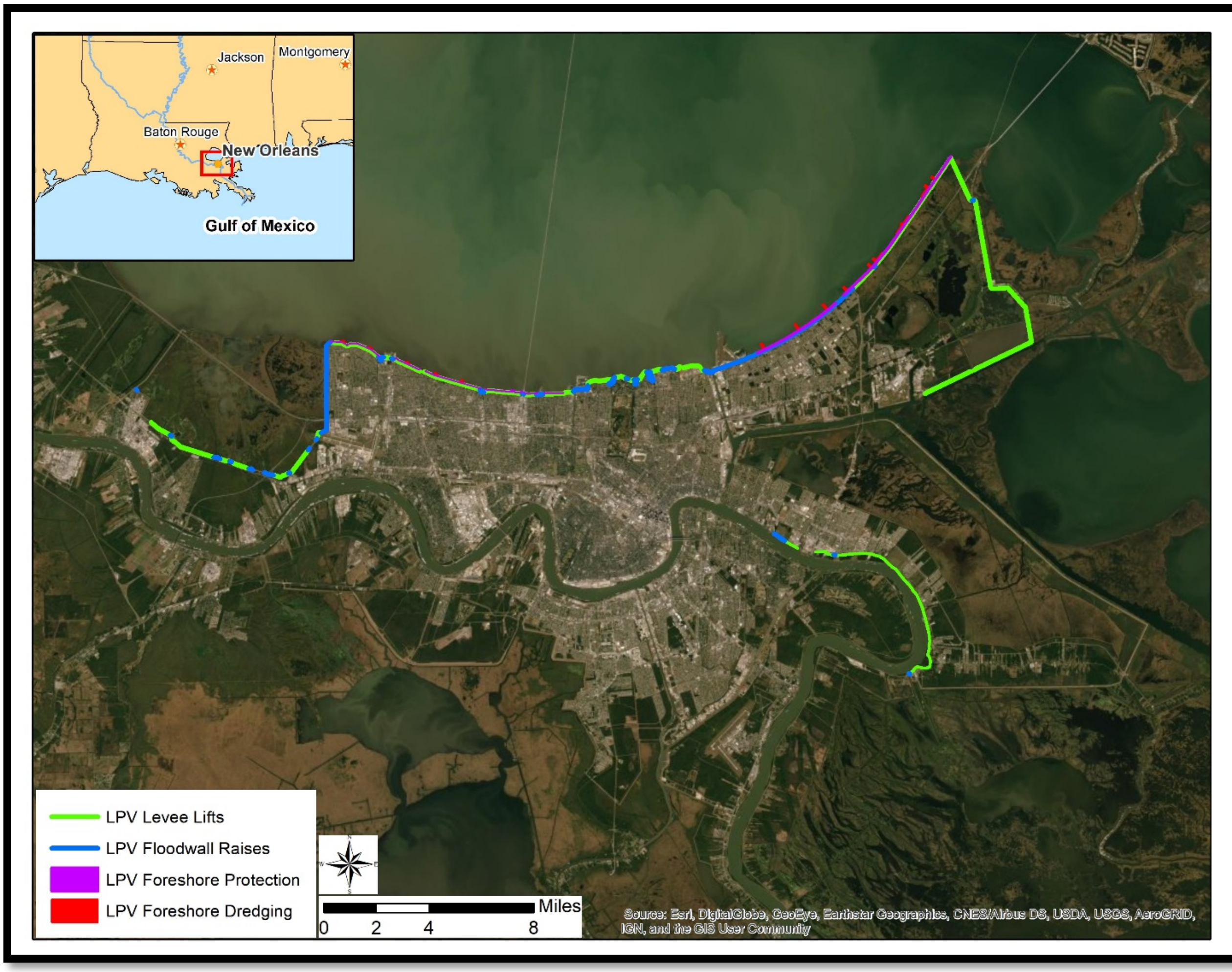


Figure 8. Proposed Action feature locations.

Construction would not be expected to commence until 2021 at the earliest and would be dependent upon congressional authorization and appropriations. Levee lifts would be conducted in multiple lifts over the course of the 50-year period of analysis. Lift schedules would vary by location and by the corresponding rates of subsidence. Floodwall lifts would only occur once per location but the timing would vary.

Placement of the stone foreshore protection along the shoreline of Lake Pontchartrain would result in filling approximately 75.1 acres of aquatic habitat. However, the stone would be placed on the existing foreshore protection footprint to bring it back up to the required elevation. Stone would be transported by barge to the project area. Stone would be placed by crane-operated skip-pan, dragline bucket, clamshell, rock-bucket, hydraulic excavator, trackhoe, or other similar equipment.

Construction access dredging and associated temporary stockpiling would impact approximately 212.5 acres of aquatic habitat. This impact would be temporary as areas would be returned to pre-project conditions after construction. Material would be dredged from the bed of Lake Pontchartrain with a bucket dredge. Construction access channels would consist of parallel channels at the shoreline in areas where rock would be placed as well as perpendicular access channels to allow access to the shoreline channels (see Figure 2). The dimensions required for barge access channels would be approximately -7 feet depth with 100-foot bottom width. Perpendicular access channels would begin at the elevation -7 ft contour of the lake and extend 400 to 1600 ft. Adjacent dredged material stockpile sites would be 150 ft wide.

GUIDELINES

The following guidelines are used to review a proposed coastal use for compliance with the CZMA through the Louisiana Coastal Resources Program administered by the Louisiana Department of Natural Resources. Reviewing all these guidelines is required for making a decision as to whether or not the proposed action complies with the guidelines, and all applicable guidelines must be considered.

GUIDELINES APPLICABLE TO ALL USES

Guideline 1.1 The guidelines must be read in their entirety. Any proposed use may be subject to the requirements of more than one guideline or section of guidelines and all applicable guidelines must be complied with.

Guideline 1.2 Conformance with applicable water and air quality laws, standards and regulations, and with those other laws, standards and regulations which have been incorporated into the coastal resources program shall be deemed in conformance with the program except to the extent that these guidelines would impose additional requirements.

Guideline 1.3 The guidelines include both general provisions applicable to all uses and specific provisions applicable only to certain types of uses. The general guidelines apply in all situations. The specific guidelines apply only to the situations they address. Specific and general guidelines should be interpreted to be consistent with each other. In the event there is an inconsistency, the specific should prevail.

Guideline 1.4 These guidelines are not intended to nor shall they be interpreted so as to result in an involuntary acquisition or taking of property.

Guideline 1.5 No use or activity shall be carried out or conducted in such a manner as to constitute a violation of the terms of a grant or donation of any lands or water-bottoms to the State or any subdivision thereof. Revocations of such grants and donations shall be avoided.

Guideline 1.6 Information regarding the following general factors shall be utilized by the permitting authority in evaluating whether the proposed use is in compliance with the guidelines.

a) type, nature and location of use.

b) elevation, soil and water conditions and flood and storm hazard characteristics of site.

c) techniques and materials used in construction, operation and maintenance of use.

d) existing drainage patterns and water regimes of surrounding area including flow, circulation, quality, quantity and salinity; and impacts on them.

e) availability of feasible alternative sites or methods – for implementing the use.

f) designation of the area for certain uses as part of a local program.

g) economic need for use and extent of impacts of use on economy of locality.

h) extent of resulting public and private benefits.

i) extent of coastal water dependency of the use.

j) existence of necessary infrastructure to support the use and public costs resulting from use.

k) extent of impacts on existing and traditional uses of the area and on future uses for which the area is suited.

l) proximity to, and extent of impacts on important natural features such as beaches, barrier islands, tidal passes, wildlife and aquatic habitats, and forest lands.

m) the extent to which regional, state and national interests are served including the national interest in resources and the siting of facilities in the coastal zones as identified in the coastal resources program.

n) proximity to, and extent of impacts on, special areas, particular areas, or other areas of particular concern of the state program or local programs.

o) likelihood of, and extent of impacts of, resulting secondary impacts and cumulative impacts.

p) proximity to and extent of impacts on public lands or works, or historic, recreational or cultural resources.

q) extent of impacts on navigation, fishing, public access, and recreational opportunities.

r) extent of compatibility with natural and cultural setting.

s) extent of long term benefits or adverse impacts.

Guideline 1.7 It is the policy of the coastal resources program to avoid the following adverse impacts. To this end, all uses and activities shall be planned, sited, designed, constructed, operated and maintained to avoid to the maximum extent practicable significant:

a) reductions in the natural supply of sediment and nutrients to the coastal system by alterations of freshwater flow.

b) adverse economic impacts on the locality of the use and affected governmental bodies.

c) detrimental discharges of inorganic nutrient compounds into coastal waters.

d) alterations in the natural concentration of oxygen in coastal waters.

e) destruction or adverse alterations of streams, wetland, tidal passes, inshore waters and waterbottoms, beaches, dunes, barrier islands, and other natural biologically valuable areas or protective coastal features.

f) adverse disruption of existing social patterns.

g) alterations of the natural temperature regime of coastal waters.

h) detrimental changes in existing salinity regimes.

i) detrimental changes in littoral and sediment transport processes.

j) adverse effects of cumulative impacts.

k) detrimental discharges of suspended solids into coastal waters, including turbidity resulting from dredging.

l) reductions or blockage of water flow or natural circulation patterns within or into an estuarine system or a wetland forest.

m) discharges of pathogens or toxic substances into coastal waters.

n) adverse alteration or destruction of archaeological, historical, or other cultural resources.

o) fostering of detrimental secondary impacts in undisturbed or biologically highly productive wetland areas.

p) adverse alteration or destruction of unique or valuable habitats, critical habitat for endangered species, important wildlife or fishery breeding or nursery areas, designated wildlife management or sanctuary areas, or forestlands.

q) adverse alteration or destruction of public parks, shoreline access points, public works, designated recreation areas, scenic rivers, or other areas of public use and concern.

r) adverse disruptions of coastal wildlife and fishery migratory patterns.

s) land loss, erosion and subsidence.

t) increases in the potential for flood, hurricane or other storm damage, or increases in the likelihood that damage will occur from such hazards.

u) reductions in the long-term biological productivity of the coastal ecosystem.

Guideline 1.8 In those guidelines in which the modifier "maximum extent practicable" is used, the proposed use is in compliance with the guideline if the standard modified by the term is complied with. If the modified standard is not complied with, the use will be in compliance with the guideline if the permitting authority finds, after a systematic consideration of all pertinent information regarding the use, the site and the impacts of the use as set forth in guideline 1.6, and a balancing of their relative significance, that the benefits resulting from the proposed use would clearly outweigh the adverse impacts resulting from non-compliance with the modified standard and there are no feasible and practical alternative locations, methods and practices for the use that are in compliance with the modified standard and:

a) significant public benefits will result from the use, or;

b) the use would serve important regional, state or national interests, including the national interest in resources and the siting of facilities in the coastal zone identified in the coastal resources program, or;

c) the use is coastal water dependent.

The systematic consideration process shall also result in a determination of those conditions necessary for the use to be in compliance with the guideline. Those conditions shall assure that the use is carried out utilizing those locations, methods and practices which maximize conformance to the modified standard; are technically, economically, environmentally, socially and legally feasible and practical and minimize or offset those adverse impacts listed in guideline 1.7 and in the guideline at issue.

Guideline 1.9 Uses shall to the maximum extent practicable be designed and carried out to permit multiple concurrent uses which are appropriate for the location and to avoid unnecessary conflicts with other uses of the vicinity.

Guideline 1.10 These guidelines are not intended to be, nor shall they be, interpreted to allow expansion of governmental authority beyond that established by La. R.S. 49:213.1 through 213.21, as amended; nor shall these guidelines be interpreted so as to require permits for specific uses legally commenced or established prior to the effective date of the coastal use permit program nor to normal maintenance or repair of such uses.

Response: These guidelines are acknowledged and have been addressed through the preparation of responses to the guidelines contained within the specific use categories below.

GUIDELINES FOR LEVEES

Guideline 2.1 The leveeing of unmodified or biologically productive wetlands shall be avoided to the maximum extent practicable.

Response: The project involves raising existing levees and floodwalls. Construction activities would occur along the alignment of existing levees and floodwalls. As a result, most impacts to wetlands would be avoided. However, potential wetland impacts would occur with lifts associated with Mississippi River levees due to the necessity to expand the levees to the flood side, thereby impacting bottomland hardwood-wet habitat (Figure 3). These impacts would be avoided to the maximum extent practicable but would be unavoidable in some locations due to infrastructure on the protected side of the levees. Jurisdictional wetlands would be avoided when designating borrow sites and as a result no impacts to wetlands are anticipated.

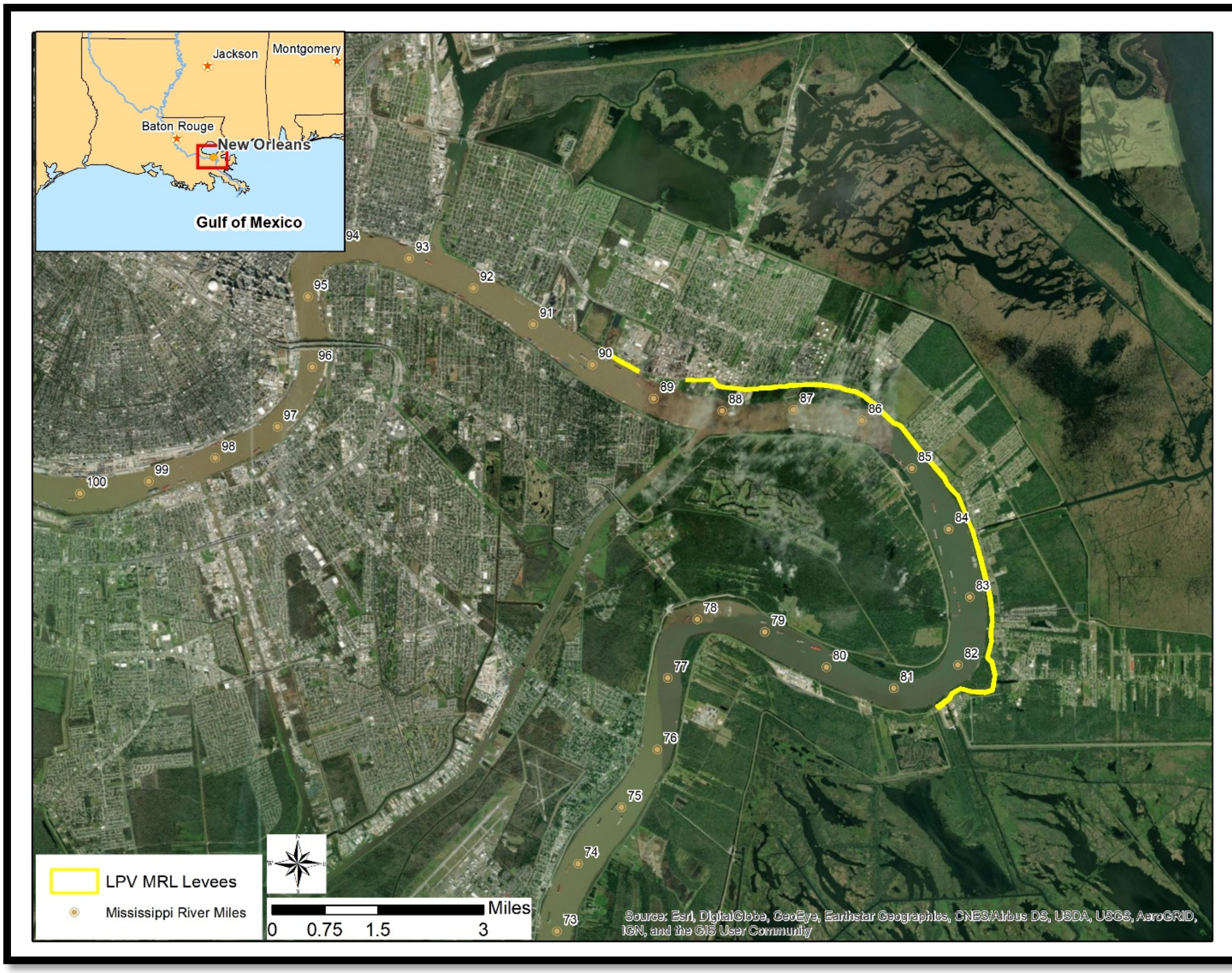


Figure 9. Location of Mississippi River levee lifts.

Guideline 2.2 Levees shall be planned and sited to avoid segmentation of wetland areas and systems to the maximum extent practicable.

Response: The project involves raising existing levees and floodwalls. Construction activities would occur along the alignment of existing levees and floodwalls and as a result no new segmentation of wetland areas and systems is anticipated.

Guideline 2.3 Levees constructed for the purpose of developing or otherwise changing the use of a wetland area shall be avoided to the maximum extent practicable.

Response: The project involves raising existing levees and floodwalls to maintain the authorized level of coastal storm risk reduction. Large sections of the project area are heavily developed for urban and industrial uses, but undeveloped wetlands are abundant in some areas. Wetlands that remain within the project area are subject to local, state, and federal permitting and zoning requirements including the Coastal Zone Management Program and the regulatory procedures of the Clean Water Act. Local, state, and federal interests would be responsible for regulating land development and, therefore, for defining mitigation requirements. Development and change of use would be regulated through these programs.

Guideline 2.4 Hurricane and flood protection levees shall be located at the non-wetland/wetland interface or landward to the maximum extent practicable.

Response: The project involves raising existing levees and floodwalls. Construction activities would occur along the alignment of existing levees and floodwalls and as a result no new impacts to wetlands are anticipated in the footprint of the levees or floodwalls or associated construction areas. In areas where an expansion of the levee footprint is required, wetland impacts would be avoided to the maximum extent practicable. In some areas of Mississippi River levees, a floodside shift and associated wetland impacts are unavoidable (Figure 3).

Guideline 2.5 Impoundment levees shall only be constructed in wetland areas as part of approved water or marsh management projects or to prevent release of pollutants.

Response: Not applicable

Guideline 2.6 Hurricane or flood protection levee systems shall be designed, built and thereafter operated and maintained utilizing best practical techniques to minimize disruptions of existing hydrologic patterns, and the interchange of water, beneficial nutrients and aquatic organisms between enclosed wetlands and those outside the levee system.

Response: The project involves raising existing levees and floodwalls to maintain the authorized level of coastal storm risk reduction. Construction activities would occur along the alignment of existing levees and floodwalls and no changes to existing hydrologic patterns or the interchange of water, beneficial nutrients, or aquatic organisms are anticipated.

GUIDELINES FOR LINEAR FACILITIES

Guideline 3.1 Linear use alignments shall be planned to avoid adverse impacts on areas of high biological productivity or irreplaceable resource areas.

Response: The project involves raising existing levees and floodwalls to maintain the authorized level of coastal storm risk reduction and, therefore, would utilize existing linear corridors for construction. No impacts to areas of high biological productivity or irreplaceable resources are anticipated.

Guideline 3.2 Linear facilities involving the use of dredging or filling shall be avoided in wetland and estuarine areas to the maximum extent practicable.

Response: The project involves raising existing levees and floodwalls to maintain the authorized level of coastal storm risk reduction and, therefore, would utilize existing linear corridors for levee construction. However, water-based construction would be required for construction of the foreshore protection along the shore of Lake Pontchartrain. In order to allow construction equipment to access the shoreline, construction access channels would be dredged and dredged material would be temporarily stockpiled adjacent to the channels. Construction access channels and stockpile areas would be brought back to original elevations subsequent to completion of construction activities. In addition, rock foreshore protection would be placed on top of existing foreshore protection in Lake Pontchartain to bring the stone back up to the required elevation for proper levee protection. See Figures 4 and 5 below for foreshore protection and construction access dredging areas.

Coastal Zone Management Act compliance

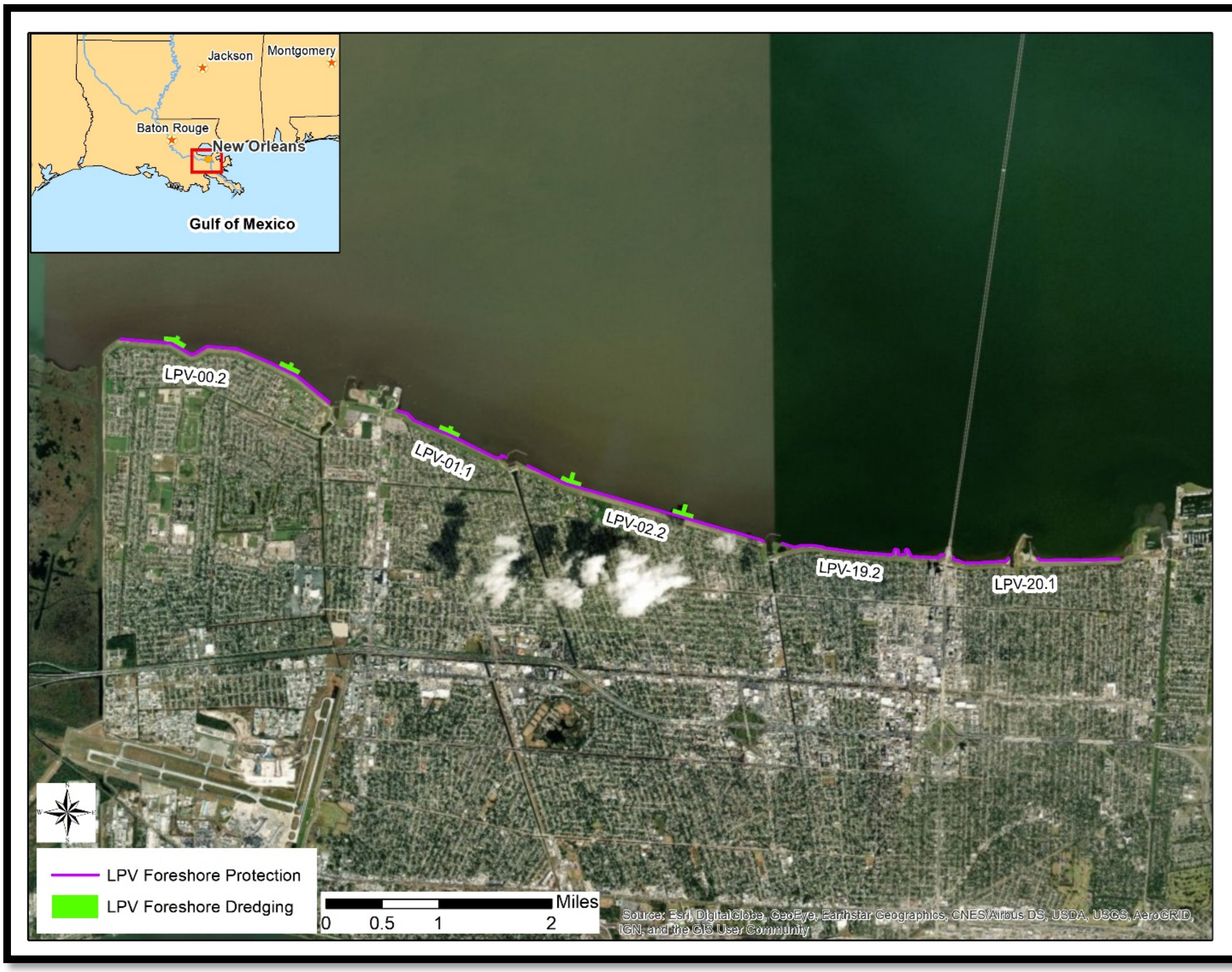


Figure 10. Foreshore protection placement and construction access dredging areas.

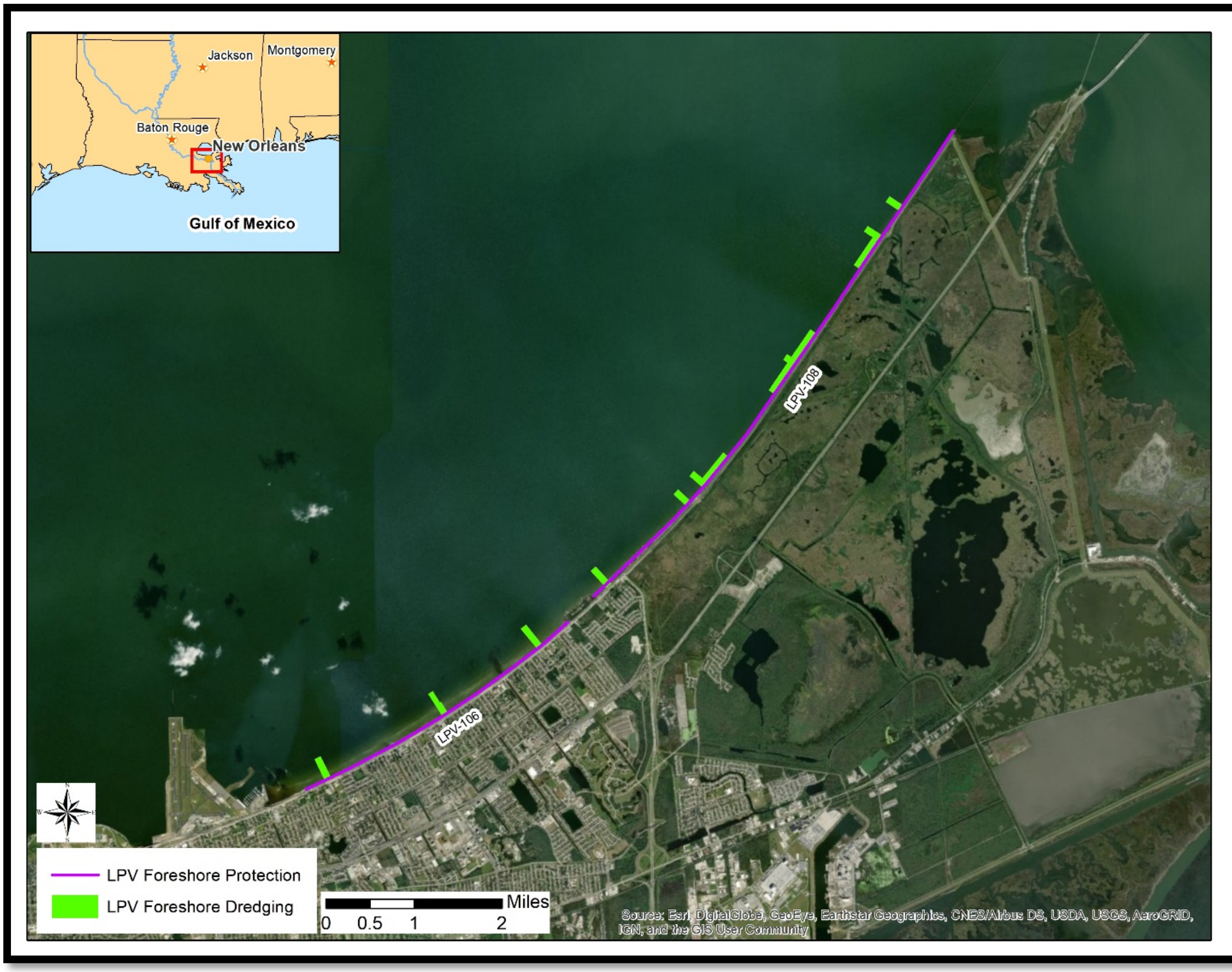


Figure 11. Foreshore protection placement and construction access dredging areas.

Guideline 3.3 Linear facilities involving dredging shall be of the minimum practical size and length.

Response: Dredging to provide access for construction activities along the Lake Pontchartrain shoreline would be of the minimum practical size and length to allow barge and tow access to the shoreline.

Guideline 3.4 To the maximum extent practicable, pipelines shall be installed through the "push ditch" method and the ditch backfilled.

Response: Not applicable.

Guideline 3.5 Existing corridors, rights-of-way, canals, and streams shall be utilized to the maximum extent practicable for linear facilities.

Response: The use of existing corridors and rights-of-way has been and would continue to be implemented throughout the design and construction process.

Guideline 3.6 Linear facilities and alignments shall be, to the maximum extent practicable, designed and constructed to permit multiple uses consistent with the nature of the facility.

Response: Existing linear corridors would be used and would be designed and constructed to permit multiple uses consistent with the existing nature of the facilities.

Guideline 3.7 Linear facilities involving dredging shall not traverse or adversely affect any barrier island.

Response: Not applicable.

Guideline 3.8 Linear facilities involving dredging shall not traverse beaches, tidal passes, protective reefs or other natural gulf shoreline unless no other alternative exists. If a beach, tidal pass, reef or other natural gulf shoreline must be traversed for a non-navigation canal, they shall be restored at least to their natural condition immediately upon completion of construction. Tidal passes shall not be permanently widened or deepened except when necessary to conduct the use. The best available restoration techniques which improve the traversed area's ability to serve as a shoreline shall be used

Response: Not applicable.

Guideline 3.9 Linear facilities shall be planned, designed, located and built using the best practical techniques to minimize disruption of natural hydrologic and sediment transport patterns, sheet flow, and water quality, and to minimize adverse impacts on wetlands.

Response: The project involves raising existing levees and floodwalls to maintain the authorized level of coastal storm risk reduction and, therefore, would utilize existing linear corridors for construction. The project also involves placement of foreshore protection and associated construction access dredging in Lake Pontchartrain. Minor, short-term, impacts on water quality from construction activities may include decreased dissolved oxygen levels in the waters immediately surrounding the construction site, increased turbidity due to construction runoff and sedimentation, and increased water body temperature due to increased suspended solids produced during construction that could absorb incident solar radiation. Temporary, minor water quality impacts could occur due to increased nutrient loading, miscellaneous debris, and accidental spills from construction equipment. Impacts would be minimized by use of silt curtains and other best management practices. Prior to construction, the National Pollutant Discharge Elimination System (NPDES) permit process would be completed and a General Stormwater Permit would be required. Contractors would need a site-specific Spill Prevention, Control and Countermeasure Plan (SPCCP) in place prior to the start of construction. After construction, conditions would be expected to stabilize and return to conditions similar to pre-construction. No new impacts to wetlands are anticipated in the footprint of the levees or floodwalls or associated construction areas. However, potential wetland impacts would occur with lifts associated with Mississippi River levees due to the necessity to expand the levees to the flood side, thereby impacting bottomland hardwood-wet habitat (Figure 3). These impact would be avoided to the maximum extent practicable but would be unavoidable in some locations due to infrastructure on the protected side of the levees.

Guideline 3.10 Linear facilities shall be planned, designed, and built using the best practical techniques to prevent bank slumping and erosion, saltwater intrusion, and to minimize the potential for inland movement of storm-generated surges. Consideration shall be given to the use of locks in navigation canals and channels which connect more saline areas with fresher areas.

Response: The levees and floodwalls of the existing system and the proposed levee and floodwall raises are designed to protect again storm events, specifically storm generated surges and related saltwater intrusion and are designed using best practical techniques to prevent bank slumping and erosion. No modifications to navigation locks are proposed.

Guideline 3.11 All non-navigation canals, channels, and ditches which connect more saline areas with fresher areas shall be plugged at all waterway crossings and at intervals between crossings in order to compartmentalize them. The plugs shall be properly maintained.

Response: Not applicable.

Guideline 3.12 The multiple use of existing canals, directional drilling, and other practical techniques shall be utilized to the maximum extent practicable to minimize the number and size of access canals, to minimize changes of natural systems and to minimize adverse impacts on natural areas and wildlife and fisheries habitat.

Response: Not applicable.

Guideline 3.13 All pipelines shall be constructed in accordance with parts 191, 192, and 195 of Title 49 of the Code of Federal Regulations, as amended, and in conformance with the Commissioner of Conservation's Pipeline Safety Rules and Regulations and those safety requirements established by La. R. S. 45:408, whichever would require higher standards.

Response: Not applicable.

Guideline 3.14 Areas dredged for linear facilities shall be backfilled or otherwise restored to the pre-existing conditions upon cessation of use for navigation purposes to the maximum extent practicable.

Response: Construction access channels and stockpile areas in Lake Pontchartrain would be brought back to original elevations subsequent to completion of construction activities.

Guideline 3.15 The best practical techniques for site restoration and re-vegetation shall be utilized for all linear facilities.

Response: Re-vegetation through the establishment of turf is required for all levee and floodwall reaches. Along levee and floodwall alignments, vegetation-free zones and root-free zones are maintained to ensure that safety, structural integrity, and functionality are retained and accessibility for maintenance, inspection, monitoring, and flood-fighting are retained per Engineering Technical Letter No. 1110-2-583: Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures.

Guideline 3.16 Confined and dead end canals shall be avoided to the maximum extent practicable. Approved canals must be designed and constructed using the best practical techniques to avoid water stagnation and eutrophication.

Response: Not applicable.

GUIDELINES FOR DREDGED MATERIAL DEPOSITION

Guideline 4.1 Spoil shall be deposited utilizing the best practical techniques to avoid disruption of water movement, flow, circulation and quality.

Response: Impacts would be minimized by use of silt curtains and other best management practices. Prior to construction, the National Pollutant Discharge Elimination System (NPDES) permit process would be completed and a General Stormwater Permit would be required.

Contractors would need a site-specific Spill Prevention, Control and Countermeasure Plan (SPCCP) in place prior to the start of construction. After construction, conditions would be expected to stabilize and return to conditions similar to pre-construction.

Guideline 4.2 Spoil shall be used beneficially to the maximum extent practicable to improve productivity or create new habitat, reduce or compensate for environmental damage done by dredging activities, or prevent environmental damage. Otherwise, existing spoil disposal areas or upland disposal shall be utilized to the maximum extent practicable rather than creating new disposal areas.

Response: Temporary dredged material stockpile areas would be located immediately adjacent to dredged construction access channels. Construction access channels and stockpile areas would be brought back to original elevations subsequent to completion of construction activities.

Guideline 4.3 Spoil shall not be disposed of in a manner which could result in the impounding or draining of wetlands or the creation of development sites unless the spoil deposition is part of an approved levee or land surface alteration project.

Response: Acknowledged.

Guideline 4.4 Spoil shall not be disposed of on marsh, known oyster or clam reefs or in areas of submersed vegetation to the maximum extent practicable.

Response: Construction access channels and temporary dredged material stockpile areas would not impact marsh, oyster reefs, or clam reefs. Submerged aquatic vegetation is limited along the south shore of Lake Pontchartrain. Construction access channels and associated stockpile areas would be located so as to avoid any potential impacts. Pre-construction surveys would be required to delineate existing SAV to facilitate avoidance of impacts. SAV surveys and avoidance of impacts would be included in construction contract solicitation language.

Guideline 4.5 Spoil shall not be disposed of in such a manner as to create a hindrance to navigation or fishing, or hinder timber growth.

Response: Acknowledged.

Guideline 4.6 Spoil disposal areas shall be designed and constructed and maintained using the best practical techniques to retain the spoil at the site, reduce turbidity, and reduce shoreline erosion when appropriate.

Response: Impacts would be minimized by use of silt curtains and other best management practices. Prior to construction, the National Pollutant Discharge Elimination System (NPDES) permit process would be completed and a General Stormwater Permit would be required. Contractors would need a site-specific Spill Prevention, Control and Countermeasure Plan (SPCCP) in place prior to the start of construction. After construction, conditions would be expected to stabilize and return to conditions similar to pre-construction.

Guideline 4.7 The alienation of state-owned property shall not result from spoil deposition activities without the consent of the Department of Natural Resources.

Response: Acknowledged.

GUIDELINES FOR SHORELINE MODIFICATION

Guideline 5.1 Non-structural methods of shoreline protection shall be utilized to the maximum extent practicable.

<u>Guideline 5.2</u> Shoreline modification structures shall be designed and built using best practical techniques to minimize adverse environmental impacts.

<u>Guideline 5.3</u> Shoreline modification structures shall be lighted or marked in accordance with U.S. Coast Guard regulations, not interfere with navigation, and should foster fishing, other recreational opportunities, and public access.

<u>Guideline 5.4</u> Shoreline modification structures shall be built using best practical materials and techniques to avoid the introduction of pollutants and toxic substances into coastal waters.

<u>Guideline 5.5</u> Piers and docks and other harbor structures shall be designed and built using best practical techniques to avoid obstruction of water circulation.

<u>Guideline 5.6</u> Marinas, and similar commercial and recreational developments shall to the maximum extent practicable not be located so as to result in adverse impacts on open productive oyster beds, or submersed grass beds.

<u>Guideline 5.7</u> Neglected or abandoned shoreline modification structures, piers, docks, mooring and other harbor structures shall be removed at the owner's expense, when appropriate.

<u>Guideline 5.8</u> Shoreline stabilization structures shall not be built for the purpose of creating fill areas for development unless part of an approved surface alteration use.

<u>Guideline 5.9</u> Jetties, groins, breakwaters and similar structures shall be planned, designed and constructed so as to avoid to the maximum extent practicable downstream land loss and erosion.

Response to Guidelines for Shoreline Modification: The proposed foreshore protection features along the Lake Pontchartrain shoreline are designed to protect project features from erosion and wave impacts and would be designed and built using the best practical techniques to minimize adverse environmental impacts and to avoid introduction of pollutants. Non-structural measures and nature-based features were considered in plan formulation (See Chapter 6 of main report). Nature-based measures were screened out. Marsh creation was screened out due to the high cost per acre of this measure for a low effect. The dunes/beach measure was screened out because the measure would be located too far from the study area to be effective. Non-structural measures (buyouts, floodproofing, risk communication, and elevation) and could be included as part of any of the structural plans. The solely non-structural alternative part of the final array of alternatives considered; however it was screened (Section 6.7.1.3) because it was not considered complete, effect, or efficient.

GUIDELINES FOR SURFACE ALTERATIONS

<u>Guideline 6.1</u> Industrial, commercial, urban, residential, and recreational uses are necessary to provide adequate economic growth and development. To this end, such uses will be encouraged in those areas of the coastal zone that are suitable for development. Those uses shall be consistent with the other guidelines and shall, to the maximum extent practicable, take place only:

a) on lands five feet or more above sea level or within fast lands; or

b) on lands which have foundation conditions sufficiently stable to support the use, and where flood and storm hazards are minimal or where protection from these hazards can be reasonably well achieved, and where the public safety would not be unreasonably endangered; and

1) the land is already in high intensity of development use, or
2) there is adequate supporting infrastructure, or
3) the vicinity has a tradition of use for similar habitation or development

Response: Acknowledged

Guideline 6.2 Public and private works projects such as levees, drainage improvements, roads, airports, ports, and public utilities are necessary to protect and support needed development and shall be encouraged. Such projects shall, to the maximum extent practicable, take place only when:

a) they protect or serve those areas suitable for development pursuant to Guideline 6.1; and
b) they are consistent with the other guidelines; and
c) they are consistent with all relevant adopted state, local and regional plans.

Response: Acknowledged. The project protects the Greater New Orleans Area, an area with significant existing urban and commercial development.

Guideline 6.3 BLANK (Deleted)

Guideline 6.4 To the maximum extent practicable wetland areas shall not be drained or filled. Any approved drain or fill project shall be designed and constructed using best practical techniques to minimize present and future property damage and adverse environmental impacts.

Response: Potential wetland impacts would occur with lifts associated with Mississippi River levees due to the necessity to expand the levees to the flood side, thereby impact bottomland hardwood-wet habitat (Figure 3). These impact would be avoided to the maximum extent practicable but would be unavoidable in some locations due to infrastructure on the protected side of the levees. Impacts would be mitigated as appropriate through compensatory mitigation. Borrow areas would be designed and constructed using the best practical techniques and would avoid wetland impacts.

Guideline 6.5 Coastal water dependent uses shall be given special consideration in permitting because of their reduced choice of alternatives.

Response: Acknowledged

Guideline 6.6 Areas modified by surface alteration activities shall, to the maximum extent practicable, be re-vegetated, refilled, cleaned and restored to their predevelopment condition upon termination of the use.

Response: Project implementation would restore foreshore protection areas to their previous elevation to provide adequate protection for levees. Construction access channels and stockpile areas would be brought back to original elevations subsequent to completion of construction activities.

Guideline 6.7 Site clearing shall to the maximum extent practicable be limited to those areas immediately required for physical development.

Response: Throughout the design and construction process, construction areas and temporary work sites would be minimized to limit impacts beyond what would be required to construct project features.

Guideline 6.8 Surface alterations shall, to the maximum extent practicable, be located away from critical wildlife areas and vegetation areas. Alterations in wildlife preserves and management areas shall be conducted in strict accord with the requirements of the wildlife management body.

Response: Acknowledged

Guideline 6.9 Surface alterations which have high adverse impacts on natural functions shall not occur, to the maximum extent practicable, on barrier islands and beaches, isolated cheniers, isolated natural ridges or levees,' or in wildlife and aquatic species breeding or spawning areas, or in important migratory routes.

Response: Acknowledged. Construction activities would be coordinated with state and federal resource agencies to ensure impacts are avoided to the maximum extent practicable. Project activities with potential impacts to threatened or endangered species are being coordinated with USFWS and NMFS. Impacts to threatened and endangered species and their critical habitat would be avoided to the maximum extent practicable. Project activities with potential impacts to Essential Fish Habitat are being coordinated with NMFS. Project activities with potential impacts to colonial nesting water birds are being coordinated with Louisiana Department of Wildlife and Fisheries. Pre-construction bird surveys would be conducted to ensure impacts to colonial nesting water birds are avoided to the maximum extent practicable and construction buffers and season limitations would be employed as necessary. Pre-construction surveys would be required to delineate existing SAV to facilitate avoidance of impacts. SAV surveys and avoidance of impacts would be included in construction contract solicitation language.

Guideline 6.10 The creation of low dissolved oxygen conditions in the water or traps for heavy metals shall be avoided to the maximum extent practicable.

Response: Acknowledged. Prior to construction, the National Pollutant Discharge Elimination System (NPDES) permit process would be completed and a General Stormwater Permit would be required. Contractors would need a site-specific Spill Prevention, Control and Countermeasure Plan (SPCCP) in place prior to the start of construction.

Guideline 6.11 Surface mining and shell dredging shall be carried out utilizing the best practical techniques to minimize adverse environmental impacts.

Response: Not applicable.

Guideline 6.12 The creation of underwater obstructions which adversely affect fishing or navigation shall be avoided to the maximum extent practicable.

Response: Acknowledged

Guideline 6.13 Surface alteration sites and facilities shall be designed, constructed, and operated using the best practical techniques to prevent the release of pollutants or toxic substances into the environment and minimize other adverse impacts.

Response: Acknowledged

Guideline 6.14 To the maximum extent practicable only material that is free of contaminants and compatible with the environmental setting shall be used as fill.

Response: Acknowledged. Potential borrow sites would be screened for potential contaminant issues per USACE regulations. Only material meeting physical and contaminant criteria would be approved for use in levee construction.

GUIDELINES FOR HYDROLOGIC AND SEDIMENT TRANSPORT MODIFICATIONS

Guideline 7.1 The controlled diversion of sediment-laden waters to initiate new cycles of marsh building and sediment nourishment shall be encouraged and utilized whenever such diversion will enhance the viability and productivity of the outfall area. Such diversions shall incorporate a plan for monitoring and reduction and/or amelioration of the effects of pollutants present in the freshwater source.

Guideline 7.2 Sediment deposition systems may be used to offset land loss, to create or restore wetland areas or enhance building characteristics of a development site. Such systems shall only be utilized as part of an approved plan. Sediment from these systems shall only be discharged in the area that the proposed use is to be accomplished.

Guideline 7.3 Undesirable deposition of sediments in sensitive habitat or navigation areas shall be avoided through the use of the best preventive techniques.

Guideline 7.4 The diversion of freshwater through siphons and controlled conduits and channels, and overland flow to offset saltwater intrusion and to introduce nutrients into wetlands shall be encouraged and utilized whenever such diversion will enhance the viability and productivity of the outfall area. Such diversions shall incorporate a plan for monitoring and reduction and/or amelioration of the effects of pollutants present in the freshwater source.

Guideline 7.5 Water or marsh management plans shall result in an overall benefit to the productivity of the area.

Guideline 7.6 Water control structures shall be assessed separately based on their individual merits and impacts and in relation to their overall water or marsh management plan of which they are a part.

Guideline 7.7 Weirs and similar water control structures shall be designed and built using the best practical techniques to prevent "cut arounds," permit tidal exchange in tidal areas, and minimize obstruction of the migration of aquatic organisms.

Guideline 7.8 Impoundments which prevent normal tidal exchange and/or the migration of aquatic organisms shall not be constructed in brackish and saline areas to the maximum extent practicable.

Guideline 7.9 Withdrawal of surface and ground water shall not result in saltwater intrusion or land subsidence to the maximum extent practicable.

Response to Guidelines for Hydrologic and Sediment Transport Modifications: Not applicable.

GUIDELINES FOR DISPOSAL OF WASTES

Guideline 8.1 The location and operation of waste storage, treatment, and disposal facilities shall be avoided in wetlands to the maximum extent practicable, and best practical techniques shall be used to minimize adverse impacts which may result from such use.

Guideline 8.2 The generation, transportation, treatment, storage and disposal of hazardous wastes shall be pursuant to the substantive requirements of the Department of Natural Resources adopted pursuant to Act 334 of 1978 and approved pursuant to the Resource

Conservation and Recovery Act. of 1976 P. 0. 94-580, and of the Office of Conservation for injection below surface.

Guideline 8.3 Waste facilities located in wetlands shall be designed and built to withstand all expectable adverse conditions without releasing pollutants.

Guideline 8.4 Waste facilities shall be designed and constructed using best practical techniques to prevent leaching, control leachate production, and prevent the movement of leachate away from the facility.

Guideline 8.5 The use of overland flow systems for non-toxic, biodegradable wastes, and the use of sump lagoons and reservoirs utilizing aquatic vegetation to remove pollutants and nutrients shall be encouraged.

Guideline 8.6 All waste disposal sites shall be marked and, to the maximum extent practicable, all components of waste shall be identified.

Guideline 8.7 Waste facilities in wetlands with identifiable pollution problems that are not feasible and practical to correct shall be closed and either removed or sealed, and shall be properly re-vegetated using the best practical techniques.

Guideline 8.8 Waste shall be disposed of only at approved disposal sites.

Guideline 8.9 Radioactive wastes shall not be temporarily or permanently disposed of in the coastal zone.

Response to Guidelines for Disposal of Wastes: Not applicable.

GUIDELINES FOR USES THAT RESULT IN THE ALTERATION OF WATERS DRAINING INTO COASTAL WATERS

Guideline 9.1 Upland and upstream water management programs which affect coastal waters and wetlands shall be designed and constructed to preserve or enhance existing water quality, volume, and rate of flow to the maximum extent practicable.

Guideline 9.2 Runoff from developed areas shall to the maximum extent practicable be managed to simulate natural water patterns, quantity, quality and rate of flow.

Guideline 9.3 Runoff and erosion from agricultural lands shall be minimized through the best practical techniques.

Response to Guidelines for Uses that Result in the Alteration of Water Draining into Coastal Waters: Not applicable.

GUIDELINES FOR OIL, GAS, AND OTHER MINERAL ACTIVITIES

Guideline 10.1 Geophysical surveying shall utilize the best practical techniques to minimize disturbance or damage to wetlands, fish and wildlife and other coastal resources.

Guideline 10.2 To the maximum extent practicable, the number of mineral exploration and production sites in wetland areas requiring flotation access shall be held to the minimum number, consistent with good recovery and conservation practices and the need for energy development, by directional drilling, multiple use of existing access canals and other practical techniques.

Guideline 10.3 Exploration, production and refining activities shall, to the maximum extent practicable, be located away from critical wildlife areas and vegetation areas. Mineral operations in wildlife preserves and management areas shall be conducted in strict accordance with the requirements of the wildlife management body.

Guideline 10.4 Mineral exploration and production facilities shall be to the maximum extent practicable designed, constructed and maintained in such a manner to maintain natural water flow regimes, avoid blocking surface drainage, and avoid erosion.

Guideline 10.5 Access routes to mineral exploration, production and refining sites shall be designed and aligned so as to avoid adverse impacts on critical wildlife and vegetation areas to the maximum extent practicable.

Guideline 10.6 Drilling and production sites shall be prepared, constructed, and operated using the best practical techniques to prevent the release of pollutants or toxic substances into the environment.

Guideline 10.7 All drilling activities, supplies, and equipment shall be kept on barges, on drilling rigs, within ring levees, or on the well site.

Guideline 10.8 Drilling ring levees shall to the maximum extent practicable be replaced with smaller production levees or removed entirely.

Guideline 10.9 All drilling and production equipment, structures, and storage facilities shall be designed and constructed utilizing best practical techniques to withstand all expectable adverse conditions without releasing pollutants.

Guideline 10.10 Mineral exploration, production and refining facilities shall be designed and constructed using best practical techniques to minimize adverse environmental impacts.

Guideline 10.11 Effective environmental protection and emergency or contingency plans shall be developed and complied with for all mineral operations.

Guideline 10.12 The use of dispersants, emulsifiers and other similar chemical agents on oil spills is prohibited without the prior approval of the Coast Guard or Environmental Protection Agency on-Scene Coordinator, in accordance with the National Oil and Hazardous Substances Pollution Contingency Plan.

Guideline 10.13 Mineral exploration and production sites shall be cleared, re-vegetated, detoxified and otherwise restored as near as practicable to their original condition upon termination of operations to the maximum extent practicable.

Guideline 10.14 The creation of underwater obstructions which adversely affect fishing or navigation shall be avoided to the maximum extent practicable.

Response to Guidelines for Oil, Gas, and Other Mineral Activities: Not applicable.

CONSISTENCY DETERMINATION

The Coastal Use Guidelines are acknowledged. The proposed action has been evaluated for consistency with the Coastal Use Guidelines. The proposed action has been planned and designed and would be constructed, operated, and maintained to avoid, to the maximum extent practicable, the significant impacts outlined in Guideline 1.7 of this document. The proposed action would provide a 1% level of risk reduction which would decrease the risk of hurricane and storm surge induced flooding compared to what would be provided without implementation. The project would also decrease the potential for discharge of toxic substances into coastal waters. The proposed action would provide significant public benefit and would serve important regional, state, and national interest, and the benefits resulting from the proposed action clearly outweigh the adverse impacts. While some data gaps do remain, the cumulative impact analysis for the project indicates that impacts are minor to moderate for the majority of affected resources.

Where practicable and through project feature design, implementation of best management practices, and the implementation of environmental design commitments, adverse impacts have been avoided or reduced. Since the project would largely be constructed in the footprint of the existing system, impacts to human and natural resources would be minimized.

Hazardous, Toxic, and Radioactive Waste assessments would be conducted for all construction areas and borrow sites prior to their use. Unsuitable areas would be avoided and as a result the release of pollutants or toxic substances into the environment would be avoided.

Based on this evaluation, the U. S. Army Corps of Engineers, New Orleans District, has determined that the proposed action is consistent, to the maximum extent practicable, with the State of Louisiana's Coastal Resources Program.

Enclosure: Mitigation Plan

5.1 CORRESPONDENCE WITH LOUSIANA DEPARTMENT OF NATURAL RESOURCES – FEBRUARY 2020

From:	McCain, Kathryn N CIV USARMY CEMVP (USA)
To:	jeff.harris (jeff.harris@la.gov)
Cc:	Runyon, Kip R CIV USARMY CEMVP (USA); McCain, Kathryn N CIV USARMY CEMVP (USA)
Subject:	C20190215 LPV levee lift and mitigation plan (UNCLASSIFIED)
Date:	Tuesday, February 4, 2020 7:24:55 AM
Attachments:	LPVMRL6 BLH WVA v1.2.pdf

Jeff,

View in rich text. Below in the blue are the responses for LPV. Attached is the preliminary WVA model spreadsheet too.

Let me know if you need anything else.

Thanks you
Kat

-----Original Message-----
From: Jeff Harris [mailto:Jeff.Harris@LA.GOV]
Sent: Friday, January 24, 2020 2:20 PM
To: Runyon, Kip R CIV USARMY CEMVP (USA) <Kip.R.Runyon@usace.army.mil>; McCain, Kathryn N CIV USARMY CEMVP (USA) <Kathryn.Mccain@usace.army.mil>
Subject: [Non-DoD Source] C20190215 LPV levee lift and mitigation plan

Kip, Kat--

I've completed an initial review of the consistency determination for the Lake Pontchartrain and Vicinity General Re-Evaluation Report, and there are a few questions and clarifications that need to be addressed.

Please provide:

- Locations and dimensions of borrow sites within and outside of Lake Pontchartrain

Specific borrow sites have not yet been identified. Section 7.1.4 of the EIS provides a generalized description of how borrow sites will be identified in the future in the vicinity of the study area.

From the draft EIS:

1.1.1 GENERALIZED BORROW AREA IMPACT ANALYSIS

Extended construction windows throughout the 50-year period of analysis would be required for implementation of the multiple levee lifts associated with the project. Borrow areas available for use now may not be available when future levee lifts are needed. Accordingly, an analysis of borrow area impacts has been conducted on a “typical” borrow pit that could be chosen for use. Anticipated impacts of excavation and use of such “typical” borrow areas for the action alternatives were evaluated using the below assumptions. The assumptions are based on extensive borrow area impact assessments performed for HSDRRS implementation. The quantities of borrow that would be needed for each lift are estimates. Specific borrow areas would be identified during pre-construction engineering and design for each segment of project construction. Borrow area acquisition requirements will continue to be evaluated during feasibility design to determine whether temporary or permanent easements are most advantageous to the Government. Additional NEPA documentation and associated public review would be conducted, as necessary, to address impacts associated with those borrow areas. Additionally, if a proposed borrow area contains upland bottomland hardwood forests or another significant resource that requires mitigation, a mitigation plan would be prepared in compliance with WRDA 1986, Section 906 (33 U.S.C. §2283). See Appendix A for construction schedule and estimated borrow quantity for each levee lift.

Table 7-4. Borrow Area Assumptions and Requirements Incorporated into Borrow Area Analysis

Resource	Assumptions and Requirements
Locations	Borrow sites would be located within one or more of the following parishes: • Orleans Parish • Plaquemines Parish • Jefferson Parish • St. Charles Parish • Lafourche Parish • St. John the Baptist Parish
Socioeconomics	Borrow sites with potential EJ impacts or potential impacts to sensitive receptors would be avoided.
Soils	Based on the estimated 8.3 million cubic yards of material needed for construction and based on an assumed 20-ft depth of borrow areas, Alternative 2 would require approximately 320.9 acres of borrow area. Based on the estimated 9.3 million cubic yards of material needed for construction, Alternative 3 would require approximately 361.5 acres of borrow area. Suitable clay material would meet the following requirements: • Soils classified as fat or lean clays are allowed • Soils with organic content greater than 9% 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% sand content Significant impacts to prime farmland soils would be anticipated given the strong correlation between suitable borrow soils and prime farmland soils.
Transportation	The same transportation corridors used during HSDRRS would be used, as described in *Transportation Report for the Construction of the 100-year Hurricane and Storm Damage Risk Reduction System* prepared in 2009 and incorporated by reference (USACE, 2009)[1].
Jurisdictional Wetlands	Suitable borrow areas that avoid jurisdictional wetland impacts would be used.
Non-Jurisdictional (i.e. upland) Bottomland	Suitable borrow areas that avoid non-jurisdictional bottomland hardwood (BLH-dry) impacts would be used.

Hardwoods	
Water Quality	Water quality impacts would be minimized through the use of Best Management Practices (BMPs).
Fisheries/Essential Fish Habitat	No impacts to fisheries or EFH would be anticipated due to the use of inland sites
Wildlife	Some permanent impacts to wildlife would be anticipated due to permanent removal of habitat.
Threatened and Endangered Species	No impacts to T&E species would be anticipated as no T&E species are present in upland areas in the target parishes.
Cultural Resources	Cultural resource surveys would be conducted on potential borrow sites; sites with cultural resources would be avoided; no impacts to cultural resources would be anticipated.
Recreational Resources	No impacts to recreational resources would be anticipated as borrow sites would likely be located on private property away from recreational areas
Aesthetics	Minor impacts to aesthetics would be anticipated due to conversion of habitat.
Air Quality	Minor impacts during construction would be anticipated, dissipating upon completion; borrow areas would avoid non-attainment areas
Noise	Minor impacts during construction would be anticipated and minimized through compliance with local noise ordinances; temporary impacts to wildlife in adjacent habitat would be anticipated during construction; avoidance of construction areas may cause carrying capacity of adjacent habitats to be temporarily exceeded.
HTRW	HTRW surveys would be conducted on potential borrow sites; sites with HTRW would be avoided; no impacts would be anticipated.

During scoping, the USFWS provided a recommended protocol for identifying borrow sources. The recommendations in descending order of priority are:

1. *Permitted commercial sources, authorized borrow sources for which environmental clearance and mitigation have been completed, or non-functional levees after newly constructed adjacent levees are providing equal protection.*
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., Chinese tallow-trees) or non-forested wetlands(e.g., wet pastures), excluding marshes;*
    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., Chinese tallow-trees) or non-forested wetlands(e.g., wet pastures), excluding marshes;*
    c. *disturbed wetlands (e.g., hydrologically altered, artificially impounded).*

Notwithstanding this protocol, the location, size, and configuration of borrow sites within the landscape is also critically important. Coastal ridges, natural levee flanks, and other geographic features that provide forested/wetland habitats and/or potential barriers to hurricane surges should not be utilized as borrow sources, especially where such uses would diminish the natural functions and values of those landscape *features*.

USACE would follow this recommended protocol to the extent practicable during borrow area selection. In addition, USACE will select borrow areas in the parishes listed in Table 7-4 that fall within the areas provided by USFWS that contain suitable soils and avoid potential mitigation (see Figure 7-2). Once borrow areas are identified, additional NEPA and environmental coordination for those sites would occur and, if necessary, a mitigation plan would be prepared to compensate for any significant resources existing on those borrow sites.

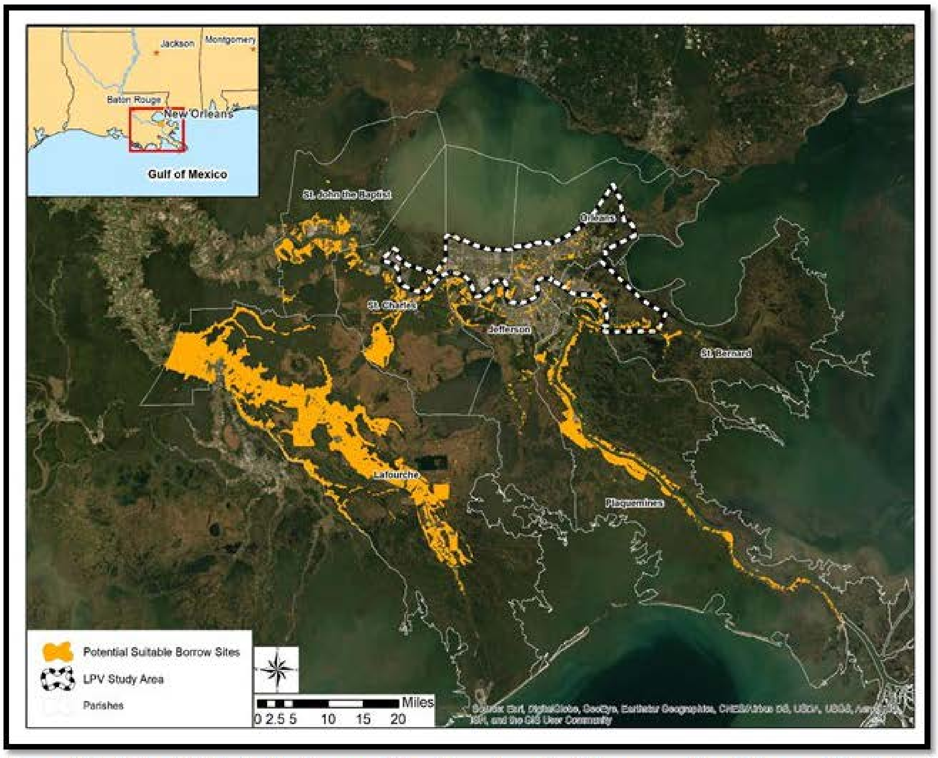


Figure 7-2. Potential Suitable Borrow Sites Based on Soil Types and Avoidance of Potential Mitigation

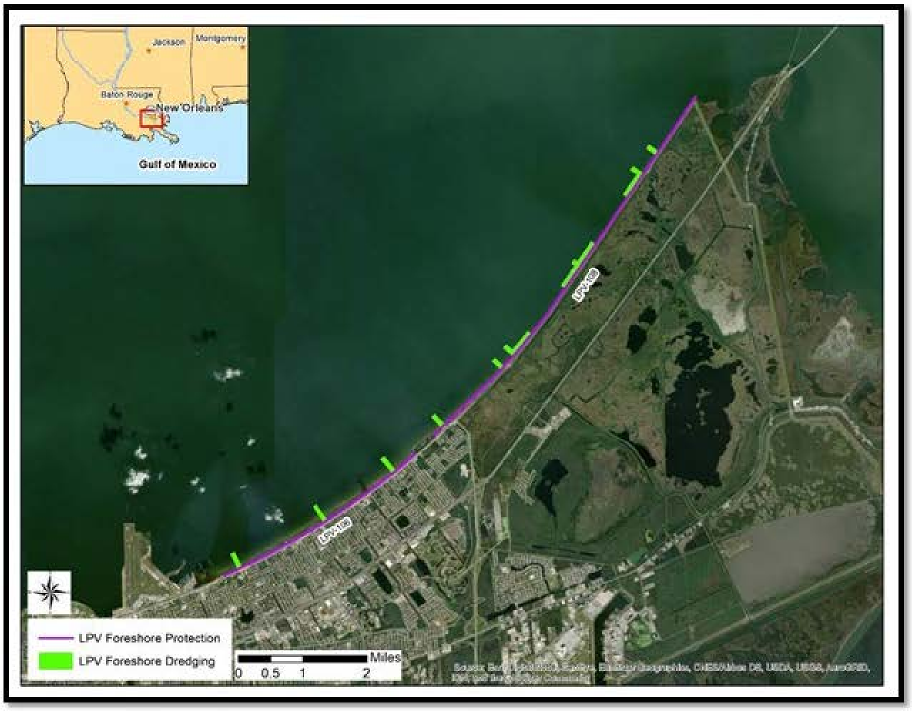
(data provided by USFWS, 2019; based on 2016 National Land Cover Database and National Resources Conservation Service (NRCS) soil surveys)

- Volume of material to be dredged

2.4 Million Cubic yards of material would be dredged in Lake Pontchartrain for construction access.

- Locations and dimensions of all access routes and staging and laydown areas

Material would be dredged from the bed of Lake Pontchartrain to provide construction access channels. Construction access channels would consist of parallel channels at the shoreline in areas where rock would be placed as well as perpendicular access channels to allow access to the shoreline channels (see Figure 2 and Figure 3). The dimensions required for barge access channels would be approximately -7 feet depth with 100-foot bottom width. Perpendicular access channels would begin at the elevation -7 ft contour of the lake and extend 400 to 1600 ft. Adjacent dredged material stockpile sites would be 150 ft wide. The total acreage of lake bottom impacted by dredging temporary construction access channels and associated temporary stockpiling would be 213 acres. A maximum of 2.4 million cubic yards of material would be dredged for construction access.



- Please clarify whether compensatory mitigation, as described in Appendix K, is or is not part of the proposed action (it is not included in the Description of the Proposed Action)
BLH-Wet mitigation is part of the proposed action.

- Please confirm that the eligibility requirements for mitigation banks will include provisions that the banks are OCM approved, and are within the same CWPPRA-defined hydrologic basin as the impacts, or an adjacent basin
Confirmed. If bank credits are purchased they will be from in-basin mitigation banks. If credits are purchased from a mitigation bank, the mitigation bank must be in compliance with the requirements of the USACE Regulatory Program and its MBI, which specifies the management, monitoring, and reporting required to be performed by the bank. The following text has been added to the mitigation appendix: The solicitation for mitigation bank bids will include requirements that the banks are OCM-approved, and within the same or adjacent CWPPRA-defined hydrologic basin as the impacts.

Also, please review the attached comment letter from the Louisiana Department of Wildlife and Fisheries, and confirm that the Corps of Engineers will:

- Obtain authorization from the LDWF Scenic Rivers Program for any activities adjacent to any Scenic River

Concur. Shouldn't be any issues

- Comply with LDWF notification and avoidance requirements regarding Manatees, Nesting Birds, Bald Eagles, Gulf Sturgeon,

Pallid Sturgeon, Blue Suckers, and Live Oak forest

Concur.

In a broader sense, it does not appear that the plans for this project are mature enough to completely describe all of the work, and potential coastal impacts, at this time. For example, the need for future lifts is mentioned. OCM may be able to concur that the project, at this phase of development, is consistent with our coastal management program, but we'll need to arrive at some statement that additional CZM review will be obtained as the project is finalized.

Agreed. Feasibility level of design will be ongoing for the next year or so and will continue to coordinate as final feasibility designs are developed.

And last, our Mitigation staff is still reviewing the proposed mitigation. I'm hoping to get their comments by the end of next week.

Please let me know if there are any questions.

--Jeff

Jeff Harris

Consistency Section

Office of Coastal Management

Louisiana Department of Natural Resources

(225) 342-7949

PS- you will shortly be receiving an identical message regarding the review of the West Bank and Vicinity project

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[1] Available online in Appendix F at https://www.mvn.usace.army.mil/Portals/56/Users/194/42/2242/CED%20Volume%20II%20Compiled.pdf; accessed 4 December 2019

Please let me know if there are any questions.

--Jeff

Jeff Harris

Consistency Section

Office of Coastal Management

Louisiana Department of Natural Resources

(225) 342-7949

PS- you will shortly be receiving an identical message regarding the review of the West Bank and Vicinity project

---

Jeff,

Well it'd be good if I sent you the correct WVA analysis.

The attached is for the proposed action (LPVMRL1). The previous WVA (LPVMRL6 - 1.52 acre) is an additional impact for Alternative 3 (which was another alternative we had evaluated).

Please see the attached for the WVA for the proposed action and what is in the cd and the mitigation plan (appx k).

Sorry for the confusion.

----Original Message-----
From: Jeff Harris [mailto:Jeff.Harris@LA.GOV]
Sent: Wednesday, February 5, 2020 4:04 PM
To: McCain, Kathryn N CIV USARMY CEMVP (USA) <Kathryn.Mccain@usace.army.mil>
Cc: Runyon, Kip R CIV USARMY CEMVP (USA) <Kip.R.Runyon@usace.army.mil>
Subject: [Non-DoD Source] FW: C20190215 LPV levee lift and mitigation plan (UNCLASSIFIED)

Kat—

The preliminary WVA model you sent yesterday has caused some confusion.

The WVAs included in the consistency determination mitigation plan (LPV GRR Appendix K) presumably addressed all of the impacts for the proposed project. The attached document evaluates impacts to 1.57 ac of BLH that we can’t correlate to anything in the cd. We can’t figure out what impacts this set of WVAs was assessing; whether they’re covered by the consistency determination, or if these are additional impacts.

Can you please explain?

Also, for the record… please confirm that new WVAs will be completed using up to date information, and submitted with the consistency determination when project plans are nearing finalization.

Thanks,

--Jeff

5.2 LDNR OFFICE OF COASTAL MANAGEMENT REQUEST FOR REVIEW EXTENSION 7 FEB 2020

JOHN BEL EDWARDS
GOVERNOR

THOMAS F. HARRIS
SECRETARY

State of Louisiana
DEPARTMENT OF NATURAL RESOURCES
OFFICE OF COASTAL MANAGEMENT

February 7, 2020

Kip Runyon
U.S. Army Corps of Engineers
1222 Spruce Street
St. Louis MO 63103
Via email: Kip.R.Runyon@usace.army.mil

RE: **C20190215,** Coastal Zone Consistency
U.S. Army Corps of Engineers
Direct Federal Action
Lake Pontchartrain & Vicinity General Re-Evaluation Report With Integrated EIS
St. Charles, Jefferson, Orleans, and St. Bernard Parishes, **Louisiana**

Dear Mr. Runyon:

The Office of Coastal Management (OCM) has received the above referenced federal application for consistency review with the approved Louisiana Coastal Resources Program in accordance with Section 307(c) of the Federal Coastal Zone Management Act of 1972, as amended. NOAA Regulations on Federal Consistency, at 15 CFR §930.41(a), allow 60 days for the review of Direct Federal Activities, and at §930.41(b) allow an additional 15 days with appropriate applicant notification. Please be advised that, by this letter, Interagency Affairs/Field Services Division is requesting the 15 day time extension.

A final determination will be made within the authorized time period. Please refer to the above Consistency Application number when responding to this letter. If you have any questions please call Jeff Harris of the Consistency Section at (225) 342-7949 or jeff.harris@la.gov.

Sincerely,

/S/ Charles Reulet
Administrator
Interagency Affairs/Field Services Division

CR/MH/jdh

cc: Kathryn McCain, Corps of Engineers

Post Office Box 44487 • Baton Rouge, Louisiana 70804-4487
617 North Third Street • 10th Floor • Suite 1078 • Baton Rouge, Louisiana 70802
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5.3 LDNR OFFICE OF COASTAL MANAGEMENT 20 FEB 2020

JOHN BEL EDWARDS
GOVERNOR

THOMAS F. HARRIS
SECRETARY

State of Louisiana

DEPARTMENT OF NATURAL RESOURCES

OFFICE OF COASTAL MANAGEMENT

February 20, 2020

Kip Runyon
U.S. Army Corps of Engineers
Regional Planning and Environmental Division North
1222 Spruce Street
St. Louis, MO 63103
Via email: Kip.R.Runyon@usace.army.mil

RE: **C20190215,** Coastal Zone Consistency
New Orleans District, Corps of Engineers
Direct Federal Action
Lake Pontchartrain and Vicinity General Re-Evaluation Report with Integrated EIS: Levee lifts, raising floodwalls, foreshore protection, access dredging, and purchase of mitigation bank credits to compensate for unavoidable wetland impacts
St. Charles, St. Bernard, Jefferson and Orleans Parishes, Louisiana

Dear Mr. Runyon:

The Office of Coastal Management has received the above referenced federal application for consistency review with the approved Louisiana Coastal Resources Program (LCRP) in accordance with Section 307(c) of the Federal Coastal Zone Management Act of 1972, as amended. The proposed activity is currently in the feasibility phase, and includes project features or alternatives which will be finalized only after additional information is developed. This includes, for example, the locations and dimensions of future levee lifts and borrow sites, processing of final Wetland Value Assessments for impacts and proposed mitigation, and acquisition/creation of sufficient Average Annual Habitat Units to offset unavoidable wetland impacts. Therefore, review of this determination has proceeded per NOAA regulations on federal consistency at 15 CFR §930.36(d) for "phased consistency determinations."

After careful review, this office finds that **this phase** of the project, as proposed in the application, is consistent with the LCRP. Pursuant to federal regulations, consistency determinations must be submitted for each major decision in subsequent phases of the project that are subject to Federal discretion. The federal agency shall ensure that the activity under development continues to be consistent to the maximum extent practicable with the management program until such plans are finalized.

In order to fully review later phases of the activities addressed by this consistency determination, a clear description and depictions of proposed work, its location, and an assessment of potential wetland impacts must be provided. Information necessary for OCM review includes the specific locations and configurations of proposed construction, borrow sources, fill areas, access routes,

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work and staging areas, and rights-of way; volumes of material excavated and amounts and sources of any material used as fill; cross sections depicting the areas of excavation and fill; estimates of wetland impacts including those resulting from access to and staging for the work site(s); and complete descriptions of compensatory mitigation measures including up-to-date Wetland Value Assessments.

As planning for the proposed activities proceeds and detailed information is developed, please provide additional consistency determinations as appropriate to ensure compliance with the LCRP. Please understand that, aside from the purchase of mitigation bank credits, this concurrence letter specifically does not authorize any construction or other activities which may have reasonably foreseeable effects on coastal land use, water use, or natural resources.

If you have any questions concerning this determination please contact Jeff Harris of the Consistency Section at (225) 342-7949 or jeff.harris@la.gov.

Sincerely,

/S/ Charles Reulet
Administrator
Interagency Affairs/Field Services Division

CR/MH/jdh

cc: Kathryn McCain, COE
Dave Butler, LDWF
Frank Cole, OCM/FI
Kirk Kilgen, OCM/FI
Earl Matherne, St. Charles Parish
William McCartney, St. Bernard Parish
Jason Smith, Jefferson Parish
Jerome Landry, Orleans Parish

5.4 CONSISTENCY MODIFICATION CORRESPONDENCE WITH LOUISIANA DEPARTMENT OF NATURAL RESOURCES – NOVEMBER 2020

From:	Runyon, Kip R CIV USARMY CEMVP (USA)
To:	Sara.Krupa@la.gov
Cc:	Jeff.Harris@la.gov
Subject:	Modification #1 to C20190215 Phased Consistency Review for LPV
Date:	Thursday, November 5, 2020 12:07:00 PM
Attachments:	LPV Shapefiles.zip LPVMRL1.1_BLH WVA v1.2_20201015.pdf LPVMRL1.2_BLH WVA v1.2_20201015.pdf LPVMRL1.3_BLH WVA v1.2_20201015.pdf LPVMRL1.4_BLH WVA v1.2_20201015.pdf LPVMRL1.5_BLH WVA v1.2_20201015.pdf 20201015_LPV_PIS.pdf LPV Appendix K - Mitigation Plan 02 Nov 2020.docx

Ms. Krupa,

Attached please find updated information for your consideration regarding phased consistency review for the Lake Pontchartrain and Vicinity (LPV) General Re-Evaluation Report with Integrated EIS. The U.S. Army Corps of Engineers New Orleans District has completed a more detailed analysis of the levees and floodwalls in the study area and, based on this updated analysis, has revised the subset of levees and floodwalls that will require modifications over the 50-year period of analysis (please see attached shapefiles). Based on these changes, the U.S. Fish and Wildlife Service updated the Wetland Value Assessment (WVA) impact analysis for bottomland hardwood habitat adjacent to the Mississippi River Levees (please see attached WVA files). Based on this updated analysis, the District updated the Mitigation Plan (please see attached Appendix K).

Based on this updated information, the District evaluated the proposed action for consistency with the Coastal Use Guidelines and determined that the proposed action is consistent, to the maximum extent practicable, with the State of Louisiana's Coastal Resources Program.

The District will continue to provide details on other aspects of the proposed project as they become available during pre-construction engineering and design and will request further phased consistency reviews accordingly.

Please let me know if I can provide additional information. Thank you.

Kip Runyon

Kip Runyon
U.S. Army Corps of Engineers
Regional Planning and Environmental Division North
1222 Spruce Street
St. Louis, MO 63103
Phone: 314-331-8396
Cell: 618-223-9749

From: Runyon, Kip R CIV USARMY CEMVP (USA)
To: Jeff Harris
Cc: Sara Krupa; Kelley Templet
Subject: RE: C20190215 mod 01, Lake Pontchartrain and Vicinity mitigation plan
Date: Thursday, December 3, 2020 6:56:00 AM

Jeff,
Thank you for the comments. Please consider the following responses:

1. Acknowledged. The language on preservation is part of the original 33 CFR Section 332.3 language. USACE is not proposing the use of preservation for mitigation.
2. Acknowledged. The language referencing in-lieu fee programs is part of the original 33 CFR Section 332.3 language. USACE is not proposing use of an in-lieu fee program.
3. Acknowledged. OCM review would be sought should the need arise.
4. Acknowledged. Documents representing recent examples of USACE-constructed mitigation projects meeting all current mitigation requirements were provided. USACE will update Appendix K with similar BLH examples should they become available.

Thank you.
Kip

From: Jeff Harris <Jeff.Harris@LA.GOV>
Sent: Tuesday, December 1, 2020 3:06 PM
To: Runyon, Kip R CIV USARMY CEMVP (USA) <Kip.R.Runyon@usace.army.mil>
Cc: Sara Krupa <Sara.Krupa@LA.GOV>; Kelley Templet <Kelley.Templet@LA.GOV>
Subject: [Non-DoD Source] C20190215 mod 01, West Bank and Vicinity mitigation plan

Kip--

After review of the consistency determination for C20190215 Mod 01, Lake Pontchartrain and Vicinity mitigation, the OCM Mitigation Section provides the following comments:

1. Enclosure 2, Page 24, General considerations includes a statement that "Compensatory mitigation may be performed using the methods of restoration, enhancement, establishment, and in certain circumstances preservation." Preservation does not replace habitat loss and therefore is not compliant with no net loss of coastal resources. OCM does not support preservation as an option for mitigation.

2. Enclosure 2, Page 25, refers to use of the In Lieu Fee Program. CEMVN requirements preclude the ILF Program as an option for mitigation for this project.

3. Enclosure 2, Page 24, under type and location of mitigation states "...mitigation through off-site and/or out-of-kind mitigation." These alternatives would have to be reviewed by OCM on a case-by-case basis.

4. Enclosures 4 and 5 provide examples of a mitigation monitoring plan and an adaptive management plan, respectively. These examples are for a marsh creation project rather than a BLH project. It would be more appropriate to include a examples of a BLH project.

Please provide the information noted in items 1 and 2, and responses to the comments in items 3-7.

Thanks,

--Jeff

JOHN BEL EDWARDS
GOVERNOR

THOMAS F. HARRIS
SECRETARY

State of Louisiana

DEPARTMENT OF NATURAL RESOURCES

OFFICE OF COASTAL MANAGEMENT

December 15, 2020

Kip Runyon
U.S. Army Corps of Engineers
Regional Planning and Environmental Division North
1222 Spruce Street
St. Louis, MO 63103
Via email: Kip.R.Runyon@usace.army.mil

RE: **C20190215 mod 01,** Coastal Zone Consistency
New Orleans District, Corps of Engineers
Direct Federal Action
Lake Pontchartrain and Vicinity General Re-Evaluation Report With Integrated EIS: Modification to update the proposed mitigation plan
St. Charles, St. Bernard, Jefferson and Orleans Parishes, Louisiana

Dear Mr. Runyon:

The Office of Coastal Management has received the above referenced federal application for consistency review with the approved Louisiana Coastal Resources Program (LCRP) in accordance with Section 307(c) of the Federal Coastal Zone Management Act of 1972, as amended. The proposed activity is currently in the feasibility phase, and includes project features or alternatives which will be finalized only after additional information is developed. This includes, among other things, the final flood protection design and the acquisition or creation of sufficient Average Annual Habitat Units to offset unavoidable wetland impacts. Therefore, review of this determination has proceeded per NOAA regulations on federal consistency at 15 CFR §930.36(d) for "phased consistency determinations."

After careful review, this office finds that **this phase** of the project, the updated mitigation plan, is consistent with the LCRP. Pursuant to federal regulations, consistency determinations must be submitted for each major decision in subsequent phases of the project that are subject to Federal discretion. The federal agency shall ensure that the activity under development continues to be consistent to the maximum extent practicable with the management program until such plans are finalized.

In order to fully review later phases of the activities addressed by this consistency determination, a clear description and depictions of proposed work, its location, and an assessment of potential wetland impacts must be provided. Information necessary for OCM review includes the specific locations and configurations of proposed construction, borrow sources, fill areas, access routes, work and staging areas, and rights-of way; volumes of material excavated and amounts and sources of any material used as fill; cross sections depicting the areas of excavation and fill; estimates of wetland impacts including those resulting from access to and staging for the work

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site(s); and complete descriptions of compensatory mitigation measures including up-to-date Wetland Value Assessments.

As planning for the proposed activities proceeds and detailed information is developed, please provide additional consistency determinations as appropriate to ensure compliance with the LCRP. Please understand that, aside from the purchase of mitigation bank credits, this concurrence letter specifically does not authorize any construction or other activities which may have reasonably foreseeable effects on coastal land use, water use, or natural resources.

If you have any questions concerning this determination please contact Jeff Harris of the Consistency Section at (225) 342-7949 or jeff.harris@la.gov.

Sincerely,

/S/ Charles Reulet
Administrator
Interagency Affairs/Field Services Division

CR/MH/jdh

cc: Dave Butler, LDWF
Kirk Kilgen, OCM/FI
Earl Matherne, St. Charles Parish
John Lane, St. Bernard Parish
Jason Smith, Jefferson Parish
Jerome Landry, Orleans Parish

6 CLEAN AIR ACT COMPLIANCE

6.1 AIR QUALITY CONFORMITY ANALYSIS

The U.S. Environmental Protection Agency (USEPA) Office of Air Quality Planning and Standards has set National Ambient Air Quality Standards (NAAQS) for six principal pollutants, called “criteria” pollutants. They are carbon monoxide, nitrogen dioxide, ozone, lead, particulates of 10 microns or less in size (PM-10 and PM-2.5), and sulfur dioxide (SO_2). The Clean Air Act General Conformity Rule (58 FR 63214, November 30, 1993, Final Rule, Determining Conformity of General Federal Actions to State or Federal Implementation Plans) dictates that a conformity review be performed when a Federal action generates air pollutants in a region that has been designated a non-attainment or maintenance area for one or more NAAQS. A conformity assessment would require quantifying the direct and indirect emissions of criteria pollutants caused by the Federal action to determine whether the proposed action conforms to Clean Air Act requirements and any State Implementation Plan (SIP).

The general conformity rule was designed to ensure that Federal actions do not impede local efforts to control air pollution. It is called a conformity rule because Federal agencies are required to demonstrate that their actions “conform with” (i.e., do not undermine) the approved SIP for their geographic area. The purpose of conformity is to (1) ensure Federal activities do not interfere with the air quality budgets in the SIPs; (2) ensure actions do not cause or contribute to new violations, and (3) ensure attainment and maintenance of the NAAQS.

St. Bernard Parish was designated by the Environmental Protection Agency as a sulfur dioxide (SO_2) non-attainment area under the 1-hour standard effective October 4, 2013. This classification is the result of area-wide air quality modeling studies, and the information is readily available from Louisiana Department of Environmental Quality, Office of Environmental Assessment and Environmental Services.

Federal activities proposed in St. Bernard Parish may be subject to the State’s general conformity regulations as promulgated under LAC 33:III.14.A, Determining Conformity of General Federal Actions to State or Federal Implementation Plans. A general conformity applicability determination is made by estimating the total of direct and indirect SO_2 emissions caused by the construction of the project. Prescribed *de minimis* levels of 100 tons per year per pollutant are applicable in St. Bernard Parish. Projects that would result in discharges below the *de minimis* level are exempt from further consultation and development of mitigation plans for reducing emissions.

Tables 1-6 describe the proposed construction activities related to proposed action alternatives generating air pollutants of concern. These estimates were determined by using the USEPA's "Exhaust and Crankcase Emission Factors for Non-road Engine Modeling - Compression Ignition". For additional information on the air quality model method see https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory/road-documentation/msei-documentation-road.

With implementation of the proposed action, on-site construction activities are expected to produce less than 9.0 tons per year of SO_2 emissions (which is markedly less than the *de minimis* level of 100 tons per year per pollutant). Thus, the ambient air quality in St. Bernard

Parish would not noticeably change from current conditions, and the status of attainment for the parish would not be altered.

St. Bernard Parish LPV Levee Enlargement

Chalmette, Meraux, Violet, and Poydras, St. Bernard Parish, LA

Table 1 Combustible Emissions

Assumptions for Combustible Emissions					
Type of Construction Equipment	**Number of Units**	**HP Rated**	**Hrs/day**	**Days/yr**	**Total hp-hrs**
Diesel Compactor	1	70	4	96	26,880
Diesel Bull Dozer	2	110	10	9	19,800
Diesel Grader	2	165	5	64	105,600
Diesel Dump Truck	16	350	8	96	4,300,800
Diesel Crane	1	263	10	64	168,320
Water Truck	3	180	3	9	14,580
Diesel Tractor	1	110	8	64	56,320
Hydro-Mulch Water Truck	1	180	8	56	80,640
Stakebed Truck	2	200	2	64	51,200

Table 2 Emission Factors

Type of Construction Equipment	SO2 g/hp-hr	SO2 lbs/hp-hr
Diesel Compactor	1.0728	0.0024
Diesel Bull Dozer	1.0728	0.0024
Diesel Grader	1.0728	0.0024
Diesel Dump Truck	1.0728	0.0024
Diesel Crane	1.0729	0.0024
Water Truck	1.0728	0.0024
Diesel Tractor	1.0728	0.0024
Hydro-Mulch Water Truck	1.0728	0.0024
Stakebed Truck	1.0728	0.0024

Emission Factors derived from the EPA's NONROAD2010 model

Table 3 Annual S02 Emissions Totals

Total Calculated Emissions	
Type of Construction Equipment	**SO2lbs/hp-hr**
Diesel Compactor	0.032256
Diesel Bull Dozer	0.02376
Diesel Grader	0.12672
Diesel Dump Truck	5.16096
Diesel Crane	0.201984
Water Truck	0.017496
Diesel Tractor	0.067584
Hydro-Mulch Water Truck	0.096768
Stakebed Truck	0.06144
TOTALS	5.788968

NOTE: The listed equipment is the type and number of equipment that may typically be used at a levee enlargement project.

Arabi to Chalmette T-walls

Arabi & Chalmette, St. Bernard Parish, LA

Table 4 Combustible Emissions

Assumptions for Combustible Emissions					
Type of Construction Equipment	**Number of Units**	**HP Rated**	**Hrs/day**	**Days/yr**	**Total hp-hrs**
Diesel Crane	1	130	10	96	124,800
Diesel Crane	2	225	10	9	40,500
Diesel Crane	3	245	10	64	470,400
Diesel Concrete Truck	1	210	10	96	201,600
Diesel Dump Truck	3	350	10	64	672,000
Diesel Vibratory Pile Driver	1	185	10	9	16,650
Diesel Pile Extractor	1	176	10	64	112,640
Diesel Hammer Pile Driver	1	185	10	56	103,600
Diesel Excavator	1	176	10	64	112,640

Table 5 Emissions Factors

Type of Construction Equipment	SO2 g/hp-hr	SO2 lbs/hp-hr
Diesel Crane	1.0728	0.0024
Diesel Crane	1.0728	0.0024
Diesel Crane	1.0728	0.0024
Diesel Concrete Truck	1.0728	0.0024
Diesel Dump Truck	1.0729	0.0024
Diesel Vibratory Pile Driver	1.0728	0.0024
Diesel Pile Extractor	1.0728	0.0024
Diesel Hammer Pile Driver	1.0728	0.0024
Diesel Excavator	1.0728	0.0024

Emission Factors derived from the EPA's NONROAD2010 model

Table 6 Annual SO2 Emissions Totals

Total Calculated Emissions	
Type of Construction Equipment	**SO2 lbs/hp-hr**
Diesel Crane	0.14976
Diesel Crane	0.0486
Diesel Crane	0.56448
Diesel Concrete Truck	0.24192
Diesel Dump Truck	0.8064
Diesel Vibratory Pile Driver	0.01998
Diesel Pile Extractor	0.135168
Diesel Hammer Pile Driver	0.12432
Diesel Excavator	0.135168
TOTALS	2.225796

NOTE: The listed equipment is the type and number of equipment that may typically be used at a concrete levee wall demolition/construction project.

7 NATIONAL HISTORIC PRESERVATION ACT COMPLIANCE

7.1 PROGRAMMATIC AGREEMENT

PROGRAMMATIC AGREEMENT

AMONG THE
U.S. ARMY CORPS OF ENGINEERS, MEMPHIS, NEW ORLEANS, AND VICKSBURG DISTRICTS
THE CHICKASAW NATION;
THE CHOCTAW NATION OF OKLAHOMA;
THE OSAGE NATION;
THE QUAPAW NATION;
THE ARKANSAS STATE HISTORIC PRESERVATION OFFICER;
THE ILLINOIS STATE HISTORIC PRESERVATION OFFICER;
THE KENTUCKY STATE HISTORIC PRESERVATION OFFICER;
THE LOUISIANA STATE HISTORIC PRESERVATION OFFICER;
THE MISSISSIPPI STATE HISTORIC PRESERVATION OFFICER;
THE MISSOURI STATE HISTORIC PRESERVATION OFFICER;
THE TENNESSEE STATE HISTORIC PRESERVATION OFFICER;
AND THE ADVISORY COUNCIL ON HISTORIC PRESERVATION
REGARDING
THE MISSISSIPPI RIVER AND TRIBUTARIES PROJECT:
MISSISSIPPI RIVER LEVEE FEATURES

PREAMBLE

WHEREAS, the mission of the U.S. Army Corps of Engineers (USACE), Memphis District (MVM), Vicksburg District (MVK), and New Orleans District (MVN), is to deliver vital public and military engineering services; partnering in peace and war to strengthen our Nation's security, energize the economy, and reduce risks from disasters; and

WHEREAS, the Mississippi River and Tributaries (MR&T) Project, authorized by the Flood Control Act of 1928, as amended, is designed to reduce flood risk in the Mississippi River alluvial valley for approximately 1,610 miles between Cape Girardeau, Missouri and the Head of Passes, Louisiana from the Project Design Flood (PDF); and

WHEREAS, the MR&T Project, including the Mississippi River Levee (MRL) feature assists in protecting the 36,000 square-mile Lower Mississippi River Valley from periodic overflows of the Mississippi River with a Project area in the alluvial valley that encompasses parts of the seven states of Missouri, Illinois, Kentucky, Tennessee, Arkansas, Mississippi, and Louisiana; and

WHEREAS, the MRL feature (levees and floodwalls) extends for nearly 1,610 miles along the Mississippi River beginning at the head of the alluvial valley near Cape Girardeau, Missouri and continues to approximately 10 miles above Head of Passes near the Gulf of Mexico and is considered the backbone of the MR&T flood risk management system; and

WHEREAS, there is an urgent need to design, build, maintain, operate, and repair the mainline MRL system to ensure that the system provides protection up to the level of the PDF to avoid a catastrophic failure of the MRL, at any which, would likely cause grievous loss of life and personal injury, extensive damage to property and natural resources, serious harm to river navigation, and significant and long-lasting economic and social upheaval; and

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WHEREAS, the MR& T Project has four major elements 1) levees and floodwalls to contain flood flows; 2) floodways to pass excess flows past critical Mississippi River reaches; 3) channel improvement and stabilization measures to provide efficient navigation alignment, increased flood-carrying capacity, and protection of the levee system; and 4) tributary basin improvements, such as retention lakes and sediment reduction features. The MR&T Project functions as a system across portions of seven states: Illinois, Missouri, Kentucky, Tennessee, Arkansas, Mississippi and Louisiana. The project was initiated under the authority of the Flood Control Act of 1928, as amended. The MRL feature—the only component of the MR&T project addressed by this Programmatic Agreement (Agreement) —has been under construction since 1928 and continually augmented through time. The current effort contains 143 Work Items that are listed in Appendix A; and

WHEREAS, the planned MRL construction work (Work Items or Undertakings) will include a variety of measures including but not limited to, the construction of levee enlargements, stability berms, relief wells, stabilizing floodwalls, cutoff trenches, riverside blankets, slope paving, and other forms of under-seepage controls and erosion protections, to improve deficient sections of MRL levees and to achieve the authorized levee design grade and provide the required level of flood protection. The Undertakings will be limited to only the construction of remaining authorized MRL features of the MR&T Project; and

WHEREAS, USACE is the lead federal agency for purposes of the National Environmental Policy Act of 1969 (NEPA) and its implementing regulations, set out at 40 CFR Parts 1500-1508 (43 FR 55978), “Section 106” of the National Historic Preservation Act (NHPA) [54 U.S.C. § 300101 et seq.], as amended (54 U.S.C. § 306108), and its implementing regulations, set out at 36 CFR Part 800, and in accordance with 36 CFR § §800.2(a)(2) and 800.8; and

WHEREAS, USACE has conducted previous assessments of the MRL feature of the MR&T Project under NEPA. The 1976 Environmental Impact Statement (EIS) was filed with the Council of Environmental Quality on 8 April 1976. The Supplemental EIS Number 1 (SEIS I) was prepared to supplement the 1976 EIS to evaluate the effects of continued construction of the MRL levee enlargements, stability berms, seepage control, and erosion protection measures. SEIS I was filed with the Environmental Protection Agency on 31 July 1998. SEIS I focused on the levees of the MRL that were the most deficient in height and on seepage control measures for levee reaches with observable signs of seepage during previous high water events. This Agreement has been negotiated during USACE’s current effort to supplement and as necessary augment the earlier NEPA documents with a second Supplemental EIS (MRL SEIS II); and

WHEREAS, USACE plans to conduct design work and construction for each Work Item in order to provide flood risk reduction for the PDF; the Non-Federal Sponsor (NFS) (Levee District, Levee Board, or other Local Sponsor) will be responsible for the designated cost share for the development of each Work Item including the Land, Easements, Rights-Of-Way, Relocation, and Disposal Areas (LERRDS); and

WHEREAS, USACE has informed local governments, and local non-federal sponsors during the development of this Agreement and will take appropriate steps to involve and notify those parties, as appropriate, during the implementation of the terms of this Agreement; and

WHEREAS, USACE has determined that the Work Items in Appendix A constitute multiple “Undertakings”, as defined by 54 U.S.C. § 300320 and 36 CFR § 800.16(y), that may affect properties listed in or eligible for listing on the National Register of Historic Places (NRHP) pursuant to 36 CFR Part 60 (historic properties) and/or properties having religious and cultural significance to Tribes including sites that may contain human remains and/or associated cultural items, but that there are no Tribal Lands [as defined in 36 CFR § 800.16(x)] within the MRL levee alignment; and

WHEREAS, in accordance with 36 C.F.R. §§ 800.4(b)(2) and 800.5(a)(3), USACE has elected to use a phased process to conduct identification and evaluation of historic properties, and for application of the criteria of adverse effect, respectively, because the scope and programmatic nature of MRL features make it unreasonable to identify historic properties or determine the effects of site-specific Work Items at this time; and

WHEREAS, as USACE cannot fully determine at this time how these Undertakings may affect historic properties, the location of historic properties, or their significance and character, USACE has elected to negotiate an Agreement in consultation with stakeholders, as provided for in 36 CFR § 800.14(b)(1)(ii), and 800.14(b)(2) to govern the implementation of this series of Undertakings and fulfill its obligations under Section 106 of the NHPA including the resolution of adverse effects for these Undertakings; and

WHEREAS, as used in this Agreement, "Signatories" is defined in 36 CFR § 800.6(c)(1), "Invited Signatories" is defined in 36 CFR § 800.6(c)(2), and "Concurring Party" is defined in 36 CFR § 800.6(c)(3); and

WHEREAS, a Consulting Party will be recognized by USACE as a Signatory, Invited Signatory, or Concurring Party starting on the date the Consulting Party signs this Agreement as a Signatory, Invited Signatory, or Concurring Party and provides USACE with a record of this signature; and

WHEREAS, in accordance with 36 CFR § 800.6(c)(1), a Signatory has the authority to execute, amend, or terminate the Agreement; and

WHEREAS, in accordance with 36 CFR § 800.6(c)(2), Invited Signatories who sign this Agreement are signatories with the authority to amend and terminate the Agreement; and

WHEREAS, in accordance with 36 CFR § 800.6(c)(3), a Concurring Party is a Consulting Party invited to concur in the Agreement but who does not have the authority to amend or terminate the Agreement; and

WHEREAS, USACE initiated consultation, via letter on September 11, 2019 with the Absentee-Shawnee Tribe of Indians of Oklahoma, the Alabama-Coushatta Tribe of Texas, the Alabama-Quassarte Tribal Town, the Apache Tribe of Oklahoma, the Caddo Nation of Oklahoma, the Cherokee Nation, the Chitimacha Tribe of Louisiana, the Coushatta Tribe of Louisiana, the Delaware Nation, Oklahoma, the Delaware Tribe of Indians, the Eastern Band of Cherokee Indians, the Eastern Shawnee Tribe of Oklahoma, the Jena Band of Choctaw Indians, the Kaw Nation, Oklahoma, the Kialegee Tribal Town, the Kickapoo Tribe of Indians of the Kickapoo Reservation in Kansas, the Menominee Indian Tribe of Wisconsin, the Miami Tribe of Oklahoma, the Mississippi Band of Choctaw Indians, the Otoe-Missouria Tribe of Indians, Oklahoma, the Peoria Tribe of Indians of Oklahoma, the Poarch Band of Creeks, the Ponca Tribe of Indians of Oklahoma, the Quapaw Nation, the Sac & Fox Nation of Missouri in Kansas and Nebraska, the Sac & Fox Nation, Oklahoma, the Seminole Tribe of Florida, the Shawnee Tribe, The Chickasaw Nation, The Choctaw Nation of Oklahoma, The Muscogee (Creek) Nation, The Osage Nation, The Seminole Nation of Oklahoma, the Thlopthlocco Tribal Town, the Tunica-Biloxi Tribe of Louisiana, the United Keetoowah Band of Cherokee Indians in Oklahoma, the Advisory Council on Historic Preservation (ACHP), the Missouri, Illinois, Kentucky, Tennessee, Arkansas, Mississippi, and Louisiana State Historic Preservation Officers (SHPOs), and the National Park Service's National Trails Program; and

WHEREAS, in accordance with 36 CFR § 800.6(a)(1), the ACHP has been provided the required documentation and invited to participate in this Agreement. On March 27, 2020, the ACHP provided written notice that it has chosen to participate in the consultation; and

WHEREAS, USACE recognizes that the seven different State Historic Preservation Offices are organized in accordance with each state's needs. However each has a body of staff, dedicated to historic preservation of the built-environment (divisions, commissions, or departments, etc.) and a body of staff dedicated to archaeological sites (divisions, departments, surveys, etc.). Collectively, these staff fulfill the SHPO's role for each respective state in accordance with the NHPA. These collective units, regardless of how each state has organized them, will be referred to as the SHPO of jurisdiction. Any specific roles or authorities under state regulation will be defined, as appropriate; and

WHEREAS, USACE has consulted with the Missouri State Historic Preservation Officer (MOSHPO), Illinois State Historic Preservation Officer (IL SHPO), Kentucky State Historic Preservation Officer (KY SHPO) Tennessee State Historic Preservation Officer (TN SHPO), Arkansas State Historic Preservation Officer (AR SHPO) Mississippi State Historic Preservation Officer (MS SHPO), and Louisiana State Historic Preservation Officer (LA SHPO) on this Agreement pursuant to 36 C.F.R. § 800.14(b) and 36 C.F.R. § 800.6. Each SHPO of jurisdiction is a Signatory to this Agreement; and

WHEREAS, USACE recognizes that the Absentee-Shawnee Tribe of Indians of Oklahoma, the Alabama-Coushatta Tribe of Texas, the Alabama-Quassarte Tribal Town, the Apache Tribe of Oklahoma, the Caddo Nation of Oklahoma, the Cherokee Nation, the Chitimacha Tribe of Louisiana, the Coushatta Tribe of Louisiana, the Delaware Nation, Oklahoma, the Delaware Tribe of Indians, the Eastern Band of Cherokee Indians, the Eastern Shawnee Tribe of Oklahoma, the Jena Band of Choctaw Indians, the Kaw Nation, the Kialegee Tribal Town, the Kickapoo Tribe of Indians of the Kickapoo Reservation in Kansas, the Menominee Indian Tribe of Wisconsin, the Miami Tribe of Oklahoma, the Mississippi Band of Choctaw Indians, the Otoe-Missouria Tribe of Indians, Oklahoma, the Peoria Tribe of Indians of Oklahoma, the Poarch Band of Creeks, the Ponca Tribe of Indians of Oklahoma, the Quapaw Nation, the Sac & Fox Nation of Missouri in Kansas and Nebraska, the Sac & Fox Nation, Oklahoma, the Seminole Tribe of Florida, the Shawnee Tribe, The Chickasaw Nation, The Choctaw Nation of Oklahoma, The Muscogee (Creek) Nation, The Osage Nation, The Seminole Nation of Oklahoma, Thlopthlocco Tribal Town, Tunica-Biloxi Tribe of Louisiana, and the United Keetoowah Band of Cherokee Indians in Oklahoma, (collectively referenced as " Federally-recognized Tribes"), may have sites of religious and cultural significance off Tribal Lands that may be affected by these Undertakings, and in meeting its Federal trust responsibility, USACE invited Tribes to participate in government-to-government consultation starting in September 2019. Pursuant to 36 CFR § 800.2 (c)(2)(ii)(E), and in consideration of the confidentiality of information, USACE has invited the Tribes to enter into this Agreement that specifies how USACE will carry out Section 106 responsibilities for these Undertakings; and

WHEREAS, USACE may invite additional Federally-recognized Tribes that have sites of religious and cultural significance to enter into the terms of this Agreement as invited signatories or concurring parties in accordance with 36 CFR § 800.14(f), and nothing in this Agreement prevents a Federally-recognized Tribe from entering into a separate Programmatic Agreement or other agreement with USACE for administration of USACE Programs; and

WHEREAS, in accordance with 36 CFR § 800.6(c)(2), and based on each Tribe's response, the USACE has invited The Chickasaw Nation, The Choctaw Nation of Oklahoma, the Quapaw Nation, and The Osage Nation (collectively referenced as " Consulting Tribes") to be Invited Signatories in this Agreement and each has elected to sign the Agreement as Invited Signatories; and

WHEREAS, in accordance with 36 CFR § 800.6 (c)(3), the Mississippi Band of Choctaw Indians, and the United Keetoowah Band of Cherokee Indians in Oklahoma (collectively included in "Consulting Tribes" reference) have been invited to participate in the development of this Agreement and have elected to sign as Concurring Parties in this Agreement; and

WHEREAS, as of the date of this Agreement, no Tribe(s) have declined to enter into this Agreement as an Invited Signatory Party; and

WHEREAS, on August 28, 2020, in conjunction with the posting of the SEIS II, USACE posted a NHPA/NEPA Public Notice on the designated project website (https://www.mvk.usace.army.mil/MRLSEIS/) for a 45-day comment period requesting the public's input concerning: 1) the proposed Undertaking and its potential to significantly affect historic properties; 2) assistance in identifying any relevant parties who may have an interest in participating in this consultation, and; 3) USACE's proposal to develop an Agreement pursuant to 36 CFR § 800.14(b). No comments specific to historic properties were received; and

WHEREAS, for the review of specific Undertakings under this Agreement, USACE may invite other agencies, organizations, and individuals to participate as Consulting Parties; and

WHEREAS, each USACE District (Memphis, Vicksburg, or New Orleans), depending on the specific Work Item location, uses its own staff and authority and will consult with the SHPO of jurisdiction and the appropriate Federally-recognized Tribe(s) regarding specific Work Items within the respective districts; and

WHEREAS, The Signatories, Invited Signatories, and Concurring Parties have determined that USACE's Section 106 requirements can be effectively and efficiently implemented through a programmatic approach stipulating roles and responsibilities, exempting certain Undertakings from Section 106 review, establishing protocols for consultation, facilitating identification and evaluation of historic properties, and streamlining the assessment and resolution of adverse effects;

NOW THEREFORE, the Memphis, Vicksburg and New Orleans Districts of USACE , the ACHP, the Missouri SHPO, the Illinois SHPO, the Kentucky SHPO, the Tennessee SHPO, the Arkansas SHPO, the Mississippi SHPO, the Louisiana SHPO (Signatories), The Chickasaw Nation, The Choctaw Nation of Oklahoma, the Quapaw Nation, The Osage Nation (Invited Signatories) and the Mississippi Band of Choctaw Indians, and the United Keetoowah Band of Cherokee Indians in Oklahoma (Concurring Parties) agree that the Undertakings associated with the MRL shall be administered in accordance with the following stipulations in order to take into account the effects of the individual undertakings on historic properties and to satisfy USACE's responsibilities under Section 106 of the NHPA for all applicable undertakings.

STIPULATIONS

To the extent of its legal authority, and in coordination with other Signatories, USACE shall ensure that the following measures are implemented and shall not authorize an individual Undertaking until Section 106 review is completed pursuant to this Agreement.

I. APPLICABILITY

A. This Agreement applies to Undertakings in the New Orleans District (MVN), Vicksburg District (MVK) and/or Memphis District (MVM) of USACE for the currently identified authorized remaining work required to complete the MRL feature of the MR&T Project and any USACE proposed work co-located with existing MRL features.

   1. Co-located work includes any authorized and funded civil works project addressing the enhancement of the MRL features. This includes the co-location

of features for the West Bank and Vicinity and Lake Pontchartrain and Vicinity (WBV/LPV) Projects, but only the portions along the MRL.

2. The current Work Items (i.e., the list of projects) are listed in Appendix A, which includes the Work Items addressed in the MRL SEIS II.

B. USACE may utilize this Agreement to fulfill its Section 106 responsibilities and those of other federal agencies that designate USACE as the lead federal agency pursuant to 36 CFR § 800.2(a)(2) with appropriate notification to the other Signatories and ACHP regarding Undertakings that fall within the scope of this Agreement. When USACE is not designated as the lead federal agency, all federal agencies, including USACE, remain individually responsible for their compliance with Section 106. This provision does not prevent USACE from recognizing another federal agency as lead federal agency for specific Undertakings, as appropriate.

C. If another federal program or federal agency has concluded Section 106 consultation review and approved an Undertaking within the past five (5) years, and no new substantial information has been revealed, USACE has no further requirement for Section 106 compliance regarding that Undertaking provided that USACE:

1. Confirms that the Area of Potential Effects (APE) and effect [as defined by 36 CFR § 800.16(i)] of its Undertaking are the same as that of the Undertaking reviewed by the previous agency, and;

2. Determines that the previous agency complied with Section 106, including tribal consultation, appropriately and;

3. Adopts the findings and determinations of the previous agency.

D. USACE shall document these findings in its project file in order to confirm that the requirements of Section 106 have been satisfied. Should USACE, in consultation with the applicable SHPO and Consulting Tribes determine that the previous Section 106 review was insufficient or involved interagency disagreements about eligibility, effect determinations, and/or resolution of adverse effects (implementation of Treatment Measures), USACE shall conduct additional Section 106 consultation in accordance with the terms of this Agreement.

E. USACE has determined that the following types of activities have limited or no potential to affect historic properties and USACE has no further Section 106 responsibilities with regard to them, pursuant to 36 CFR § 800.3(a)(1):

1. Administrative actions such as personnel actions, travel, procurement of services, and supplies (including vehicles and equipment) for the support of day-to-day operational activities, and the temporary storage of materials provided storage occurs within existing facilities or on previously disturbed soils.

2. Providing funding for planning, studies, and design and engineering costs that involve no commitment of resources other than staffing and associated funding.

3. Funding the administrative action of acquiring properties, including the real estate transactions and transfers.

4. Boundary surveying, monitoring, data gathering, and reporting in support of planning or design activities (e.g., conducting geotechnical boring investigations or other geophysical and engineering activities provided no clearing or grubbing is necessary).

5. Demarcation of project areas and resources (e.g., cultural sites, wetlands, threatened and endangered species habitat).

II. POINTS OF CONTACT

A. Each USACE District will provide at a minimum a primary and secondary contact, which may include technical staff as well as liaisons). The primary contact is the contact to which all initial and formal correspondence is sent. If the individual designated as the primary point of contact is not available, communications shall be directed to the secondary contact.

B. Consulting Parties, including Signatories, Invited Signatories and Concurring Parties, will each designate a primary and secondary point of contact. Each Consulting Party to this Agreement is requested to provide phone numbers, email addresses, and mailing addresses for the primary and secondary contacts.

C. USACE has requested and shall continue to request that Federally-recognized Tribes provide areas of interest in the form of a map or other listing that USACE can use to determine, on a county-by-county (parish-by-parish) basis which Tribes to consult regarding specific Work Items.

D. USACE acknowledges that contacts and areas of interest may change over time. Addressing this is primarily a USACE responsibility with assistance from the Consulting Parties. The initial compilation is provided in Appendix B. Following the initial compilation, USACE and the Consulting parties shall follow the process outlined in the appropriate set of roles and responsibilities below to provide and distribute updated information for Appendix B. Alteration of Appendix B will not require executing an amendment to the Agreement.

E. In accordance with the process laid out in the roles and responsibilities below, USACE will follow-up on returned email and hard-copy mail or disconnected phone lines to ensure that a POC is re-established and the relevant Consulting Party receives the necessary information.

III. ROLES AND RESPONSIBILITIES OF THE CONSULTING PARTIES

A. USACE:

1. Shall not authorize implementation of an individual Undertaking (Work Item) until Section 106 review is completed pursuant to this Agreement.

2. Shall notify and consult with the SHPO of jurisdiction, appropriate Federally-recognized Tribes, and other Consulting Parties. Consultations may include face-to-face meetings, as well as communications by U.S. mail, e-mail, facsimile, and/or telephone. Times and places of meetings, as well as an agenda for meetings, will be developed with mutual acceptance and done in a timely manner.

3. Shall maintain the POC List (Appendix B) and will distribute it annually as part of the consultation, to the Primary POCs. USACE will incorporate any changes to the POC

listing as derived from the steps below into the annual distribution, as well as individual updates received in the interim.

a. USACE district staff engaged in consultation who receive a returned email, returned letter, or notification of a disconnected phone line, will follow up with the relevant Consulting Party to re-establish the appropriate point of contact. This will be communicated to necessary parties upon clarification and in the annual POC update.

b. At a minimum the Mississippi Valley Division (MVD) Cultural staff will make a round of phone calls to confirm the current POC listed for each of the Federally-recognized Tribes contained in the POC listing.

c. USACE District Archaeologists will ensure that the contact information for the SHPOs within their district have not changed.

4. Shall consult with any Federally-recognized Tribe on a government-to-government basis in recognition of its sovereign status, whether a signatory to this Agreement or not, but particularly regarding sites that may have traditional, religious, and/or cultural importance to Federally-recognized Tribes. In meeting its federal trust responsibility, USACE alone shall conduct all government-to-government consultation with Federally-recognized Tribes.

5. Shall be responsible for determining the APE, identifying historic properties located within the APE, providing NRHP eligibility determinations, and findings of effect, in consultation with SHPO, appropriate Federally-recognized Tribes, and other Consulting Parties.

6. Shall ensure all Cultural Resources review is conducted by qualified professional staff as outlined in Stipulation VI.A. 2.

7. Shall ensure that all documentation generated as part of the NHPA process resulting from these Undertakings shall be consistent with applicable *Standards (State and Federal)* (Stipulation VI.A) and confidentiality provisions outlined in Stipulation IV.

8. Shall use federal staff who meet the Professional Qualifications Standards as set forth in the Federal Register at 48 Fed. Reg., Vol. 190, 44716-01 (September 29, 1983), as amended (Qualified Staff) in applying the Programmatic Allowances (Allowances) listed in Appendix D, defining APE boundaries, completing identification and evaluation of all historic properties, and making determinations of effects.

9. Shall ensure, to the greatest extent practicable, that the SHPO of jurisdiction and the appropriate Federally-recognized Tribe(s) are consulted at the same time. And will, prior to submitting any determinations of eligibility and/or finding of effect as part of the consultation, review National Register eligibility recommendations provided by a cultural resources contractor and make its own determination.

10. USACE contractors shall not consult directly with any SHPO or Tribal Historic Preservation Officer (THPO), Consulting Tribes, or Federally-recognized Tribes. Consultation with SHPO/THPO, Consulting Tribes, or Federally-recognized Tribes remains a federal responsibility. This is/will be documented in any SOW for Cultural Resource Management activities or other construction work.

11. Shall, when authorizing individual Undertakings requiring environmental/cultural conditions pursuant to this Agreement, include all stipulations and conditions negotiated as part of the Section 106 Process. USACE will ensure that this information is communicated to the NFS and USACE contractor, and will be available for technical questions related to its implementation. This information is conveyed through the Buildability, Constructability, Operability, Environmental and Sustainability Reviews (BCOES Process), per Engineering Regulation 415-1-11, leading to solicitation.

12. Shall ensure that a written record of all stipulations and conditions pursuant to this Agreement regarding any Work Item location for which a particular NFS has jurisdiction are provided to the NFS, and USACE will be available to the NFS technical questions related to its implementation. Additionally, USACE shall provide the NFS with information and technical guidance on the treatment of any historic properties, if applicable.

13. Shall ensure that all documentation (e.g., identification, evaluation, and mitigation reports) resulting from Undertakings reviewed pursuant to this Agreement is consistent with the SHPO of jurisdiction and appropriate Consulting Tribes' Tribal guidelines, per Stipulation VI A. 3, and the confidentiality provisions of 54 U.S.C. § 307103 and 36 CFR § 800.11(c), per Stipulation IV A-E.

14. Shall ensure that, on federal and tribal land, that the provisions of the Native American Graves Protection and Repatriation Act (NAGPRA) (25 U.S.C. §3001-3013, 18 U.S.C. § 1170) and the Archaeological Resources Protection Act of 1979 (ARPA)(16 U.S.C. §470aa – 470mm) are followed.

15. Shall ensure that the provisions of the appropriate states' burial laws, including specific authorities outlined in Stipulation IX- Treatment of Human Remains and Items of Religious and Cultural Importance are provided to the NFS. USACE will provide any necessary technical guidance on the implementation of these laws, in support of the Designated Authority on NFS, state, or private land, subject to this agreement.

16. Annual Reporting: USACE shall provide Consulting Parties to this Agreement, with an annual report for the previous calendar year on or about July 30th of each year that this Agreement is in effect.

    a. This annual report summarizes the actions taken to implement the terms of this Agreement, such as, statistics on Undertakings meeting Allowances; emergency reviews; streamlined project review; resolution of adverse effects; after-the-fact consultations; use of other agency's determinations; the progress and completion of all treatment measures; and recommends any actions or revisions to be considered, including updates to the appendices, A, B, D, and E.

    b. USACE shall convene a conference call within thirty (30) days from the distribution of the Annual Report. During the conference call, USACE shall invite the Signatories, Consulting Tribes, and interested parties to review the annual report and discuss issues, if any, regarding implementation of the Agreement.

17. The District Tribal Liaison shall consult to establish protocols regarding which Federally-recognized Tribes to engage in specific geographical areas and the District shall follow those protocols. The results will be reflected in the list of POCs.

B. SHPOs:

1. The SHPO of jurisdiction shall coordinate with USACE, to identify Consulting Parties, including any communities, organizations, or individuals that may have an interest in a specific Undertaking and its effects on historic properties.

2. The SHPO of jurisdiction shall consult with USACE regarding USACE's determination of the APE, National Register eligibility, and findings of effect responding within timeframes set out in Stipulation V.

3. On a per Work Item basis, the SHPO of jurisdiction shall provide, as part of the consultation, available information about historic properties (such as access to site files, GIS data, survey information, geographic areas of concern) for the purposes of addressing effects to historic properties. Only Qualified Staff, per Stipulation VI A. 1. shall be afforded access to protected historic property information. USACE and any SHPO of jurisdiction may execute a written agreement to clarify and memorialize data sharing if it extends beyond any basic fee structure or access schedule.

4. The SHPO staff of jurisdiction (typically Division of Historic Preservation and Division of Archaeology staff members or equivalent) shall be reasonably available as a resource and for consultation through site visits, written requests, telephone conversations or electronic media. In those instances where consultation has occurred, USACE shall provide a written summary via e-mail or regular mail to SHPO, including any decisions that were reached.

5. All seven SHPOs, based on availability, shall participate in annual reviews convened by USACE to discuss the effectiveness of this Agreement in accordance with Stipulation III. A. 16.

C. Federally Recognized Tribes:

1. USACE acknowledges that Federally-recognized Tribes possess special expertise in assessing the National Register eligibility of properties with religious and cultural significance to that particular Tribe. Tribal leaders, and as appropriate, their representatives, shall designate an individual(s) for the Tribe's review of Undertakings affecting properties with religious and cultural significance to that particular Tribe. Designations such as this will follow the intent and processes laid out in USACE's 2012 Tribal Consultation Policy.

2. Federally-recognized Tribes (THPOs and other designees) may coordinate with USACE, to identify Consulting Parties, including any communities, organizations, or individuals that may have an interest in a specific Undertaking and its effects on historic properties.

3. Federally-recognized Tribes (THPOs and other designees) may consult with USACE regarding USACE's determination of the APE, National Register eligibility, and findings of effect responding within timeframes set out in Stipulation V.

4. On a per Work Item basis, Federally-recognized Tribes (THPOs and other designees) may provide, as part of the consultation, available information about historic properties (such as access to site files, GIS data, survey information, geographic areas of concern) for the purposes of addressing effects to historic properties. Only Qualified Staff, per

Stipulation VI A. 1. shall be afforded access to protected historic property information. USACE and any Federally-recognized Tribe may execute a written agreement to clarify and memorialize data sharing, if it extends beyond any basic fee structure or access schedule.

5. Federally-recognized Tribes (THPOs and other designees) shall be reasonably available as a resource and for consultation through site visits, written requests, telephone conversations or electronic media. In those instances where consultation has occurred, USACE shall provide a written summary via e-mail or regular mail to THPO, including any decisions that were reached.

6. Federally-recognized Tribes (THPOs and other designees) shall, based on availability, participate in annual reviews convened by USACE to discuss the effectiveness of this Agreement in accordance with Stipulation III. A. 16.

D. ACHP:

1. ACHP will provide guidance and advisory information to resolve disputes that may occur during the implementation of this Agreement, pursuant to the Dispute Resolution process in Stipulation XII.

2. ACHP will advise USACE if it will participate in consultations to resolve adverse effects, pursuant to 36 CFR § 800.6(a)(1).

3. ACHP will participate in the annual reviews convened by USACE to review the effectiveness of this Agreement.

IV. CONFIDENTIALITY OF HISTORIC PROPERTY INFORMATION

A. USACE will safeguard information about historic properties to the extent allowed by Section 304 of NHPA (54 U.S.C. § 307103), Section 9 of the Archaeological Resources Protection Act (ARPA), and other applicable federal laws, as well as implementing restrictions conveyed to USACE by SHPO and Federally-recognized Tribes, consistent with state and tribal guidelines. These safeguards will be included in any developed cultural resources Scopes of Work, as well.

B. Only USACE staff meeting the Professional Standards (Stipulation VI. A. 1.) , shall be afforded access to protected historic property information provided by any SHPO and/or Federally-recognized Tribes;

C. Regarding sensitive information shared by Federally-recognized Tribes, USACE, in accordance with provisions of federal law, will not share non-public information, without first confirming (in writing with the provider of the information) the appropriateness of sharing.

D. USACE shall provide to all Consulting Parties the documentation specified in 36 CFR § 800.11 subject to the confidentiality provisions of 36 CFR § 800.11(c) and such other documentation as may be developed during consultation to resolve adverse effects to the extent permitted by federal law.

E. SHPO/THPO, Consulting Tribal staff, and Federally-recognized Tribal staff and/or designee(s), shall safe guard historic property information (locational and other non-public) in accordance with the provisions of Section 304 of the NHPA and applicable state and tribal legal authorities.

F. USACE anticipates the presentation of historic property data as part of any Standard Treatment Measure (STM) or Memorandum of Agreement Treatment Measure (MOA TM) but shall ensure that these products, presentations, or other publications are adequately coordinated and consulted upon before release/presentation to ensure that any otherwise protected information is being represented appropriately.

V. CONSULTATION STANDARDS, TIMEFRAMES, AND CORRESPONDENCE

A. Consultation Standards:

1. Consultation among all Consulting Parties to this Agreement will continue throughout the implementation of this Agreement. Consultation is mutual, meaningful dialogue regarding the fulfillment of this Agreement, the process of Section 106 compliance, and the treatment of historic properties that may be affected by USACE undertakings.

2. USACE, when consulting with any Federally-recognized Indian Tribe, whether a signatory to this Agreement or not, will do so on a government-to-government basis in recognition of their sovereign status.

3. USACE will consult with the SHPOs, Federally-recognized Tribes, and other consulting parties, based on expressed areas of interest in the case of Federally-recognized Tribes or jurisdiction in case of SHPO offices. Consultations may include face-to-face meetings, as well as communications by regular mail, electronic mail, and/or telephone. Times and places of meetings, as well as an agenda for meetings, will be developed with mutual acceptance and done in a timely manner.

B. Timeframes:

1. All time designations in this Agreement shall be in calendar days unless otherwise expressly stipulated in writing in this Agreement:

    a. For emergency Undertakings as reviewed under Stipulation VII.B, USACE shall follow the timeframes as indicated in 36 CFR 800.12 (b) (2.).

    b. For Undertakings associated with all other activities as reviewed under the Streamlined Project Review Stipulations of this Agreement, the response time for each request for concurrence shall be a maximum of thirty (30) days, unless otherwise agreed to by the parties to the specific consultation on a case-by-case basis.

2. The review period will be extended until the next business day, if a review period included in this Agreement concludes on a Saturday, Sunday, state, or federal, or tribal holiday. If requested, USACE may consider an extension of a review period consistent with the time designations in this Agreement for parties affected by an unanticipated state office closure (any state) (e.g., hurricane, tornado or similar).

3. Any electronic communication forwarding plans or other documents for review under the terms of this Agreement that is sent after 4:00 pm Central Time will be deemed to have been received by the reviewing party on the next business day.

4. E-mail comments by the Signatories on any documents submitted for review under this Agreement are timely if they are received at any time on or before the last day of a review period. Responses sent by mail will be accepted as timely if they are postmarked by the last day allowed for the review.

5. If any Signatory does not object to USACE's finding or determination related to an Undertaking within an agreed upon timeframe, USACE may proceed to the next step in the consultation process as described in Stipulation VII, Project Review.

6. Timeframes are contingent upon USACE ensuring that its findings and determinations are made by Qualified Staff and supported by documentation as required by 36 CFR § 800.11(d) and 36 CFR § 800.11(e), and consistent with USACE guidance.

C. Correspondence:

1. The Consulting Parties may send and accept official notices, comments, requests for further information and documentation, and other communications required by this Agreement in accordance with the protocol in Appendix B.

   a. If the size of an e-mail message is unusually large or an e-mail is returned to a sender because its size prevents delivery, the sender will contact the intended recipient(s) and determine alternative methods to deliver the information (including available file sharing platforms).

   b. Time-sensitive information that is not sent by e-mail should be sent by overnight mail, courier, or hand-delivered. The timeframe for requests for review not sent by e-mail will be measured by the date the delivery is signed for by the SHPO of jurisdiction, Federally-recognized Tribe, or other organization representing the Consulting Party.

VI. STANDARDS

A. In addition to the definitions utilized in 36 CFR § 800, this Agreement uses the definitions presented in the subsequent paragraphs to establish standards for performing all cultural resource project reviews and investigations required under the terms of this Agreement including, but not limited to, site identification, NRHP eligibility evaluations, and as appropriate, STM or MOA TM for the resolution of adverse effects to historic properties:

1. "Qualified Staff" – shall mean staff who meet, at a minimum, the SOI Professional Qualifications Standards set forth at 48 FR 44738 (September 29, 1983), for History, Archaeology, Architectural History, Architecture, or Historic Architecture (https://www.nps.gov/history/local-law/arch_stnds_9.htm) and the appropriate qualifications presented in Professional Qualifications (36 CFR Part 61, Appendix A).

2. "Standards" -- shall mean the Secretary of the Interior's (SOI) Standards and Guidelines for Archaeology and Historic Preservation [Federal Register 48(190) 1983:44716-44737] (https://www.nps.gov/history/local-law/arch_stnds_0.htm);

3. "Meeting Professional Standards" -- shall mean that all cultural resource investigations shall be performed by, or under the direct (in-field) supervision of appropriate professional(s) or by contractors, who are "Qualified Staff.";

4. "Field and Reporting Standards" – shall mean the current historic standing structure and archaeological guidance from the SHPO's Office of jurisdiction, depending on the work item location:

   - Arkansas Historic Preservation Program and the Arkansas Archeological Survey, or
   - Illinois State Historic Preservation Office (DNR), or
   - Kentucky Heritage Council, or
   - LA State Historic Preservation Office, or
   - Mississippi Department of Archives and History, or
   - MO State Historic Preservation Office, or
   - Tennessee Department of Environment and Conservation, Division of Archeology and Tennessee Historical Commission;

5. "Policies and Guidelines" -- shall mean guidance from any of the following:

   a) The National Park Service publication *The Archaeological Survey: Methods and Uses* (National Park Service 1978);
   b) ACHP's Treatment of Archeological Properties: A Handbook (1980) (https://www.achp.gov/sites/default/files/documents/2018-11/Treatment%20of%20Archeological%20Properties-A%20Handbook-OCR.pdf);
   c) Identification of Historic Properties: A Decision-making Guide for Managers (1988, joint ACHP-NPS publication);
   d) Consulting About Archeology Under Section 106 (1990);
   e) ACHP's Recommended Approach for Consultation on Recovery of Significant Information from Archeological Sites (1999);
   f) ACHP's Policy Statement Regarding the Treatment of Burial Sites, Human Remains and Funerary Objects (2007) https://staging.achp.gov/sites/default/files/policies/2018-06/ACHPPolicyStatementRegardingTreatmentofBurialSitesHumanRemainsandFuneraryObjects0207.pdf; and
   g) Section 106 Archaeology Guidance: A reference guide to assist federal agencies in making effective decisions about archaeological sites (2009) https://www.achp.gov/sites/default/files/guidance/2017-02/ACHP%20ARCHAEOLOGY%20GUIDANCE.pdf)

B. In developing Scopes of Work (SOW) for identification and evaluation studies, STM or MOA TM(s), or any other cultural resources activities required under the terms of this Agreement, USACE will comply with the requirements of the Standards, Field and Reporting Standards, and the Policies and Guidelines, in existence at the time this work is performed.

C. Additionally, in developing SOW for identification and evaluation studies, STM or MOA TM(s), or any other cultural resources activities required under the terms of this Agreement, and where geographically appropriate, USACE will take into account the following guidance:

1. Guidance from the Osage Nation *National Historic Preservation Act Section 106 Protocol and Standards*, *Archaeological Survey Standards*, and *Archaeological Resources Protection Act Violation Procedures*; and

2. Any additional area-specific guidance beyond that provided for under VI A 1. – 4 (e.g., additional Federally-recognized Tribal guidance, or local preservation ordinances).

VII. PROJECT REVIEW

A. Programmatic Allowances:

1. If USACE determines an Undertaking conforms to one or more allowances in Appendix D of this Agreement, USACE shall complete the Section 106 review process by documenting this determination in the project file, without SHPO or Federally-recognized Tribal review or notification, excepting in the annual report.

2. If USACE determines any portion of an Undertaking's scope of work does not conform to one or more Allowances listed in Appendix D, USACE shall conduct Section 106 review, as appropriate, for the entire Undertaking in accordance with Stipulation VII.B, Review for emergency Undertakings, or Stipulation VII.C, Streamlined Project Review.

3. Allowances may be revised and new Allowances may be added to this Agreement in accordance with Stipulation XIV, Amendments.

B. Review for Emergency Undertakings:

1. For review of actions that are emergencies, an essential and immediate response to a disaster or emergency declared by the President, a tribal government, or the Governor of a State or another immediate threat to life or property USACE shall follow the provisions of 36 CFR 800.12 (b).

C. Streamlined Project Review:

For Undertakings not falling under VII. A. or VII. B, USACE shall ensure that the following project review steps are implemented. In the interest of streamlining, USACE may combine some or all of these steps during consultation in accordance with 36 CFR § 800.3(g).

1. <u>Consulting Parties</u>**:** USACE shall consider all written requests of individuals and organizations to participate as Consulting Parties, and consult with the SHPO of jurisdiction and the appropriate Federally-recognized Tribe(s) to identify any other parties that meet the criteria to be Consulting Parties and invite them to participate in the Section 106 process. USACE may invite others to participate as Consulting Parties as the Section 106 consultation proceeds.

2. <u>Area of Potential Effects (APE):</u> For all projects undergoing streamlined project review, Qualified Staff shall determine the APE in consultation with the SHPO of jurisdiction and appropriate Federally-Recognized Tribe(s).

   The APE will be defined as all areas to be affected by construction activities and areas of associated ground disturbance including but not limited to haul roads, borrow areas, staging and stockpiling areas. The APE would generally include all areas for which a Right-of-Entry is sought by USACE or the NFS. Additional effects that will be considered shall include visual, auditory, and off-site anticipated erosion resulting from the constructed feature. USACE may consider information provided by other parties, such as local governments and the public, when establishing the APE.

APE Definition Factors:

a. For standing structures not adjacent to or located within the boundaries of a National Register listed or eligible district, Qualified Staff may define the APE as the individual structure or structures when the proposed Undertaking is limited to its repair or rehabilitation (e.g. floodwalls, or other appurtenant structures to the levees, etc.).

b. For archaeological sites the USACE should consider the nature of likely properties in unsurveyed areas, the fact that mound sites may have been incorporated into the levee profile or may have been excavated and used as fill material in the levee.

3. Identification and Evaluation: Qualified Staff shall determine, in consultation with SHPO and Tribe(s), if the APE contains historic properties, including properties of religious and cultural significance to Federally-recognized Tribes. This may include the review of newly developed or previously produced documentation in coordination with the SHPO of jurisdiction, appropriate Federally-recognized Tribe(s), and any additional Consulting Parties.

a. Level of Effort: USACE shall make a reasonable and good faith effort to identify historic properties in accordance with 36 CFR § 800.4(b)(1). USACE shall consult with the SHPO of jurisdiction and appropriate Federally-recognized Tribe(s) to determine the level of effort, methodology necessary to identify and evaluate a variety of historic property types, and any reporting requirements. For properties of religious and cultural significance to affected Federally-recognized Tribe(s), USACE shall consult with the affected Tribe(s) to determine if the APE contains such properties and determine the necessary level of effort to identify and evaluate or avoid any such historic properties. All Identification and Evaluation studies will comply with the Standards (Stipulation VI).

b. Timing:

i. With respect to each Work Item, USACE shall achieve compliance with all relevant terms of this Agreement prior to initiating physical construction of that Work Item.

ii. The results of all field investigations will be subject to a review and comment period of no less than thirty (30) days by the appropriate Consulting Parties, following the receipt by the SHPO of jurisdiction and the appropriate Federally-recognized Tribe(s) of the completed reporting document architectural survey, Phase I or II archaeological reports, and any other supporting documentation.

iii. Coordination of consultation will be through the designated POC (Stip. II).

c. National Historic Landmarks (NHL): When USACE identifies an Undertaking with the potential to affect an NHL, USACE will adhere to 36 CFR 800.10 Special

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Requirements for Protecting NHL's. USACE shall contact NPS NHL Program Manager of the Southeast NPS Regional Office in addition to the SHPO of jurisdiction, appropriate Federally-recognized Tribe(s), and other Consulting Parties. The purpose of this notification is to ensure early coordination for the Undertaking, which USACE later may determine adversely affects the NHL as outlined in Stipulation VII C. 7, Assessing Adverse Effects.

4. Determinations of Eligibility: USACE shall make determinations of National Register eligibility based on identification and evaluation efforts, and consult with the SHPO of jurisdiction, appropriate Federally-recognized Tribe(s), and other Consulting Parties regarding these determinations. Should the SHPO of jurisdiction, or appropriate Federally-recognized Tribe(s) disagree with the determination of eligibility, USACE shall:

   a. Consult further with the objecting party to resolve the objection;

   b. Treat the property as eligible for the National Register; or

   c. Obtain a determination of eligibility from the Keeper of the National Register in accordance with 36 CFR § 63.2(d)-(e) and 36 CFR § 800.4 (c) 2.

5. Findings of No Historic Properties Affected:

   a. Basis for Finding. USACE shall make a finding of "no historic properties affected" under the following circumstances:

      i. If no historic properties are present in the APE; or

      ii. The Undertaking shall avoid alteration to the characteristics of a historic property qualifying it for inclusion in or eligibility for the National Register (including cumulative effects); or

   b. USACE shall notify the SHPO of jurisdiction, appropriate Federally-recognized Tribes(s), and any other Consulting Parties of this finding and provide supporting documentation in accordance with 36 CFR § 800.11(d). Unless Consulting Parties object to the finding, or request additional information, within 30-days, the Section 106 review of the Undertaking will have concluded.

   c. If the SHPO of jurisdiction and/or appropriate Federally-recognized Tribes(s), objects to a finding of "no historic properties affected," USACE shall consult with the objecting party to resolve the disagreement.

      i. If the objection is resolved, USACE either may proceed with the Undertaking in accordance with the resolution or reconsider effects on the historic property by applying the criteria of adverse effect pursuant to Stipulation VII.C.6., Application of the Criteria of Adverse Effect, below.

      ii. If USACE is unable to resolve the disagreement, it will forward the finding and supporting documentation to ACHP and request that ACHP review USACE's finding in accordance with the process described in 36 CFR § 800.4(d)1)(iv)(A) through 36 CFR § 800.4(d)(1)(iv)(C).). USACE shall, pursuant to 800.4(d)(1)(iv)(C), prepare a summary of its decision that

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contains the rationale for the decision and evidence of consideration of the ACHP's opinion, and provide this to the SHPO of jurisdiction, appropriate Federally-recognized Tribes(s), and all other Consulting Parties. If USACE's final determination is to reaffirm its "no historic properties affected" finding, the Section 106 review of the Undertaking will have concluded. If USACE will revise its finding, then it shall proceed in accordance with Stipulation VII.C.5., 6, below.

6. Assessing Adverse Effects: If, through consultation, USACE finds an Undertaking may affect historic properties in the APE, including those of religious or cultural significance to affected Federally-recognized Tribe(s), USACE shall apply the criteria of adverse effect to historic properties within the APE(s), including cumulative effects, taking into account the views of the Consulting Parties and the public concerning effects in accordance with 36 CFR § 800.5(a).

a. Findings *of No Adverse Effect:* If, through consultation, USACE determines that an Undertaking does not meet the adverse effect criteria, pursuant to 36 C.F.R. § 800.5(a)(1), USACE shall propose a finding of "no adverse effect" and consult with the SHPO of jurisdiction, appropriate Federally-recognized Tribes(s) and Consulting Parties in accordance with 36 CFR § 800.5(b) and following steps i-iii below, or will move to subparagraph b.

i. USACE shall notify all Consulting Parties of its finding; describe any project specific conditions and/or modifications required to avoid or minimize effects to historic properties; and provide supporting documentation pursuant to 36 CFR §800.11(e).

ii. Unless a Consulting Party objects within thirty (30) days, USACE will proceed with its "no adverse effect" determination and conclude the Section 106 review.

iii. If a Consulting Party objects to a finding of "no adverse effect," USACE will consult with the objecting party to resolve the disagreement.

a) If the objection is resolved, USACE shall proceed with the Undertaking in accordance with the resolution; or

b) If the objection cannot be resolved, USACE shall request that ACHP review the findings in accordance with 36 CFR § 800.5(c)(3)(i)-(ii) and submit the required supporting documentation. USACE shall, pursuant 800.5(c)(3)(ii)(B), prepare a summary of its decision that contains the rationale for the decision and evidence of consideration of the ACHP's opinion, and provide this to the SHPO of jurisdiction, appropriate Federally-recognized Tribes and all other Consulting Parties. If USACE's final determination is to reaffirm its "no adverse effect" finding, the Section 106 review of the Undertaking will have concluded. If USACE will revise its finding then it shall proceed to Stipulation VI 6. b., below.

b. *Avoidance and Minimization of Adverse Effects:* If USACE, during its initial review, finds the Undertaking may adversely affect historic properties, USACE

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may make a further internal review to consider ways to avoid or minimize effects to historic properties. The review will consider revising the elements of the scope of work affecting historic properties to substantially conform to the SOI Preservation Standards or otherwise avoid or minimize adverse effects.

i. If USACE modifies the scope of work following its initial internal review to avoid or minimize effects below the "criteria of adverse effect" (36 CFR 800.5 (a)(1), (i.e., to the point USACE can make a finding of No Adverse Effect), USACE shall consult with the SHPO of jurisdiction, appropriate Federally-recognized Tribe(s), and all other Consulting Parties providing the *original and modified* Scopes of Work as part of its finding of "no adverse effect" following the process in Stipulation VII.C.6.a.

ii. If USACE is unable to modify the Undertaking to avoid or minimize effects below the "criteria of adverse effect", USACE shall initiate consultation to resolve the adverse effect(s) in accordance with Stipulation VII.C.7, Resolution of Adverse Effects.

7. <u>Resolution of Adverse Effects (AE):</u> If USACE determines that an Undertaking may adversely affect a historic property, it shall resolve the effects of the Undertaking in consultation with the SHPO of jurisdiction; the appropriate Federally-recognized Tribe(s); ACHP, if participating; and other Consulting Parties; by one of the methods described in VII.C.7.(a) through (c). When, through consultation, USACE determines an Undertaking will adversely affect an NHL, USACE shall notify and invite the Secretary of the Interior and ACHP, as well as notifying Regional National Park Service staff to participate in consultation in accordance with 36 CFR § 800.10.

a. *Abbreviated Resolution Process (ABR):* USACE may propose in writing to the Consulting Parties to resolve the adverse effects of the Undertaking through the application of one or more Treatment Measures outlined in Appendix E (Historic Property Treatment Plan). USACE shall ensure that the provisions of the Historic Property Treatment Plan, as outlined in the consultation and agreed to by Consulting Parties, are documented in writing and implemented. The use of these Treatment Measures in a Historic Property Treatment Plan shall not require the execution of an individual Memorandum of Agreement or Secondary Programmatic Agreement.

i. In consultation with the SHPO of jurisdiction, appropriate Federally-recognized Tribe(s), and other Consulting Parties, USACE shall propose in writing the implementation of a specific Historic Property Treatment Measure, or combination of Treatment Measures, with the intent of expediting the resolution of adverse effects, and provide documentation as required by 36 CFR § 800.11(e) and subject to the confidentiality provisions of 36 CFR § 800.11(c)). The correspondence will include a Historic Properties Treatment Plan that outlines roles and responsibilities for accomplishment of the selected treatment measures, specify the deliverables, and define the timeline.

ii. The ACHP is not required to, and would not normally, participate in the development of Historic Property Treatment Plans, under the Abbreviated Resolution Process. However, the ACHP will receive a copy of the

Historic Properties Treatment Plan. Only when requested by USACE, the SHPO of jurisdiction, appropriate Federally-recognized Tribe(s), or other Consulting Parties, would they participate, if the ACHP determines that its participation is warranted.

iii. Unless a Consulting Party or the ACHP objects to USACE's proposed Historic Property Treatment Plan within the timeframe outlined in Stipulation V. B Timeframes, USACE shall proceed with the implementation of the Historic Property Treatment Plan and will conclude the Section 106 review.

iv. If any of the Consulting Parties or ACHP objects within the timeframe outlined in Stipulation V.B. Timeframes, to the resolution of adverse effects through the application of the Abbreviated Consultation Process, USACE shall resolve the adverse effect(s) using procedures outlined below in Stipulation VII.C.7 (b), MOA or Stipulation VII.C.7 (c), Programmatic Agreement. USACE shall invite any individual or organization that will assume a specific role or responsibility outlined in a Memorandum of Agreement or Secondary Programmatic Agreement to participate as an Invited Signatory to the Undertaking-specific agreement.

v. Because funding and implementation details of a Historic Property Treatment Plan for specific Undertakings may vary by state and Non-Federal Sponsor, USACE shall provide written notice to the Consulting Parties within sixty (60) days of the completion of the Historic Property Treatment Measure(s). This written notice will serve as confirmation that the Historic Property Treatment Measure(s) for a specific Undertaking have been implemented. USACE also shall include information pertaining to the progress and completion of Historic Property Treatment Plans in the annual report pursuant to Stipulation III A. 16. USACE Roles and Responsibilities.

b. *Memorandum of Agreement (MOA):* USACE shall provide ACHP with an adverse effect notice in accordance with 36 CFR § 800.6(a)(1) if it has not already provided such under the Abbreviated Consultation Process of this Agreement, if a Consulting Party or ACHP objects in accordance with Stipulation II.C.6(a)(iii), or if USACE in consultation with SHPO/THPO, Tribe(s), and other Consulting Parties has determined that an MOA would be more appropriate than the Abbreviated Consultation Process to resolve the adverse effect(s). In consultation with the SHPO of jurisdiction, appropriate Federally-recognized Tribe(s), and other Consulting Parties, including ACHP (if participating), USACE shall develop an MOA, in accordance with 36 CFR § 800.6(c) to agree upon Treatment Measures to avoid, minimize, and/or mitigate adverse effects on historic properties. The MOA may also include Treatment Measures that serve an equal or greater public benefit in promoting the preservation of historic properties in lieu of the Treatment Measures outlined in Appendix E.

c. *Programmatic Agreement (Secondary PA):* Should the execution of an MOA be inappropriate given the similar nature of effects on historic properties, the inability to determine effects prior to approval of an Undertaking, or where other circumstances warrant, USACE, shall consult with SHPO/THPO, Tribe(s), ACHP, if participating, and any other Consulting Parties to develop a

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Programmatic Agreement in accordance with 36 CFR § 800.14(b) and to identify programmatic conditions or Treatment Measures to govern the resolution of potential or anticipated adverse effects from certain complex project situations for an Undertaking or for multiple, but similar Undertakings by a single agent or contractor.

8. Disagreements Regarding AE Resolution Actions: Should any signatory or Consulting Party object within the timeframes established by this Agreement to any plans, specifications, or actions taken pursuant to resolving an adverse effect, USACE shall consult further with the objecting party to seek resolution. If USACE determines the objection cannot be resolved, USACE shall address the objection in accordance with Stipulation XII, Dispute Resolution.

9. Reports:

a. USACE shall ensure that all reports and other documents resulting from the actions pursuant to this Agreement will be provided in a format acceptable to the SHPO of jurisdiction and appropriate Federally-recognized Tribes. USACE will ensure that all such reports (e.g., identification surveys, evaluation reports, treatment plans, and data recovery reports) meet or exceed the Department of the Interior's *Format Standards for Final Reports of Data Recovery* (42 FR 5377-79) and the *Field and Report Standards* identified in Stipulation II.A.1(d).

b. USACE shall provide all documentation for these efforts to the SHPO of jurisdiction, appropriate Federally-recognized Tribes, or other Consulting Parties, as appropriate, consistent with the confidentiality provisions of Stipulation IV. of this Agreement.

c. Once supporting documentation is received, SHPO and Tribes will have thirty (30)-days to review supporting documentation (e.g., site forms and reports). If the SHPO of jurisdiction or appropriate Federally-recognized Tribes intend to review and comment on documentation, and are unable to do so within the thirty (30)-day review period, a request for additional review time must be made in writing to USACE and specify the anticipated completion date. USACE will consider the request and work with the requesting party to come to a mutually agreeable timeframe. USACE will notify other Consulting Parties of any mutually approved extension by e-mail.

VIII. The Public:

A. USACE recognizes that the views of the public are essential to informed decision making throughout the Section 106 consultation process. USACE shall notify the public of proposed Undertakings in a manner that reflects the nature, complexity, significance of historic properties likely affected by the Undertaking, the likely public interest given USACE's specific involvement, and any confidentiality concerns of Federally-recognized Tribe(s), private individuals and organizations.

B. USACE may consult with the relevant SHPO/THPO, Consulting Tribes, or Federally-recognized Tribe(s), and other Consulting Parties, to determine if there are individuals or organizations with a demonstrated interest in historic properties that should be included as a Consulting Party for the Undertaking in accordance with 36 CFR § 800.2(c)(5). If such parties are identified or identify themselves to USACE, USACE shall provide them with information regarding the Undertaking and its effects on historic properties, consistent with the confidentiality provisions of 36 CFR § 800.11(c).

C. In accordance with the public outreach strategy developed for an Undertaking in consultation with the SHPO of jurisdiction, appropriate Federally-recognized Tribe(s), USACE shall identify the appropriate stages for seeking public input during the Section 106 consultation process. USACE shall consider all views provided by the public regarding an Undertaking.

D. USACE shall also provide public notices and the opportunity for public comment or participation in an Undertaking through the public participation process of the National Environmental Policy Act (NEPA) and its implementing regulations set out at 40 CFR Parts 1500-1508, and/or Executive Orders 11988 and 11990 relating to floodplains and wetlands, and if applicable, Executive Order 12898, Environmental Justice, provided such notices specifically reference Section 106 as a basis for public involvement and provide the notices on a webpage established to address MRL Projects (see Appendix A for the specific web addresses).

IX. CURATION

Recovered archaeological collections from a USACE-required archaeological survey, evaluation, and/or mitigation remain the property of the land owner (either private, state, federal, etc.). USACE, in coordination with the SHPO of jurisdiction and appropriate Federally-recognized Tribe(s) may, as determined through consultation, encourage private land owners to transfer any recovered artifacts and related documentation to an appropriate archive or public or Federally-recognized Tribal entity. USACE, in coordination with SHPO and Federally-recognized Tribe(s), shall work with all tribal, state, and local agents to support steps that ensure the long-term curation of these artifacts and documents through the transfer of the materials to a suitable repository as agreed to by USACE, the SHPO of jurisdiction, and appropriate Federally-recognized Tribes(s) and following applicable state or tribal guidelines. USACE shall ensure that collections from federal or tribal land, including field and laboratory records sufficient to document the collection, are curated at a repository meeting federal standards (36 C.F.R. 79) as agreed to by USACE, SHPO, and affected Federally-recognized Tribe(s), and follow that repository's guidelines.

X. TREATMENT OF HUMAN REMAINS AND ITEMS OF RELIGIOUS AND CULTURAL IMPORTANCE

A. **Documenting Human Remains:** The recordation of human remains in a burial context or as individual elements is a task that requires sensitivity and good judgment, as defined through consultation. Consultation is a necessary part of documenting any human remains (in a discovery situation or during the treatment of historic properties) following the provisions of this stipulation. In planning how to document human remains (photography, drawing for the purposes of illustration, videography, or other), the determination will be made in consultation and concurrence with the SHPO of jurisdiction, Federally-recognized Tribe(s), and, as appropriate, other descendant communities. Even if it is determined to photo document the human remains, the photographs should not be published or made publicly available in any way. The USACE will maintain records for the purpose of management of the human remains, with the intent of satisfying the protection provisions of the federal and state laws governing human remains, the records will be hardcopy and digital. When the records are digital, they will not be connected to externally available electronic resources like GIS servers or other and marked as restricted (per NHPA, FOIA, and, as appropriate, ARPA). As part of the consultation for each Work Item where Human Remains are present, the USACE will ensure that the consultation happens as appropriate to each jurisdiction to determine the course of action for each situation.

B. General Human Remains Discovery Process:

1. In the event that previously unreported or unanticipated human remains, burials, funerary objects, Native American sacred objects, or Native American objects of cultural patrimony are encountered during field investigations, laboratory work, or during construction or maintenance activities originating from federal, state, or private lands (Federal and Non-Federal Lands) USACE shall notify the relevant historic preservation interests (SHPO's of jurisdiction, and interested Federally-recognized Tribal representatives) within 24-hrs of the discovery. Concurrently, USACE will implement the provisions 2 thru 6, below:

2. Any USACE employee or contractor(s) who knows or has reason to know that they have inadvertently discovered human remains, burials, funerary objects, Native American sacred objects, or Native American objects of cultural patrimony must provide immediate telephone notification of the inadvertent discovery to the responsible Federal construction official, with written confirmation, to the appropriate USACE District's Point of Contact in this agreement. The written notification should contain the results, if any, of the field evaluation. The appropriate USACE District's Cultural Resources Staff and Tribal Liaison will begin to develop a plan of action to inform the appropriate District Commander of the consultation tasks necessary to address the discovery. No photographs should be taken at this time of the human remains.

3. All fieldwork, construction or maintenance activities, must stop immediately within a one hundred (100) meter (328 ft.) radius buffer zone around the point of discovery; unless there is reason to believe that the area of the discovery may extend beyond the one hundred (100) meter (328 ft.) radius buffer zone in which case the buffer zone will be expanded appropriately, within the APE. USACE will implement measures to protect the discovery from theft and vandalism. Any human remains or other items in the immediate vicinity of the discovery must not be removed or otherwise disturbed. USACE will take immediate steps, if necessary, to further secure and protect inadvertently discovered human remains, burials, funerary objects, Native American sacred objects, or Native American objects of cultural patrimony, as appropriate, including stabilization, or covering the find location.

4. USACE will notify local law enforcement, coroner, or medical examiner, as appropriate, and the SHPO of jurisdiction, per the POC in Appendix B, by telephone to assess the nature and age of the human skeletal remains within twenty-four (24) hours of the discovery of unmarked human remains and accompany local law enforcement personnel during all field investigations. USACE will also notify interested Federally-recognized Tribes of the discovery within the same period. If the appropriate local law enforcement official determines that the remains are not involved in a criminal investigation, USACE will follow jurisdictional guidelines as provided for based on land ownership (per Stipulation X. B.).

   a. In cases where human remains, burials, funerary objects, Native American sacred objects, or Native American objects of cultural patrimony are discovered during the implementation of a USACE-funded undertaking on Federal Land, USACE will notify by telephone and e-mail, the SHPO of jurisdiction, Tribes, and other affected parties (e.g., living descendants) that may that might attach religious and cultural significance to the discovery at the earliest possible time, but no later than forty-eight (48) hours and inform them of the steps already taken to address the discovery.

b. In cases where the human remains are discovered on Non-Federal Lands and are determined to be Native American, the individual state's Designated Authority will notify and coordinate with Tribes as required by the appropriate state law, but not later than forty-eight (48)-hours from the time of their notification. As requested and to the extent of its legal authority, USACE will assist the Designated Authority, to consult with Tribes and affected parties, as appropriate.

c. In cases where the human remains are discovered on Non-Federal Lands and determined to be other than Native American, the individual state's Designated Authority will notify and coordinate in accordance with the appropriate state law. As requested and to the extent of its legal authority, USACE will assist the Designated Authority to consult with the affected parties, as appropriate.

5. USACE will consult with SHPO, THPOs, and appropriate Federally-recognized Tribes, and other affected parties to develop a mutually agreeable action plan with timeframes to take into account the effects of the Undertaking on the discovery; resolve adverse effects if necessary; and ensure compliance with applicable federal laws and their implementing regulations, if the discovery of Native American human remains, funerary objects, Native American sacred objects, or Native American objects of cultural patrimony occurs on Federal Land (see Stipulation IX. B. for the detailed process).

6. Following the outcome of any consultation (Federal Lands or Non-Federal Lands) to address the discovery of human remains, USACE will coordinate with any contractor(s) regarding any required scope of project modification necessary to implement recommendations from the consultation and facilitate proceeding with the Undertaking.

C. **Specific Authorities and Processes for Addressing Human Remains**: If human remains, funerary objects, Native American sacred objects, or Native American objects of cultural patrimony are encountered during project field investigations or laboratory work or during construction activities, the USACE will comply with the provisions based on the nature of the land ownership at the time remains or objects are encountered, in accordance with Engineering Regulation 1102-2-100 (Policy & Guidance), Appendix C-4.

1. Federal Lands: If discovered/recovered from *Federal lands*, USACE shall concurrently implement processes defined in this Agreement, satisfying NHPA, as well as

- ensuring consultation with appropriate Federally-recognized Tribes for any human remains, funerary objects, Native American sacred objects, or Native American objects of cultural patrimony (objects) as required by the Native American Graves Protection and Repatriation Act of 1990 (NAGPRA), as amended (25 U.S.C. §§ 3001-3014) and its implementing regulations (43 C.F.R. Part 10; and
- ensuring the appropriate provisions of the Archaeological Resources Protection Act, 16 USC §§ 470aa et seq., are followed.

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a. For discoveries of human remains, burials, funerary objects, Native American sacred objects, or Native American objects of cultural patrimony, USACE will continue to consult with the SHPO of jurisdiction, claimant Federally-recognized Tribes, and other affected parties, as appropriate, whether they are Signatories to this Agreement or not, regarding additional measures to avoid and protect or mitigate the adverse effect of the Undertaking. These measures may include:

    i. Visits to the site by the SHPO of jurisdiction, claimant Federally-recognized Tribes, and other affected parties, as appropriate;
    ii. Formally evaluate the archaeological site for NRHP-eligibility;
    iii. Explore potential avoidance alternatives;
    iv. Develop and implement a mitigation plan in consultation and concurrence with the SHPO of jurisdiction, claimant Federally-recognized Tribes, and other affected parties, as appropriate, including procedures for disinterment and re-interment.

b. Initial Determination of nature of discovered Human Remains when from Federal Lands (Native American or Other)

    i. USACE, in consultation with the SHPO of jurisdiction and claimant Federally-recognized Tribes, whether they are Signatories to this Agreement or not, and other affected parties, may consult with a qualified physical anthropologist, forensic scientist, or other experts as may be needed to examine and assess the discovery. Unless the remains were inadvertently removed, the evaluation will be conducted at the site of discovery. Other than for crime scene investigation, no excavation, examination, photographs, or analysis of Native American human remains or remains suspected of being Native American will be conducted or allowed by USACE archaeologists or any other professional without first consulting with the claimant Federally-recognized Tribes, whether they are Signatories to this Agreement or not. The consulting expert will be allowed to draw and measure the exposed remains and associated funerary objects. Drawings cannot be published in any form or shown as part of scholarly presentations without the written permission of the appropriate Tribes or next living descendant.

    ii. USACE, in consultation with the SHPO of jurisdiction, claimant Federally-Recognized Tribes, and other affected parties, as appropriate, whether they are Signatories to this Agreement or not, will have seven (7) days to determine if the skeletal remains are human, the degree to which they were disturbed, and if possible, using reasonable measures to assess their potential age, cultural affiliation, and identity, without any further disturbance. Upon making a determination or at the end of the seven (7) days, whichever comes first, USACE will notify the appropriate affected parties of its findings. This notification will include pertinent information as to kinds of human remains, funerary objects, Native American sacred objects, or Native American items of cultural patrimony discovered, their condition, and the circumstances of their inadvertent discovery.

    iii. If the remains are determined NOT to be Native American in origin, USACE will follow the principals outlined in the 2007 ACHP "Policy Statement Regarding Treatment Of Burial Sites, Human Remains and Funerary Objects" to respectfully treat the remains and determine proper disposition, disinterment, re-interment, and memorialization, as well as any Real Estate guidance at the time of the discovery.

c. Initiating NAGPRA Consultation following Inadvertent Discoveries/Recovery of Human Remains from Federal Lands

   i. For the purposes of notification and consultation of an inadvertent discovery, USACE considers the Consulting Tribes, and Federally-recognized Tribes who have identified the County/Parish as an area of interest are likely to be cultural affiliated with inadvertently discovered NAGPRA items found on a specific Work Item.

   ii. Upon certification of an inadvertent discovery of NAGPRA items by the responsible federal official, the USACE shall notify the consulting Federally-recognized Tribes. This notification will be made via email and telephone call to the appropriate consulting Tribes' Primary POC within twenty-four (24) hours, and include concurrent hard copy written notification, via regular mail. Notifications shall include a copy of the field documentation and a list of all other parties being notified.

   iii. No later than three (3) days after the email and telephone notification, the consulting Federally-recognized Tribes and/or claimant Federally-recognized Tribe shall agree to a date and time for a teleconference to begin the consultation process.

d. Consultation for Inadvertent Discoveries//Recovery of Human Remains from Federal Lands that are Native American

   i. Consultation will begin with the teleconference with all consulting Federally-recognized Tribes and/or claimant Federally-recognized Tribe. At this time both parties may determine that the cause of the inadvertent discovery is not on-going, that the location where the discovery occurred is secure (or can be secured), and that the NAGPRA items do not need to be removed.

   ii. If all Consulting Parties participating in the consultation reach the same conclusion under A above, then the USACE will issue a written notice to all parties concluding that the location of the inadvertent discovery is secure and that the NAGPRA items will be left in place. If any Consulting Parties disagree with this assessment, then consultation will progress with all Consulting Parties including the signatories to this Agreement.

   iii. If consensus is not attained, the USACE will notify, in writing, all consulting Federally-recognized Tribes of its intent to complete consultation with a written plan of action in accordance with 43 CFR § 10.5(e). The USACE will produce a NAGPRA plan of action which details the steps it will follow to complete the NAGPRA consultation process (43 CFR § 10.5(e)). This plan will contain a) a list of all materials considered to be NAGPRA items, b) the planned treatment, care, and handling of the materials, c) any planned recording of the find location as an archaeological site, d) any analysis planned for the remains, e) and a description of any anticipated summary reports. USACE and the consulting Federally-recognized Tribes will create a template plan of action to be on file.

iv. Within thirty (30) days of receipt of notice to consult and the action plan, the consulting Federally-recognized Tribes agree to provide a summary response containing the names and contact info for any potential lineal descendants, recommendations on any topics that should be included in consultation, request for any additional consultation meetings, recommendations for any treatment actions for the location of the discovery, and a list of any items that should be considered as NAGPRA items. Submission of this report does not preclude on-going discussion on any of these topics as consultation progresses.

v. Based on the responses received, USACE may choose to update and resubmit the plan of action to all Consulting Parties, but at a minimum will notify all Consulting Parties in writing of its intent to implement the plan of action previously presented to the Consulting Parties.

vi. At the conclusion of implementation of the plan of action, USACE will provide all of the Consulting Parties, in writing, copies of the draft Notice of Intended Disposition, and will provide the Consulting Parties thirty (30) days to comment.

e. Process to Determine Disposition of Native American Human Remains from Federal Lands

i. Once the thirty (30) days has commenced after providing the Consulting Parties with the draft copy of the Notice of Intended Disposition, and considering all comments, USACE will publish the Notice of Intended Disposition in a newspaper of general circulation in the local area, and also in a newspaper of general circulation in the local area for the Tribes. Both notices will be published a second time, at least one week later.

ii. Copies of the Notice of Intended Disposition, as well as a description of when and where it was published, will be provided to the National Parks Service, National NAGPRA program.

iii. USACE anticipates that during the notice period described above, discussions will begin with the appropriate claimant Federally-recognized Tribe/s regarding disposition. Disposition will generally take the form of a physical transfer of custody and reburial on USACE lands, or the claimant Federally-recognized Tribe(s) may choose to rebury privately once the Tribe assumes control over the NAGPRA items.

2. Non-Federal Lands: If human remains are recovered *from NFS, state, or other private land*, USACE will require that the laws of the state of jurisdiction are followed, as outlined by each state's statute. As requested and to the extent of its legal authority, USACE will support the state lead (Designated Authority) in following the state's processes related to discovery, disposition, disinterment, re-interment, and memorialization.

a. Arkansas: Arkansas Burial Law.

   i. Arkansas Act 753 of 1991, as amended – "An act to prohibit the desecration of human skeletal burial remains in unregistered cemeteries; to prohibit trade of commercial display of human skeletal remains or associated burial furniture; and for other purposes."

   i. Arkansas Act 1533 of 1999 – "An act to increase the penalties for displaying human skeletal remains and desecrating burial grounds."

   ii. Arkansas Act 705 of 2011 – "An act to amend Arkansas law concerning burial furniture associated with human skeletal burial remains."

   iii. In the event of an inadvertent discovery of a human burial on Non-Federal Lands, we recommend securing the area-to include a cessation of work at the site, establishing an appropriate buffer, providing protection as necessary, and notifying the following: local law enforcement, the federal agency Point of Contact, the State Archeologist, and the Director and/or Section 106 Manager of the Arkansas Historic Preservation Program. Personnel should refrain from taking photographs except as necessary and directed by authorized authorities. All burials and associated furniture should be treated with respect and dignity. In the event the burial is determined to be archeological in nature, the Arkansas Historic Preservation Program staff will work with the federal agency, State Archeologist, and other parties, consult and enact appropriate measures in accordance with existing Arkansas law.

   iv. Excavation of an unregistered burial by qualified personnel will require completion of a Burial Permit-Application for Excavation Authorization and compliance with Sections 7 through 9 of Act 753.

b. Illinois: Illinois Human Skeletal Remains Protection Act (20 ILCS 3440

   i. http://www.ilga.gov/legislation/ilcs/ilcs3.asp?ActID=376&ChapAct=20%26nbsp%3bILCS%26nbsp%3b3440/&ChapterID=5&ChapterName=EXECUTIVE+BRANCH&ActName=Human+Skeletal+Remains+Protection+Act

   ii. Implementation Rules are here: http://www.ilga.gov/commission/jcar/admincode/017/01704170sections.html

   iii. The notification protocols are outlined in Section 4170.200. Since these rules were written, oversight of this law is no longer a responsibility of the SHPO office. Notification and oversight is carried out by Illinois DNR's Office of Realty and Environmental Planning, Dawn Cobb, archeologist at (217) 785-4992. She is the person to notify, per Section 4170.200(b), despite the definitions in Section 4170.110.

   iv. Per 20 ILCS 3440/16, Section 106 projects are exempted from the permitting process outlined in the regulation and rules but the notification process outlined is to be followed.

c. Kentucky: Kentucky statues related to the discovery and proper treatment of human remains are spread across several different revised statutes. The statutes also treat public land and private land differently regarding the discovery of and potential removal of human remains.

   i. Notification of Legal Authorities When Human Remains are Discovered (KRS 72.020), This process must be followed upon discovery;

   ii. Desecration of Venerated Objects (KRS 525.105), Violation of Graves (KRS 525.115) and Abuse of a Corpse (KRS 525.120). These define both the nature of violations and penalties;

   iii. Kentucky Antiquities Act (KRS 164.705-KRS 164.735; KRS 164.990) governs the Removal of "Burial Grounds" from "lands of the Commonwealth," meaning public lands. While KRS Chapter 381 governs the processes for having a cemetery declared abandoned and removed from private lands;

   iv. The language of each statute can be found here: Kentucky Revised Statue Search--https://apps.legislature.ky.gov/lrcsearch#tabs-3.

   v. For unanticipated discoveries on private, county, or state land in Kentucky, the Kentucky Heritage Council (KHC) (i.e. SHPO) is the lead authority and will consult with USACE, Tribe(s), landowner, and descendants as appropriate to determine the necessary course of action. If human remains are found on city, county, or state lands, the KHC will notify the State Archaeologist.

d. Louisiana: Louisiana Statues related to the discovery of human remains are found in the Unmarked Human Burial Sites Preservation Act (R.S. 8:671-681).

   i. https://www.crt.state.la.us/cultural-development/archaeology/CRM/cemeteries-burials/index

   ii. For unanticipated discoveries on private, parish, or state land in Louisiana, the Louisiana Unmarked Human Burial Sites Preservation Act (R.S. 8:671-681) applies. The Louisiana Division of Archaeology is the lead agency and will consult with USACE, Tribe(s), landowner, and descendants as appropriate to determine the necessary course of action.

e. Mississippi: Mississippi statutes related to the discovery of human remains are collected below.

   i. Burial Excavation Permits (Native American only). Miss. Code§§ 25-59-1, 39-7-19 (1972, as amended);

   ii. Abandoned Cemeteries, House Bill 780. https://www.mdah.ms.gov/historic-preservation/archaeology/permits

   iii. For unanticipated discoveries on private, county, or state land in Mississippi, which are Native American, The Chief Archaeologist is the lead authority and will consult with USACE, Tribe(s), landowner, and descendants as appropriate to determine the necessary course of action.

f. Missouri: Missouri Unmarked Human Burial Sites.

   i. http://revisor.mo.gov/main/OneChapter.aspx?chapter=194

   ii. The process for notice and proper treatment of unmarked human burial sites is contained in Missouri State Law under section 194.

   iii. For unanticipated discoveries on private, county, or state land in Missouri, the MO SHPO has jurisdiction and will consult with USACE, Tribe(s), landowner, and descendants as appropriate to determine the necessary course of action.

g. Tennessee: Tennessee statutes related to the discovery and treatment of human remains are collected below.

   i. https://www.tn.gov/environment/program-areas/arch-archaeology/services-and-resources/human-remains-and-burials.html

   ii. Discovery of sites, artifacts or human remains Notice to division, contractors and authorities: TCA 11-6-107d;

   iii. Desecration of Venerated Objects and Proper Treatment of Corpses: TCA 39-17-(311-312);

   iv. For unanticipated discoveries on private, county, or state land in Tennessee, the TN SHPO is the lead authority and will consult with USACE, Tribe(s), landowner, and descendants as appropriate to determine the necessary course of action.

h. Regardless of state, if the human remains recovered are determined to be Native American, USACE, in conjunction with the NFS, will identify and secure a mutually agreeable reburial location in which to reinter the human remains removed from the project area. Other arrangements may defined at the time it is determined that Native American human remains have been recovered, but will include at a minimum:

   i. In person consultation regarding the human remains and any objects;

   ii. The identification of a reburial location as close to the disinterment location as feasible;

   iii. A commitment on the part of USACE to facilitate the reburial by an affiliated Tribe and to protect the human remains and associated grave goods, at no cost to the Federally-recognized Tribes, or the SHPO of jurisdiction.

   iv. Acknowledgment of the establishment of the cemetery in the administrative record and in the real estate records as determined best at time of reburial.

i. If the remains are determined NOT to be Native American in origin, USACE will follow the principals outlined in the 2007 ACHP "Policy Statement Regarding Treatment Of Burial Sites, Human Remains and Funerary Objects" to respectfully treat the remains and determine proper disposition, disinterment, re-interment, and memorialization, as well as any USACE real estate guidance at the time of the discovery.

XI. Provisions for Post-Review Discoveries (Non-Human Remains)

A. USACE is responsible for complying with 36 C.F.R. § 800.13(a) in the event of inadvertent discoveries of Historic Properties during implementation of the Project. Discoveries of previously unidentified Historic Properties or unanticipated adverse effects to known Historic Properties are not anticipated, however if there is an inadvertent discovery or unanticipated effect, USACE will ensure that the following stipulations are met. These provisions will be included in all construction, operations, and maintenance plans and project managers will brief field personnel.

B. If previously unreported properties that may be eligible for nomination to the NR or that may be of significance to Federally-recognized Tribes, and/or, if unanticipated effects on historic properties are found during the construction phase, USACE will implement the provisions outlined below that are intended to ensure that the Undertaking is in compliance with all applicable federal and state laws and regulations, including Section 106 of the NHPA:

C. If there is no reasonable expectation that the property contains human remains, funerary objects, Native American sacred objects, or Native American objects of cultural patrimony, all work within a fifty (50) meter (164 ft.) radius buffer zone must stop immediately. If Human Remains are located or suspected, provisions of Stipulation X will be followed. USACE will notify SHPO and Federally-recognized Tribes, as appropriate, as well as any other affected party, of the discovery, and implement interim measures to protect the discovery from theft and vandalism. Construction may continue outside the fifty (50) meter (164 ft.) radius buffer zone. Within seventy-two (72) hours of receipt of notification of the discovery, USACE, as appropriate, will:

1. Inspect the work site to determine the extent of the discovery and ensure that work activities have halted within the fifty (50) meter (164 ft.) radius buffer zone;

2. Clearly mark the area of the discovery;

3. Implement additional measures, as appropriate, to protect the discovery from theft and vandalism; and

4. Provide an initial assessment of the site's condition and eligibility to the SHPO of jurisdiction and appropriate Federally-recognized Tribes; and

5. Notify other Consulting Parties, if applicable, of the discovery.

D. If USACE, in consultation with the SHPO of jurisdiction, Consulting Tribes, and other Consulting Parties, as appropriate, determines the site is either isolated, does not retain integrity sufficient for listing on the NRHP, or will not be further disturbed by construction activities, construction may resume within the fifty (50) meter (164 ft.) radius buffer zone.

E. If USACE determines that the cultural resource site or artifact either is, or may be, eligible for inclusion on the NRHP, USACE will consult with the SHPO, Consulting Tribes, and other Consulting Parties, as appropriate, regarding appropriate measures for site treatment pursuant to 36 C.F.R. § 800.6(a). SHPO and Tribes will have seven (7)-days to provide their objections or concurrence on the proposed actions. These measures may include:

    1. Formal archaeological evaluation of the site;

    2. Visits to the site by SHPO and/or Consulting Tribes;

    3. Exploration of potential alternatives to avoid the site;

    4. Preparation and implementation of a mitigation plan by USACE in consultation and concurrence with the SHPO, Consulting Tribes, and other Consulting Parties, as appropriate.

F. The notified Consulting Parties will have seven (7)-days following notification to provide comment regarding USACE's determination of the NRHP eligibility of the discovery.

G. A report of findings describing the background history leading to and immediately following the reporting and resolution of an inadvertent discovery will be prepared by USACE within thirty (30)-days of the resolution of each inadvertent discovery.

H. USACE will communicate the procedures to be observed with its contractors and personnel.

I. USACE will provide Notice to Proceed to the contractor to work in the area. Notices to Proceed may be issued by USACE for individual construction segments, defined by USACE in its construction specifications, after the identification and evaluation of historic properties has been completed.

XII. DISPUTE RESOLUTION

A. Should any Signatory, or Invited Signatory or Concurring Party to this Agreement object at any time to any actions proposed or the manner in which the terms of this Agreement are implemented, the USACE shall consult with such party to resolve the objection. If USACE determines that such objection cannot be resolved, the USACE will forward all documentation relevant to the dispute, including the USACE's proposed resolution, to the ACHP. The ACHP shall provide USACE with its advice on the resolution of the objection within thirty (30) days of receiving adequate documentation. Prior to reaching a final decision on the dispute, the USACE shall prepare a written response that takes into account any timely advice or comments regarding the dispute from the ACHP, Signatories, and Invited Signatories, and provide them with a copy of this written response. The USACE will then proceed according to its final decision.

B. If the ACHP does not provide its advice regarding the dispute within the thirty (30) day time period, the USACE may make a final decision on the dispute and proceed accordingly. Prior to reaching such a final decision, USACE shall prepare a written response that takes into account any timely comments regarding the dispute from the Signatories and Invited Signatories to the Agreement, and provide them and the ACHP with a copy of such written response.

C. The USACE's responsibility to carry out all other actions subject to the terms of this Agreement that are not the subject of the dispute remain unchanged.

XIII. SEVERABILITY AND TERMINATION

A. In the event any provision of this Agreement is deemed by a federal court to be contrary to, or in violation of, any applicable existing law or regulation of the United States of America, only the conflicting provision(s) shall be deemed null and void, and the remaining provisions of the Agreement shall remain in effect.

B. USACE or ACHP may terminate this Agreement by providing thirty (30) days written notice to the other Signatories, provided that the Signatories consult during this period to seek amendments or other actions that would prevent termination. If this Agreement is terminated, USACE shall comply with Section 106 through other applicable means pursuant to 36 CFR Part 800. Upon such determination, USACE shall provide all other Signatories and ACHP with written notice of the termination of this Agreement and the current status of any on-going ABRs.

C. A Consulting Tribe may notify the other Signatories that it is fully withdrawing from participation in the Agreement. Following such a withdrawal, USACE shall review Undertakings that may affect historic properties of religious and cultural significance to the Consulting Tribe , and Undertakings that occur on the Tribal Lands of the relevant Consulting Tribe, in accordance with 36 CFR §§ 800.3 through 800.7, 36 CFR § 800.8(c), or an applicable alternative under 36 CFR § 800.14. Withdrawal from this Agreement by a Consulting Tribe does not otherwise terminate the Agreement. At any time that this Agreement remains in effect, a Consulting Tribe that has withdrawn from the Agreement may notify USACE and SHPO in writing that it has elected to participate again rescinded its notice withdrawing from participation in the Agreement.

D. Any SHPO of jurisdiction or Tribal Signatory may withdraw from this PA after providing USACE written notice ninety (90) calendar days prior to its withdrawal. USACE shall consult with the withdrawing party to identify any mutually acceptable measures that would avoid the party's withdrawal. If mutually acceptable measures are identified that would require amendment to the PA, USACE will go through the amendment procedures outlined in Stipulation XIV (Amendments). In the case of SHPO withdrawal, the PA would no longer apply within that SHPO's state and USACE would comply with 36 CFR Part 800 for all undertakings previously subject to this PA in that state. In the case of a Tribal Signatory withdrawing from the PA, USACE would consult with that Tribe pursuant to 36 CFR Part 800 for all undertakings previously subject to this PA that would have the potential to affect historic properties of religious and cultural significance to the Tribe. This PA would remain in effect in all other jurisdictions and for all other parties.

XIV. AMENDMENTS

A. Body of the Programmatic Agreement:
May be amended when such an amendment is agreed to in writing by all Signatories and Invited Signatories. The amendment will be effective on the date a copy signed by all of the Signatories and Invited Signatories is filed with the ACHP.

B. Appendices:
May be amended at the request of USACE or another Signatory or Invited Signatory in the following manner:

1. USACE, on its own behalf or on behalf of another Signatory or Invited Signatory, shall notify the Signatories of the intent to modify the current Appendix or Appendices and shall provide a draft of the updated Appendix or Appendices to all Signatory parties.

2. If no Signatory or Invited Signatory objects in writing within thirty (30) days of receipt of USACE's proposed modification, USACE shall date and sign the amended Appendix and provide a copy of the amended Appendix to the other Signatories. Such an amendment shall go into effect on the date USACE transmits the amendment to the other Signatories.

3. Current List of Appendices:

    a. Appendix A: Proposed Work Items
    b. Appendix B: Point of Contacts (POC)
    c. Appendix C: (Reserved)
    d. Appendix D: Programmatic Allowances
    e. Appendix E: Treatment Measures

C. Any Amendments to the Body of the Agreement or the Appendices, shall be posted to the websites currently tracking the implementation of the individual Work Items.

XV. DURATION

A. The Agreement shall expire ten (10) years from the date of the last signature. One (1) year prior to the expiration of the Agreement, the USACE shall review the Agreement in order to determine whether it should be reissued or allowed to expire. If the Agreement requires reissue, the USACE shall consult with the Consulting Parties, as well as amend the Agreement in order to ensure compliance with the most current version of the Federal regulations implementing the NHPA.

B. The Signatories and Invited Signatories may collectively agree to extend this Agreement to cover additional calendar years, or portions thereof, through an amendment provided that the original Agreement has not expired.

XVI. ANTI-DEFICIENCY ACT

USACE's obligations under this Agreement are subject to the availability of appropriated funds, and the stipulations of this Agreement are subject to the provisions of the Anti-Deficiency Act. USACE shall make reasonable and good faith efforts to secure the necessary funds to implement this Agreement in its entirety. If compliance with the Anti-Deficiency Act alters or impairs USACE's ability to implement the stipulations of this Agreement, USACE shall consult in accordance with the amendment procedures found at Stipulation XIV and termination procedures found at Stipulation XIII.

XVII. EXECUTION AND IMPLEMENTATION

A. Nothing in this Agreement is intended to prevent the USACE from consulting more frequently with the Consulting Parties concerning any questions that may arise or on the progress of any actions falling under or executed by this Agreement.

B. This Agreement shall be executed in counterparts, with a separate page for each Signatory, and shall become effective on the date the agreement is signed by or filed with the ACHP.

C. USACE shall ensure that each Signatory and Invited Signatory is provided with an electronic (pdf) and physical copies of the Agreement including signatures. USACE shall provide electronic copies of additional executed signature pages to the Consulting Parties as they are received. USACE shall provide a complete copy of the Agreement with original signatures to any Signatory on request.

D. Execution of this Agreement by the Memphis, Vicksburg and New Orleans Districts of USACE, the ACHP, the Missouri SHPO, the Illinois SHPO, the Kentucky SHPO, the Tennessee SHPO, the Arkansas SHPO, the Mississippi SHPO, the Louisiana SHPO (Signatories), The Chickasaw Nation, The Choctaw Nation of Oklahoma, the Quapaw Nation, The Osage Nation (Invited Signatories) and the Mississippi Band of Choctaw Indians, and the United Keetoowah Band of Cherokee Indians in Oklahoma (Concurring Parties) and implementation of its terms evidence that USACE has taken into account the effects of this undertaking on historic properties and afforded ACHP a reasonable opportunity to comment on USACE's Proposed Actions at MRL Features.

SIGNATORY PAGE

PROGRAMMATIC AGREEMENT

AMONG THE
U.S. ARMY CORPS OF ENGINEERS (USACE), MEMPHIS, NEW ORLEANS, AND VICKSBURG DISTRICTS
THE CHICKASAW NATION;
THE CHOCTAW NATION OF OKLAHOMA;
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AND THE ADVISORY COUNCIL ON HISTORIC PRESERVATION
REGARDING
THE MISSISSIPPI RIVER AND TRIBUTARIES PROJECT:
MISSISSIPPI RIVER LEVEE FEATURES

U.S. Army Corps of Engineers, New Orleans District (CEMVN)

Stephen F. Murphy
Colonel, Corps of Engineers
District Commander

Date: 1/22/21

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PROGRAMMATIC AGREEMENT

**AMONG THE
U.S. ARMY CORPS OF ENGINEERS (USACE), MEMPHIS, NEW ORLEANS, AND VICKSBURG DISTRICTS
THE CHICKASAW NATION;
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AND THE ADVISORY COUNCIL ON HISTORIC PRESERVATION
REGARDING
THE MISSISSIPPI RIVER AND TRIBUTARIES PROJECT:
MISSISSIPPI RIVER LEVEE FEATURES**

U.S. Army Corps of Engineers, Vicksburg District (CEMVK)

Date: 22 Jan 21

Robert A. Hilliard
Colonel, Corps of Engineers
District Commander

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REGARDING
THE MISSISSIPPI RIVER AND TRIBUTARIES PROJECT:
MISSISSIPPI RIVER LEVEE FEATURES

U.S. Army Corps of Engineers, Memphis District (CEMVM)

Zachary L. Miller
Zachary L. Miller
Colonel, Corps of Engineers
District Commander

Date: 6 Jan 2021

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AMONG THE
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REGARDING
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MISSISSIPPI RIVER LEVEE FEATURES

The Arkansas State Historic Preservation Officer

______________________________ Date: ________________
Secretary Stacy Hurst
Arkansas State Historic Preservation Officer

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**AMONG THE
U.S. ARMY CORPS OF ENGINEERS (USACE), MEMPHIS, NEW ORLEANS, AND VICKSBURG DISTRICTS
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AND THE ADVISORY COUNCIL ON HISTORIC PRESERVATION
REGARDING
THE MISSISSIPPI RIVER AND TRIBUTARIES PROJECT:
MISSISSIPPI RIVER LEVEE FEATURES**

The Illinois State Historic Preservation Officer

________________________________ Date: January 13, 2021

Robert Appleman
Illinois Deputy SHPO

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PROGRAMMATIC AGREEMENT

**AMONG THE
U.S. ARMY CORPS OF ENGINEERS (USACE), MEMPHIS, NEW ORLEANS, AND VICKSBURG DISTRICTS
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AND THE ADVISORY COUNCIL ON HISTORIC PRESERVATION
REGARDING
THE MISSISSIPPI RIVER AND TRIBUTARIES PROJECT:
MISSISSIPPI RIVER LEVEE FEATURES**

The Kentucky State Historic Preservation Officer

______________________________ Date: ________________

Craig Potts
Executive Director and State Historic Preservation Officer
Kentucky Heritage Council

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PROGRAMMATIC AGREEMENT

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AND THE ADVISORY COUNCIL ON HISTORIC PRESERVATION
REGARDING
THE MISSISSIPPI RIVER AND TRIBUTARIES PROJECT:
MISSISSIPPI RIVER LEVEE FEATURES**

The Louisiana State Historic Preservation Officer

Kristin P. Sanders
Kristin P. Sanders,
Louisiana State Historic Preservation Officer

Date: 2/1/2021

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PROGRAMMATIC AGREEMENT

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U.S. ARMY CORPS OF ENGINEERS (USACE), MEMPHIS, NEW ORLEANS, AND VICKSBURG DISTRICTS
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MISSISSIPPI RIVER LEVEE FEATURES**

The Mississippi State Historic Preservation Officer

______________________________ Date: _________________
Katie Blount
Mississippi State Historic Preservation Officer

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PROGRAMMATIC AGREEMENT

AMONG THE
U.S. ARMY CORPS OF ENGINEERS (USACE), MEMPHIS, NEW ORLEANS, AND VICKSBURG DISTRICTS
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MISSISSIPPI RIVER LEVEE FEATURES

The Missouri State Historic Preservation Officer

____________________________ Date: ________________
Toni M. Prawl, Ph.D.
Director and Deputy State
Historic Preservation Officer

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AMONG THE
U.S. ARMY CORPS OF ENGINEERS (USACE), MEMPHIS, NEW ORLEANS, AND VICKSBURG DISTRICTS
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THE MISSISSIPPI RIVER AND TRIBUTARIES PROJECT:
MISSISSIPPI RIVER LEVEE FEATURES

The Tennessee State Historic Preservation Officer

E. Patrick McIntyre, Jr. ______________________ Date: 1-29-21

Mr. E. Patrick McIntyre, Jr.
Tennessee SHPO

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THE KENTUCKY STATE HISTORIC PRESERVATION OFFICER;
THE LOUISIANA STATE HISTORIC PRESERVATION OFFICER;
THE MISSISSIPPI STATE HISTORIC PRESERVATION OFFICER;
THE MISSOURI STATE HISTORIC PRESERVATION OFFICER;
THE TENNESSEE STATE HISTORIC PRESERVATION OFFICER;
AND THE ADVISORY COUNCIL ON HISTORIC PRESERVATION
REGARDING
THE MISSISSIPPI RIVER AND TRIBUTARIES PROJECT:
MISSISSIPPI RIVER LEVEE FEATURES

The Advisory Council on Historic Preservation

____________________________ Date: ________________
Aimee Jorjani, Chairman
ACHP

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INVITED SIGNATORY PAGE

PROGRAMMATIC AGREEMENT

AMONG THE
U.S. ARMY CORPS OF ENGINEERS (USACE), MEMPHIS, NEW ORLEANS, AND VICKSBURG DISTRICTS
THE CHICKASAW NATION;
THE CHOCTAW NATION OF OKLAHOMA;
THE OSAGE NATION;
THE QUAPAW NATION;
THE ARKANSAS STATE HISTORIC PRESERVATION OFFICER;
THE ILLINOIS STATE HISTORIC PRESERVATION OFFICER;
THE KENTUCKY STATE HISTORIC PRESERVATION OFFICER;
THE LOUISIANA STATE HISTORIC PRESERVATION OFFICER;
THE MISSISSIPPI STATE HISTORIC PRESERVATION OFFICER;
THE MISSOURI STATE HISTORIC PRESERVATION OFFICER;
THE TENNESSEE STATE HISTORIC PRESERVATION OFFICER;
AND THE ADVISORY COUNCIL ON HISTORIC PRESERVATION
REGARDING
THE MISSISSIPPI RIVER AND TRIBUTARIES PROJECT:
MISSISSIPPI RIVER LEVEE FEATURES

Chickasaw Nation

Nothing in this Agreement shall be construed to waive the sovereign rights and immunities of the Chickasaw Nation, its officers, employees, or agents.

_____________________________ Date: ________________

Bill Anoatubby, Governor
Chickasaw Nation

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INVITED SIGNATORY PAGE

PROGRAMMATIC AGREEMENT

AMONG THE
U.S. ARMY CORPS OF ENGINEERS (USACE), MEMPHIS, NEW ORLEANS, AND VICKSBURG DISTRICTS
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THE MISSISSIPPI STATE HISTORIC PRESERVATION OFFICER;
THE MISSOURI STATE HISTORIC PRESERVATION OFFICER;
THE TENNESSEE STATE HISTORIC PRESERVATION OFFICER;
AND THE ADVISORY COUNCIL ON HISTORIC PRESERVATION
REGARDING
THE MISSISSIPPI RIVER AND TRIBUTARIES PROJECT:
MISSISSIPPI RIVER LEVEE FEATURES

The Choctaw Nation of Oklahoma

Nothing in this Agreement shall be construed to waive the sovereign rights and immunities of the Choctaw Nation of Oklahoma, its officers, employees, or agents.

______________________________ Date: ________________
Gary Batton, Chief
Choctaw Nation of Oklahoma

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INVITED SIGNATORY PAGE

PROGRAMMATIC AGREEMENT

AMONG THE
U.S. ARMY CORPS OF ENGINEERS (USACE), MEMPHIS, NEW ORLEANS, AND VICKSBURG DISTRICTS
THE CHICKASAW NATION;
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THE MISSOURI STATE HISTORIC PRESERVATION OFFICER;
THE TENNESSEE STATE HISTORIC PRESERVATION OFFICER;
AND THE ADVISORY COUNCIL ON HISTORIC PRESERVATION
REGARDING
THE MISSISSIPPI RIVER AND TRIBUTARIES PROJECT:
MISSISSIPPI RIVER LEVEE FEATURES

OSAGE NATION

______________________________ Date: ________________
Geoffrey M. Standing Bear
Principal Chief

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INVITED SIGNATORY PAGE

PROGRAMMATIC AGREEMENT

AMONG THE
U.S. ARMY CORPS OF ENGINEERS (USACE), MEMPHIS, NEW ORLEANS, AND VICKSBURG DISTRICTS
THE CHICKASAW NATION;
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THE MISSOURI STATE HISTORIC PRESERVATION OFFICER;
THE TENNESSEE STATE HISTORIC PRESERVATION OFFICER;
AND THE ADVISORY COUNCIL ON HISTORIC PRESERVATION
REGARDING
THE MISSISSIPPI RIVER AND TRIBUTARIES PROJECT:
MISSISSIPPI RIVER LEVEE FEATURES

THE QUAPAW NATION

______________________________ Date: _________________
Joseph Byrd,
Quapaw Nation Chairman

CONCURRING PARTY SIGNATORY PAGE

PROGRAMMATIC AGREEMENT

**AMONG THE
U.S. ARMY CORPS OF ENGINEERS (USACE), MEMPHIS, NEW ORLEANS, AND VICKSBURG DISTRICTS
THE CHICKASAW NATION;
THE CHOCTAW NATION OF OKLAHOMA;
THE OSAGE NATION;
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THE ARKANSAS STATE HISTORIC PRESERVATION OFFICER;
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THE MISSOURI STATE HISTORIC PRESERVATION OFFICER;
THE TENNESSEE STATE HISTORIC PRESERVATION OFFICER;
AND THE ADVISORY COUNCIL ON HISTORIC PRESERVATION
REGARDING
THE MISSISSIPPI RIVER AND TRIBUTARIES PROJECT:
MISSISSIPPI RIVER LEVEE FEATURES**

Mississippi Band of Choctaw Indians

______________________________ Date: _________________
Ben Cyrus, Chief

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CONCURRING PARTY SIGNATORY PAGE

PROGRAMMATIC AGREEMENT

AMONG THE
U.S. ARMY CORPS OF ENGINEERS (USACE), MEMPHIS, NEW ORLEANS, AND VICKSBURG DISTRICTS
THE CHICKASAW NATION;
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THE TENNESSEE STATE HISTORIC PRESERVATION OFFICER;
AND THE ADVISORY COUNCIL ON HISTORIC PRESERVATION
REGARDING
THE MISSISSIPPI RIVER AND TRIBUTARIES PROJECT:
MISSISSIPPI RIVER LEVEE FEATURES

United Keetoowah Band of Cherokee Indians in Oklahoma

______________________________ Date: _______________
Chief Joe Bunch
United Keetoowah Band of Cherokee Indians in Oklahoma

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Appendix A: Proposed Work Items
Mississippi River Levee (MRL) Agreement
As of 5 March 2020

The project descriptions below include the latest information regarding Work Items that will be reviewed in accordance with this Agreement. They are organized by USACE district, moving from north to south along the Mississippi River. These items are subject to change as additional information and analyses are conducted. In addition, Work Items may be added from other project authorities, but only for alteration or enhancement of the MRL features. USACE maintains a project website for the SEIS effort for Mississippi River Levee (https://www.mvk.usace.army.mil/MRLSEIS/) with current information and previous environmental documentation and will post the completed Agreement there.

MVM Boundaries:

For West Bank Ohio River

1. Mound City to Cairo Levee 0/0+00 to 2/26+00, Item 965-R. This item of work is 2.5 miles long and is located on right descending bank opposite river mile 965. It consists of raising the grade of the existing levee to control overtopping. The grade raise is approximately 2 feet on average which will increase the base width of the levee approximately 45 feet on average. Borrow material for the embankment is tentatively proposed to be obtained from 3.2 acres of a cultivated field one mile northeast of Mound City, IL riverside of the mainline levee.

2. North Mound City, IL Sump, Item 962.3-R. This item of work is 250 feet long on the right descending bank opposite river mile 962.3. It consists of installing relief wells with the associated drainage work to control seepage. Preliminary design indicates that the relief wells will be located at levee stations 2/45+00 to 2/47+50 landside of the levee.

3. Mound City to Cairo Levee 2/26+00 to 4/0+00, Item 962.5-R. This item of work is 1.5 miles long and is located on right descending bank opposite river mile 962.5. It consists of raising the grade of the existing levee to control overtopping. The grade raise is approximately 1 foot on average which will increase the base width of the levee approximately 35 feet on average. Borrow material for the embankment is tentatively proposed to be obtained from 3.9 acres of a cultivated field one mile northeast of Mound City, IL riverside of the mainline levee.

4. Mound City to Cairo Levee 4/30+00 to 5/7+00, Item 961-R. This item of work is less than a mile long and is located on right descending bank opposite river mile 961. It consists of raising the grade of the existing levee to control overtopping. The grade raise is approximately 1 foot on average which will increase the base width of the levee approximately 35 feet on average. Borrow material for the embankment is tentatively proposed to be obtained from 0.8 acres of a cultivated field one mile northeast of Mound City, IL riverside of the mainline levee.

5. Mound City to Cairo, IL 7/50+00 to 8/4+00, Item 958-R. This item of work is 200 feet long and is located on right descending bank opposite river mile 958. It consists of raising the grade of the existing levee to control overtopping. The grade raise is approximately 2 foot

on average which will increase the base width of the levee approximately 45 feet on average. Borrow material for the embankment is tentatively proposed to be obtained from 0.1 acres of a cultivated field one mile northeast of Mound City, IL riverside of the mainline levee.

6. Cairo, IL Floodwall, Item 956-R. This item of work is 3.2 miles long and is located on the right descending bank opposite river mile 956. It consists of replacing the existing floodwall. Preliminary design indicates the new floodwall will be located on the landside of the existing floodwall or within the existing floodwall footprint.

7. Fish Market Gate/High 51 Closure, Item 955-R. This item of work is 3,500 feet long and is located on the right descending bank opposite river mile 955. It consists of raising the grade of the existing levee to control overtopping. The grade raise is approximately 2 foot on average which will increase the base width of the levee approximately 45 feet on average. Borrow material for the embankment is tentatively proposed to be obtained from 1.8 acres of a cultivated field riverside of levee stations 10/50+75 to 11/5+00.

For East Bank Mississippi River

8. Hickman Floodwall Embankment Tie-in, Item 922-L. This item of work is 500 feet long and is located on the left descending bank opposite river mile 922. It consists of construction of levee that would extend from the existing floodwall to tie-in to high ground. Preliminary design indicates the levee will be 3 feet in height on average with a 5 foot crown. The design slopes 1 foot vertical on 3.5 feet horizontal will result in base width of the levee approximately 26 feet on average. Borrow material for the embankment is tentatively proposed to be obtained from 0.1 acres of cleared land 1000 feet west of the Levee Grade Raise adjacent to Hickman Harbor.

9. Hickman Levee Grade Raise, Item 921-L. This item of work is 500 feet long and is located on the left descending bank opposite river mile 921. It consists of raising the grade of the existing levee to control overtopping. The grade raise is approximately 2 feet on average which will increase the base width of the levee approximately 45 feet on average. Borrow material for the embankment is tentatively proposed to be obtained from 0.3 acres of cleared land 1000 feet west of the Levee Grade Raise adjacent to Hickman Harbor.

10. Island 8 Parcel 3, KY (4/0+00 to 5/20+00), Item 918-L. This item of work is 1.4 miles long and is located on the left descending bank opposite river mile 918. It consists of installing relief wells with associated drainage work to control seepage. Preliminary design indicates that relief wells will be located at levee stations 4/0+00 to 5/20+00 landside of the levee.

11. Lake No. 9 – KY-TN State Line (21/3+80 to 21/7+30), Item 902-L. This item of work is 350 feet long and is located on the left descending bank opposite river mile 902. It consists of raising the grade of the existing levee to control overtopping. The grade raise is approximately 1 foot on average which will increase the base width of the levee approximately 45 feet on average. Borrow material for the embankment is tentatively

proposed to be obtained from 0.2 acres of a cultivated field riverside of levee stations 21/2+79 to 21/4+79.

12. Great River Road Slope Flattening (12/45+00 to 15/0+00), Item 848-L. This item of work is 2.2 miles long and is located on the left descending bank opposite river mile 848. It consists of flattening the landside levee slopes from 1 foot vertical on 3.5 feet horizontal to 1 foot vertical on 5 feet horizontal which will increase the base width of the levee approximately 65 feet on average. Borrow material for the embankment is tentatively proposed to be obtained from 41.5 acres of a cultivated field riverside of levee stations 13/0+00 to 15/0+00.

13. Great River Road Slope Flattening (20/0+00 to 37/0+00), Item 832-L. This item of work is 2 miles long and is located on the left descending bank opposite river mile 832. It consists of flattening the landside levee slopes from 1 foot vertical on 3.5 feet horizontal to 1 foot vertical on 5 feet horizontal which will increase the base width of the levee approximately 65 feet on average. Preliminary design indicates that the slope flattening will be located at levee stations 20/0+00 to 21/0+00, 27/11+00, 32/5+00, 33/20+00, and 34/27+00 landside of the levee. Borrow material for the embankment is tentatively proposed to be obtained from 323.6 acres of a cultivated field riverside of levee stations 26/20+00 to 29/40+00.

For West Bank Mississippi River

14. Nash, MO Slope Flattening (11/12+00 to 12/0+00), Item 49-R AC. This item of work is 0.8 miles long and is located on the right descending bank opposite river mile 49 above the confluence (AC) of the Ohio River. It consists of flattening the landside levee slopes from 1 foot vertical on 3.5 feet horizontal to 1 foot vertical on 5 feet horizontal which will increase the base width of the levee approximately 65 feet on average. Borrow material for the embankment is tentatively proposed to be obtained from 12.6 acres of a cultivated field riverside of levee stations 7/48+13 to 8/2+00.

15. Commerce to Birds Point (15/0+00 to 17/49+00), Item 29-R AC. This item of work is 1.5 miles long and is located on right descending bank opposite river mile 29 AC. It consists of raising the grade of the existing levee to control overtopping. The grade raise is approximately 1 foot on average which will increase the base width of the levee approximately 35 feet on average. Preliminary design indicates that the grade raise will be located at levee stations 15/52+00 to 16/45+00, 16/30+00, and 17/30+00 to 17/49+00. Borrow material for the embankment is tentatively proposed to be obtained from 0.4 acres of a cultivated field riverside of levee stations 16/30+92 to 16/33+00.

16. Commerce to Birds Point (17/49+00 to 32/0+00), Item 22-R AC. This item of work is 6 miles long and is located on right descending bank opposite river mile 22 AC. It consists of raising the grade of the existing levee to control overtopping. The grade raise is approximately 1.5 feet on average which will increase the base width of the levee approximately 45 feet on average. Preliminary design indicates that the grade raise will be located at levee stations 17/49+00 to 20/14+69, 20/53+36 to 22/37+00, 27/25+63 to 32/0+00. Borrow material for the embankment is tentatively proposed to be obtained from 30.3 acres of cultivated fields riverside of levee stations 18/0+00 to 18/36+49, 18/38+00 to

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19/17+00, 19/41+02 to 19/48+02, 20/10+00 to 20/14+69, 21/8+00 to 22/0+00, 22/44+28 to 23/0+00, 28/38+68 to 30/18+00, 31/15+00, 31/22+00 to 31/25+00, and 31/33+37 to 31/37+00, respectively.

17. Birds Point – New Madrid Setback (0/0+00 to 12/32+00), Item 947-R. This item of work is 3.5 miles long and is located on right descending bank opposite river mile 947. It consists of raising the grade of the existing levee to control overtopping. The grade raise is approximately 1 foot on average which will increase the base width of the levee approximately 35 feet on average. Preliminary design indicates that the grade raise will be located at levee stations 1/18+00 to 1/20+00, 2/2+00 to 2/14+00, 3/0+00 to 6/30+00 and 9/26+00. Borrow material for the embankment is tentatively proposed to be obtained from 8.2 acres of cultivated fields riverside of levee stations 1/52+93 to 2/1+85, 3/3+00 to 3/10+00, 3/20+00 to 4/20+00, and 5/26+00 to 5/39+00, respectively.

18. Birds Point – New Madrid Frontline Levee (43/21+00 to 87/0+00), Item 920-R. This item of work is 3 miles long and is located on right descending bank opposite river mile 920. It consists of raising the grade of the existing levee to control overtopping. The grade raise is approximately 2.5 feet on average which will increase the base width of the levee approximately 50 feet on average. Preliminary design indicates that the grade raise will be located at levee stations 49/25+00 to 49/28+00, 65/5+00, 72/0+00 to 73/8+00, 75/20+00 to 76/14+00 and 77/20+00 to 78/8+00 Borrow material for the embankment is tentatively proposed to be obtained from 9.1 acres of a cultivated field riverside of levee stations (BP-NM setback levee) 30/42+00 to 31/3+00.

19. Birds Point – New Madrid Setback (12/32+00 to 36/0+00), Item 915-R. This item of work is 3 miles long and is located on right descending bank opposite river mile 915. It consists of raising the grade of the existing levee to control overtopping. The grade raise is approximately 1 foot on average which will increase the base width of the levee approximately 35 feet on average. Preliminary design indicates that the grade raise will be located at levee stations 15/25+00, 16/24+00, 17/16+00 to 17/23+00, 23/9+00 to 24/33+00, 27/46+00 to 27/48+00, and 28/37+00 to 34/0+00. Borrow material for the embankment is tentatively proposed to be obtained from 16.6 acres of a cultivated field riverside of levee stations (BP-NM setback levee) 30/37+00 to 31/2+00.

20. Farrenburg Levee, MO Slope Flattening (1/50+00 to 2/21+00), Item 889-R. This item of work is 0.5 miles long and is located on the right descending bank opposite river mile 889. It consists of flattening the waterside levee slopes from 1 foot vertical on 3.5 feet horizontal to 1 foot vertical on 5 feet horizontal which will increase the base width of the levee approximately 65 feet on average. Borrow material for the embankment is tentatively proposed to be obtained from 8.4 acres of a cultivated field riverside of levee stations (BP-NM setback levee) 30/42+00 to 31/3+00.

21. New Madrid, MO to MO-AR Levee (5/0+00N to 0/0+00), Item 882-R. This item of work is 0.5 miles long and is located on right descending bank opposite river mile 882. It consists of raising the grade of the existing levee to control overtopping. The grade raise is approximately 1 foot on average which will increase the base width of the levee

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approximately 35 feet on average. Preliminary design indicates that the grade raise will be located at levee stations 4/22+00N to 4/11+00N, 3/5+00N to 3/1+00N, 2/14+00N to 2/7+00N, and 0/35+00N to 0/13+00N. Borrow material for the embankment is tentatively proposed to be obtained from 1.1 acres of a cultivated fields riverside of levee stations 4/19+01N to 4/14+51N, 0/37+00 to 0/39+00, and 0/25+00 to 0/30+00.

22. New Madrid, MO to MO-AR Levee (2/0+00S to 2/30+00S), Item 877-R. This item of work is 0.5 miles long and is located on right descending bank opposite river mile 877. It consists of raising the grade of the existing levee to control overtopping. The grade raise is approximately 1.5 foot on average which will increase the base width of the levee approximately 45 feet on average. Borrow material for the embankment is tentatively proposed to be obtained from 0.7 acres of a cultivated field riverside of levee stations 2/19+00S to 2/26+00.

23. Barfield, AR Slope Flattening (61/0+00 to 61/25+00), Item 807-R. This item of work is 0.5 miles long and is located on the right descending bank opposite river mile 807. It consists of flattening the waterside levee slopes from 1 foot vertical on 3.5 feet horizontal to 1 foot vertical on 5 feet horizontal which will increase the base width of the levee approximately 65 feet on average. Borrow material for the embankment is tentatively proposed to be obtained from 8.5 acres of a cultivated field riverside of levee stations 60/47+50 to 63/0+00.

24. Wilson, AR Slope Flattening (100/0+00 to 100/36+00), Item 766-R. This item of work is 0.8 miles long and is located on the right descending bank opposite river mile 766. It consists of flattening the waterside levee slopes from 1 foot vertical on 3.5 feet horizontal to 1 foot vertical on 5 feet horizontal which will increase the base width of the levee approximately 65 feet on average. Borrow material for the embankment is tentatively proposed to be obtained from 13.1 acres of a cultivated field riverside of levee stations 100/4+01 to 100/37+48.

25. Pecan Point, AR Slope Flattening (116/40+00 to 117/45+00), Item 762-R. This item of work is 1 mile long and is located on the right descending bank opposite river mile 762. It consists of flattening the waterside levee slopes from 1 foot vertical on 3.5 feet horizontal to 1 foot vertical on 5 feet horizontal which will increase the base width of the levee approximately 65 feet on average Borrow material for the embankment is tentatively proposed to be obtained from 19.6 acres of a cultivated field riverside of levee stations 117/11+00 to 118/1+00.

26. St. Thomas, AR Berm Re-evaluation, Item 754-R. This item of work is 6 miles long and is located on the right descending bank opposite river mile 754. It consists of installing relief wells with associated drainage work to control seepage. Preliminary design indicates that relief wells will be located at levee stations 120/0+00 to 126/0+00 landside of the levee.

27. MO-AR State Line to St. Francis River Levee Part 1 (134/0+00 to 138/0+00), Item 747-R. This item of work is 2 miles long and is located on right descending bank opposite river mile 747. It consists of raising the grade of the existing levee to control overtopping. The

grade raise is approximately 1 foot on average which will increase the base width of the levee approximately 35 feet on average. Preliminary design indicates that the grade raise will be located at levee stations 134/11+00 to 134/25+00, 134/50+00, 135/49+00 to 136/8+00, and 136/40+00 to 137/30+00. Borrow material for the embankment is tentatively proposed to be obtained from 3.5 acres of cultivated fields riverside of levee stations 134/8+00 to 134/14+00, 135/50+00 to 136/0+00, 136/48+00 to 137/5+00, and 137/14+00 to 137/18+00, respectively.

28. MO-AR State Line to St. Francis River Levee Part 2 (145/0+00 to 147/0+00), Item 741-R. This item of work is 2 miles long and is located on right descending bank opposite river mile 741. It consists of raising the grade of the existing levee to control overtopping. The grade raise is approximately 1.5 feet on average which will increase the base width of the levee approximately 45 feet on average. Borrow material for the embankment is tentatively proposed to be obtained from 5.4 acres of cultivated fields riverside of levee stations 145/36+00 to 145/50+11 and 146/29+23 to 146/36+00.

29. West Memphis, AR Re-Evaluation, Item 726-R. This item of work is 2 miles long and is located on the right descending bank opposite river mile 726. It consists of installing relief wells with associated drainage work to control seepage. Preliminary design indicates that relief wells will be located at levee stations 156/0+00 to 158/0+00 landside of the levee.

30. West Memphis, AR Seepage Remediation, Item 723-R. This item of work is 2.8 miles long and is located on the right descending bank opposite river mile 723. It consists of installing relief wells with associated drainage work to control seepage. Preliminary design indicates that relief wells will be located at levee stations 158/40+00 to 161/29+00 landside of the levee.

31. Horseshoe Lake, AR, Item 705-R. This item of work is 3.2 miles long and is located on the right descending bank opposite river mile 705. It consists of installing relief wells with associated drainage work to control seepage. Preliminary design indicates that relief wells will be located at levee stations 177/0+00 to 180/11+00 landside of the levee.

32. MO-AR State Line to St. Francis Levee Part 3 (183/0+00 to 190/0+00), Item 697-R. This item of work is 3.5 miles long and is located on right descending bank opposite river mile 697. It consists of raising the grade of the existing levee to control overtopping. The grade raise is approximately 1 foot on average which will increase the base width of the levee approximately 35 feet on average. Preliminary design indicates that the grade raise will be located at levee stations 183/8+00 to 183/44+00, 184/30+00 to 185/1+00, 186/28+00 to 186/39+00, and 187/0+00 to 190/0+00. Borrow material for the embankment is tentatively proposed to be obtained from 8.8 acres of cultivated fields riverside of levee stations 184/4+50 to 184/8+20, 184/39+00 to 184/43+00, 186/30+00 to 186/36+00, and 187/37+63 to 188/15+50, respectively.

33. MO-AR State Line to St. Francis Levee Part 4 (190/0+00 to 198/0+00), Item 693-R. This item of work is 5.5 miles long and is located on right descending bank opposite river mile 693. It consists of raising the grade of the existing levee to control overtopping. The

grade raise is approximately 1.5 feet on average which will increase the base width of the levee approximately 45 feet on average. Preliminary design indicates that the grade raise will be located at levee stations 190/0+00 to 195/0+00, 195/42+00 to 196/15+00, and 197/18+00. Borrow material for the embankment is tentatively proposed to be obtained from 13.5 acres of a cultivated field riverside of levee stations 187/37+63 to 188/15+50.

34. MO-AR State Line to St. Francis Levee Part 5 (198/0+00 to 210/30+00), Item 682-R. This item of work is 5.5 miles long and is located on right descending bank opposite river mile 682. It consists of raising the grade of the existing levee to control overtopping. The grade raise is approximately 1.5 feet on average which will increase the base width of the levee approximately 45 feet on average. Preliminary design indicates that the grade raise will be located at levee stations 199/0+00, 199/25+00 to 204/42+00, and 208/8+00 to 210/25+00. Borrow material for the embankment is tentatively proposed to be obtained from 20.8 acres of cultivated fields riverside of levee stations 199/0+00 to 199/23+01, 204/30+00 to 204/31+00, and 209/30+20 to 209/40+20, respectively.

35. Elaine, AR to Laconia Circle Levee (48/4+00S to 48/8+90S), Item 620-R. This item of work is 500 feet long and is located on the right descending bank opposite river mile 620. It consists of raising the grade of the existing levee to control overtopping. The grade raise is approximately 1 foot on average which will increase the base width of the levee approximately 35 feet on average. Borrow material for the embankment is tentatively proposed to be obtained from 0.4 acres of a cultivated field riverside of levee stations 48/0+00 to 48/3+08.

MVK Boundaries:

36. Cessions, MS, Seepage Remediation, Item 615-L. This item of work is 1.4 miles long and located on the left descending bank opposite river mile 615. The item consist of constructing a berm and/or enlarging an existing berm to control seepage. The tentatively proposed 55-acre borrow location is assumed to be on the land side of the levee in a bottomland hardwood area.

37. Deeson-Gunnison, MS, Seepage Remediation, Item 611-L. This item of work is 7.2 miles long and located on the left descending bank opposite river mile 611. The item consists of constructing a berm and/or enlarging an existing berm to control seepage. The tentatively proposed 25-acre borrow location is assumed to be on the river side of the levee in an agricultural field.

38. Rosedale, MS, Seepage Remediation, Item 587-L. This item of work is 3.2 miles long and located on the left descending bank opposite river mile 587. The item consists of constructing a berm and/or enlarging an existing berm to control seepage. The tentatively proposed 20-acre borrow area for is assumed to be on the river side of the levee in a bottomland hardwood area.

39. Bolivar, MS, Seepage Remediation, Item 577-L. This item of work is 2.8 miles long and located on the left descending bank opposite river mile 577. The item consists of

constructing a berm and/or enlarging an existing berm to control seepage. The tentatively proposed 29-acre borrow location is assumed to be on the river side of the levee in a bottomland hardwood area.

40. Brunswick-Halpino, MS, Levee Enlargement and Seepage Remediation, Item 443-L. This item of work is 4.3 miles long and located on the left descending bank opposite river mile 443. The item consists of raising the levee an average of 3.5 feet with a river side shift of the centerline and will be further analyzed to determine if seepage measures are needed. The tentatively proposed 19-acre borrow location is assumed to be on the land side of the levee in a bottomland hardwood area.

41. Morville-Black Hawk, LA, Seepage Remediation, Item 355-R. This item of work is 1.8 miles long and located on the right descending bank opposite river mile 355. The item consists of constructing a berm and/or enlarging two existing berms to control seepage. The tentatively proposed 11-acre borrow location is assumed to be on the land side of the levee in a cropland area.

42. Morville-Black Hawk, LA, Levee Enlargement, Item 351-R. This item of work is 4.5 miles long and located on the right descending bank opposite river mile 351. The item consists of raising the levee an average of 2.3 feet with a river side shift of the centerline. The tentatively proposed 51-acre borrow location is assumed to be on the river side of the levee in a pasture/bottomland hardwood area.

43. Morville-Black Hawk, LA, Seepage Remediation, Item 348-R. This item of work is 0.3 miles long and located on the right descending bank opposite river mile 348. The item consists of constructing a berm and/or enlarging an existing berm to control seepage. The tentatively proposed 13-acre borrow location is assumed to be on the river side of the levee in a cropland area.

44. Morville-Black Hawk, LA, Levee Enlargement and Seepage Remediation, Item 345-R. This item of work is 3.4 miles long and located on the right descending bank opposite river mile 345. The item consists of raising the levee an average of 2.0 feet with a river side shift of the centerline. In addition, this item of work consists of constructing two berms and/or enlarging an existing berm to control seepage. The tentatively proposed 112-acre borrow location is assumed to be on both the river side and land side of the levee in cropland and bottomland hardwood areas.

45. Morville-Black Hawk, LA, Seepage Remediation, Item 341-R. This item of work is 1.3 miles long and located on the right descending bank opposite river mile 341. The item consists of installing relief wells to control seepage, therefore no borrow material is expected to be required.

46. Morville-Black Hawk, LA, Seepage Remediation, Item 340-R. This item of work is 3.0 miles long and located on the right descending bank opposite river mile 340. The item consists of constructing a berm and/or enlarging an existing berm to control seepage. The tentatively proposed 18-acre borrow location is assumed to be on the river side of the levee in a shrub-scrub/bottomland hardwood area.

47. Morville-Black Hawk, LA, Seepage Remediation, Item 337-R. This item of work is 3.0 miles long and located on the right descending bank opposite river mile 337. The item consists of installing relief wells to control seepage. The item consist of installing relief wells to control seepage, therefore no borrow material is expected to be required.

48. Morville-Black Hawk, LA, Levee Enlargement and Seepage Remediation, Item 333-R. This item of work is 3.4 miles long and located on the right descending bank opposite river mile 333. The item consists of raising the levee an average of 1.2 feet with a river side shift of the centerline. In addition, this item of work also consists of constructing a berm and/or enlarging an existing berm to control seepage. The tentatively proposed 39-acre borrow location is assumed to be on the river side of the levee in a cropland/bottomland hardwood area.

49. Morville-Black Hawk, LA, Levee Enlargement, Item 330-R. This item of work is 1.5 miles long and located on the right descending bank opposite river mile 330. The item consists of raising the levee an average of 1.0 foot with a river side shift of the centerline. The tentatively proposed 14-acre borrow location is assumed to be on the river side of the levee in a bottomland hardwood area.

50. Morville-Black Hawk, LA, Levee Enlargement and Seepage Remediation, Item 326-R. This item of work is 5.1 miles long and located on the right descending bank opposite river mile 326. The item consists of raising the levee an average of 1.0 foot for approximately 2.8 miles with a river side shift of the centerline and constructing a berm and/or enlarging an existing berm to control seepage. The project will require two borrow areas, with one tentatively proposed 24-acre borrow location assumed to be on the river side of the levee in a shrub/bottomland hardwood area and a 45-acre borrow location is assumed to be on the river side of the levee in a cropland/bottomland hardwood area.

51. Morville-Black Hawk, LA, Levee Enlargement and Seepage Remediation, Item 320-R. This item of work is 3.2 miles long and located on the right descending bank opposite river mile 320. The item consists of raising the levee an average of 2.2 feet with a river side shift of the centerline. Due to the proximity of Red River State Wildlife Management Area, relief wells will be installed instead of the standard berm embankment. Approximately 55-acres of borrow material is expected to be required and is assumed to be on the river side of the levee in a bottomland hardwood area.

MVN Boundaries:

52. Combined Lower/Upper 5th 308-317-W, LA, Levee, Item 312.5-R. This item of work is 4.7 miles long and located on the right descending bank opposite river mile 312.5. The item consists of raising the levee an average of 2.0 feet extending over the length of the Work Item with a flood side shift of the centerline. The borrow area (approximate 16 acres) to construct the levee raise for this item is located on the river side of the levee in a bottomland hardwood wetland area.

53. Old River Lock - Levee, LA, Levee, Item 304-R. This item of work is 0.5 miles long and located on the right descending bank opposite river mile 304. The item consists of raising

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the levee an average of 2.5 feet extending over the length of the Work Item with a levee lift straddling the existing levee centerline. The borrow area (approximate 2 acres) to construct the levee raise for this item is located on the land side of the levee in a bottomland hardwood wetland area.

54. Smithland to Lacour 289-298 R, LA, Levee and Berm, Item 293.5-R. This item of work is 8.4 miles long and located on the right descending bank opposite river mile 293.5. The item consists of raising the levee an average of 1.0 feet extending over the length of the Work Item with the levee lift straddling the existing levee centerline. The work also consists of constructing a berm for a portion of the item to control seepage. The borrow area (approximate 20 acres) to construct the levee raise and berm for this item is located on the land side of the levee in a bottomland hardwood wetland area.

55. Pt Coupee Levee Enlargement, LA, Levee, Item 268-R. This item of work is 0.2 miles long and located on the right descending bank opposite river mile 268. The item consists of raising the levee an average of 1.0 feet extending over the length of the Work Item with a flood side shift of the centerline. The borrow area (less than an acre) to construct the levee raise for this item is located on the land side of the levee in a bottomland hardwood wetland area.

56. Arbroth Levee Enlargement, LA, Levee, Item 253-R. This item of work is 0.1 miles long and located on the right descending bank opposite river mile 253. The item consists of raising the levee an average of 1.5 feet extending over the length of the Work Item with a flood side shift of the centerline. The borrow area (less than an acre) to construct the levee raise for this item is located on the land side of the levee in a bottomland hardwood wetland area.

57. Smithfield Levee Enlargement, LA, Levee, Item 246-R. This item of work is 0.5 miles long and located on the right descending bank opposite river mile 246. The item consists of raising the levee an average of 1.0 feet extending over the length of the Work Item with a flood side shift of the centerline. The borrow area (approximate 1 acre) to construct the levee raise for this item is located on the land side of the levee in a cropland area and/or bottomland hardwood wetland area.

58. Fancy Point, LA, Levee, Item 242.5-R. This item of work is 2.9 miles long and located on the right descending bank opposite river mile 242.5. The item consists of raising the levee an average of 2.0 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (approximate 11 acres) to construct the levee raise for this item is located on the land side of the levee in a cropland area and/or bottomland hardwood wetland area.

59. Thomas Point, LA, Levee, Item 240.3-R. This item of work is 0.8 miles long and located on the right descending bank opposite river mile 240.3. The item consists of raising the levee an average of 1.0 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (approximate 2 acres) to construct the levee raise for this item is located on the land side of the levee in a cropland area and/or bottomland hardwood wetland area.

60. Port Allen, LA, Levee, Item 231-R. This item of work is 2.5 miles long and located on the right descending bank opposite river mile 231. The item consists of raising the levee an average of 2.0 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (approximate 9 acres) to construct the levee raise for this item is located on the land side of the levee in a cropland area.

61. Port Allen Lock – Levee, LA, Levee, Item 228-R. This item of work is 0.01 miles long and located on the right descending bank opposite river mile 228. The item consists of raising the levee an average of 1.0 feet extending over the length of the Work Item with the levee lift straddling the existing levee centerline. The borrow area (less than an acre) to construct the levee raise for this item is located on the land side of the levee in a cropland area.

62. Addis, LA, Levee, Item 223-R. This item of work is 0.3 miles long and located on the right descending bank opposite river mile 223. The item consists of raising the levee an average of 1.0 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (less than an acre) to construct the levee raise for this item is located on the land side of the levee in a cropland area.

63. Ben Hur Road, LA, Levee, Item 217.6-L. This item of work is 0.07 miles long and located on the left descending bank opposite river mile 217.6. The item consists of raising the levee an average of 1.0 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (less than an acre) to construct the levee raise for this item is located on the land side of the levee in a cropland area.

64. Morrisonville, LA, Levee, Item 216-R. This item of work is 2.8 miles long and located on the right descending bank opposite river mile 216. The item consists of raising the levee an average of 2.5 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (approximate 9 acres) to construct the levee raise for this item is located on the land side of the levee in a cropland area.

65. Plaquemines Point, LA, Berm and/or Wells, Item 208-L. This item of work is 0.9 miles long and located on the left descending bank opposite river mile 208. The item consists of either embankment berm construction and/or relief wells to control seepage in the area. The borrow area (approximate 5 acres) to construct the levee raise for this item is located on the land side of the levee in a cropland area.

66. Plaquemine/Reveille, LA, Levee, Item 206.7-R. This item of work is 2.7 miles long and located on the right descending bank opposite river mile 206.7. The item consists of raising the levee an average of 1.0 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (approximate 4 acres) to construct the levee raise for this item is located on the land side of the levee in a cropland area.

67. Lower Plaquemines Point, LA, Levee, Item 199-L. This item of work is 5.5 miles long and located on the left descending bank opposite river mile 199. The item consists of raising the levee an average of 1.5 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (approximate 14 acres) to construct the levee raise for this item is located on the land side of the levee in a cropland area.

68. Bayou Goula to Alhambra, LA, Levee, Item 194.5-R. This item of work is 0.7 miles long and located on the right descending bank opposite river mile 194.5. The item consists of raising the levee an average of 1.5 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (approximate 2 acres) to construct the levee raise for this item is located on the land side of the levee in a cropland area.

69. Carville, LA, Levee, Item 189-L. This item of work is 0.7 miles long and located on the left descending bank opposite river mile 189. The item consists of raising the levee an average of 1.0 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (approximate 1.5 acres) to construct the levee raise for this item is located on the land side of the levee in a cropland area.

70. Claiborne Island, LA, Berm, Item 189-R. This item of work is 0.5 miles long and located on the right descending bank opposite river mile 189. The work consists of constructing a berm for control seepage. The borrow area (approximate 3 acres) to construct the levee raise for this item is located on the land side of the levee in a cropland area.

71. Marchand, LA, Levee, Item 181-L. This item of work is 0.05 miles long and located on the left descending bank opposite river mile 181. The item consists of raising the levee an average of 1.0 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (less than an acre) to construct the levee raise for this item is located on the land side of the levee in a cropland area.

72. ABLD-1 180 R, LA, Levee, Item 180-R. This item of work is 0.7 miles long and located on the right descending bank opposite river mile 180. The item consists of raising the levee an average of 1.5 feet extending over the length of the Work Item with a land side or flood side shift of the centerline. The borrow area (approximate 2 acres) to construct the levee raise for this item is located on the land side of the levee in a cropland area.

73. Smoke Bend, LA, Levee, Item 178-R. This item of work is 3.3 miles long and located on the right descending bank opposite river mile 178. The item consists of raising the levee an average of 2.5 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (approximate 10 acres) to construct the levee raise for this item is located on the land side of the levee in a cropland area.

74. Stella Landing, LA, Levee, Item 173.9-R. This item of work is 0.1 miles long and located on the right descending bank opposite river mile 173.9. The item consists of raising the levee an average of 1.0 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (less than an acre) to construct the levee raise for this item is located on the river side of the levee in a cropland area.

75. Aben, LA, Levee, Item 172.6R. This item of work is 1.6 miles long and located on the right descending bank opposite river mile 172.6. The item consists of raising the levee an average of 2.0 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (approximate 4 acres) to construct the levee raise for this item is located on the river side of the levee in a cropland area.

76. Point Houmas (Lauderdale), LA, Levee, Item 165-R. This item of work is 0.5 miles long and located on the right descending bank opposite river mile 165. The item consists of

raising the levee an average of 2.5 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (approximate 2 acres) to construct the levee raise for this item is located on the river side of the levee in a cropland area.

77. Brilliant Point 163.5 R, LA, Levee, Item 163.5-R. This item of work is 1.7 miles long and located on the right descending bank opposite river mile 163.5. The item consists of raising the levee an average of 2.5 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (approximate 10 acres) to construct the levee raise for this item is located on the river side of the levee in a cropland area.

78. Romeville, LA, Levee, Item 163-L. This item of work is 0.05 miles long and located on the left descending bank opposite river mile 163. The item consists of raising the levee an average of 1.0 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (less than an acre) to construct the levee raise for this item is located on the land side of the levee in a cropland area.

79. Barton Lane 159.7 R, LA, Levee, Item 159.7-R. This item of work is 0.1 miles long and located on the right descending bank opposite river mile 159.7. The item consists of raising the levee an average of 2.0 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (less than an acre) to construct the levee raise for this item is located on the river side of the levee in a cropland area.

80. St. Amelia 158R, LA, Levee, Item 158-R. This item of work is 0.02 miles long and located on the right descending bank opposite river mile 158. The item consists of raising the levee an average of 1.0 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (less than an acre) to construct the levee raise for this item is located on the river side of the levee in a cropland area.

81. Romeville/College Point 156.8 L, LA, Levee, Item 156.8-L. This item of work is 0.1 miles long and located on the left descending bank opposite river mile 156.8. The item consists of raising the levee an average of 1.5 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (less than an acre) to construct the levee raise for this item is located on the land side of the levee in a cropland area.

82. St. James Moonshine, LA, Levee, Item 156-R. This item of work is 1.3 miles long and located on the right descending bank opposite river mile 156. The item consists of raising the levee an average of 3.0 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (approximate 5 acres) to construct the levee raise for this item is located on the river side of the levee in a cropland area.

83. Welham Plantation, LA, Levee, Item 154-L. This item of work is 0.5 miles long and located on the left descending bank opposite river mile 154. The item consists of raising the levee an average of 1.0 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (less than an acre) to construct the levee raise for this item is located on the land side of the levee in a cropland area.

84. Belmont, LA, Levee, Item 152-L. This item of work is 0.04 miles long and located on the left descending bank opposite river mile 152. The item consists of raising the levee an average of 1.0 feet extending over the length of the Work Item with a land side shift of the

centerline. The borrow area (less than an acre) to construct the levee raise for this item is located on the land side of the levee in a cropland area.

85. Vacherie, LA, Levee, Item 149-R. This item of work is 0.2 miles long and located on the right descending bank opposite river mile 149. The item consists of raising the levee an average of 1.0 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (less than an acre) to construct the levee raise for this item is located on the river side of the levee in a cropland area.

86. Paulina/Lutcher/Gramercy, LA, Levee, Item 148-L. This item of work is 3.8 miles long and located on the left descending bank opposite river mile 148. The item consists of raising the levee an average of 2.5 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (approximate 10 acres) to construct the levee raise for this item is located on the land side of the levee in a cropland area.

87. Wallace, LA, Levee, Item 147.3-R. This item of work is 0.8 miles long and located on the right descending bank opposite river mile 147.3. The item consists of raising the levee an average of 2.0 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (approximate 2 acres) to construct the levee raise for this item is located on the land side of the levee in a cropland area.

88. Gramercy.Mt. Airy/48 mile Point, LA, Levee, Item 144-L. This item of work is 0.3 miles long and located on the left descending bank opposite river mile 144. The item consists of raising the levee an average of 1.0 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (approximate 1 acre) to construct the levee raise for this item is located on the land side of the levee in a cropland area.

89. Oak Alley - Willow Grove 142.6-144 R, LA, Levee, Item 143.7-R. This item of work is 0.1 miles long and located on the right descending bank opposite river mile 143.7. The item consists of raising the levee an average of 1.0 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (less than an acre) to construct the levee raise for this item is located on the river side of the levee in a cropland area.

90. Upper Edgard 142 R, LA, Levee, Item 142-R. This item of work is 0.3 miles long and located on the right descending bank opposite river mile 142. The item consists of raising the levee an average of 1.0 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (less than an acre) to construct the levee raise for this item is located on the river side of the levee in a cropland area.

91. Reserve, LA, Levee, Item 136-L. This item of work is 2.1 miles long and located on the left descending bank opposite river mile 136. The item consists of raising the levee an average of 1.0 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (approximate 3 acres) to construct the levee raise for this item is located on the land side of the levee in a cropland area.

92. Lower Edgard (3) 135.2-136.2 R, LA, Levee, Item 135.7-R. This item of work is 0.1 miles long and located on the right descending bank opposite river mile 135.7. The item consists of raising the levee an average of 1.0 feet extending over the length of the Work

Item with a land side shift of the centerline. The borrow area (less than an acre) to construct the levee raise for this item is located on the river side of the levee in a cropland area.

93. Laplace, LA, Levee, Item 133-L. This item of work is 0.5 miles long and located on the left descending bank opposite river mile 133. The item consists of raising the levee an average of 1.5 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (approximate 1 acre) to construct the levee raise for this item is located on the land side of the levee in a cropland area.

94. Lower Edgard 131.7 R, LA, Levee, Item 131.7-R. This item of work is 0.4 miles long and located on the right descending bank opposite river mile 131.7. The item consists of raising the levee an average of 1.5 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (approximate 1 acre) to construct the levee raise for this item is located on the river side of the levee in a cropland area.

95. 35 Mile Point, LA, Levee, Item 130-L. This item of work is 0.6 miles long and located on the left descending bank opposite river mile 130. The item consists of raising the levee an average of 2.0 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (approximate 2.5 acres) to construct the levee raise for this item is located on the land side of the levee in a cropland area.

96. Hahnville, Flagville, Dufresne 120-128.5 R, LA, Levee, Item 124.3-R. This item of work is 0.4 miles long and located on the right descending bank opposite river mile 124.3. The item consists of raising the levee an average of 1.5 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (approximate 1 acre) to construct the levee raise for this item is located on the river side of the levee in a cropland area.

97. Bonnet Carre to New Sarpy, LA, Levee, Item 124-L. This item of work is 1.8 miles long and located on the left descending bank opposite river mile 124. The item consists of raising the levee an average of 1.5 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (approximate 4 acres) to construct the levee raise for this item is located on the land side of the levee in a cropland area.

98. Lone Star to Davis Pond, LA, Levee, Item 119.2-R. This item of work is 1.0 miles long and located on the right descending bank opposite river mile 119.2. The item consists of raising the levee an average of 1.5 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (approximate 2 acres) to construct the levee raise for this item is located on the river side of the levee in a cropland area.

99. Davis Pond Freshwater Diversion Structure Floodwall, LA, Floodwall, Item 118.5- R. This item of work is 0.05 miles long capped sheet pile floodwall and located on the right descending bank opposite river mile 118. The item consists of removing the existing I-wall and replacing with a pile-founded, concrete T-wall.

100. Ama #2, LA, Levee, Item 117.3-R. This item of work is 0.2 miles long and located on the right descending bank opposite river mile 117.3. The item consists of raising the levee an average of 1.0 feet extending over the length of the Work Item with a land side shift of

the centerline. The borrow area (less than an acre) to construct the levee raise for this item is located on the river side of the levee in a cropland area.

101. Cyanamid, LA, Levee, Item 115.5-R. This item of work is 0.3 miles long and located on the right descending bank opposite river mile 115.5. The item consists of raising the levee an average of 1.5 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (approximate 1 acre) to construct the levee raise for this item is located on the river side of the levee in a cropland area.

102. St. Rose (Kenner Revet), LA, Levee, Item 115-L. This item of work is 1.3 miles long and located on the left descending bank opposite river mile 115. The item consists of raising the levee an average of 1.5 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (approximate 3 acres) to construct the levee raise for this item is located on the land side of the levee in a cropland area.

103. Ama, LA, Levee, Item 113.5-R. This item of work is 0.2 miles long and located on the right descending bank opposite river mile 113.5. The item consists of raising the levee an average of 1.0 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (less than an acre) to construct the levee raise for this item is located on the land side of the levee in a pasture land area.

104. Waggaman and Bridge City Levee and Floodwall, LA, Floodwall, Item 109.6-R. This item of work is 0.24 miles long floodwall and located on the right descending bank opposite river mile 110. The item consists of work on the floodwall only, removing the existing I-wall and replacing with a pile-founded, concrete T-wall.

105. Waggaman, LA, Levee, Item 110.4-R. This item of work is 0.4 miles long and located on the right descending bank opposite river mile 110.4. The item consists of raising the levee an average of 1.0 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area to construct the levee raise for this item is located on the land side of the levee in a pasture land area.

106. Upper Avondale, LA, Levee, Item 108.3-R. This item of work is 0.6 miles long and located on the right descending bank opposite river mile 108.3. The item consists of raising the levee an average of 2.0 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (approximate 1 acre) to construct the levee raise for this item is located on the land side of the levee in a pasture land area.

107. Lower Avondale, LA, Levee or Floodwall, Item 107-R. This item of work is 1.4 miles long and located on the right descending bank opposite river mile 107. The item consists of either raising the levee an average of 2.0 feet extending over the length of the Work Item with a land side shift of the centerline. The item for a floodwall consists of raising the current elevation of the floodwall an average of 2.0 feet for 1.4 miles. In order to meet the current design grade, the existing floodwall will be replaced completely with a new pile-founded concrete T-wall as well as adding steel gates across the ramps. The borrow area (less than an acre) to construct the levee raise for this item is located on the land side of the levee in a pasture land area.

108. Westwego Levee and Floodwall, LA, Floodwall, Item 102.1-R. This item of work is a 0.49 mile long floodwall and is located on the right descending bank opposite river mile 105. The item consists of work on the floodwall only, removing the existing I-wall and replacing with a pile-founded, concrete T-wall.

109. Dugas to Celotex, LA, Levee, Berm and/or Wells, Item 100.4-R. This item of work is 0.7 miles long and located on the right descending bank opposite river mile 100.4. The item consists of raising the levee an average of 1.0 feet extending over the length of the Work Item with a land side shift of the centerline. The item also will consist of either embankment berm construction and/or relief wells to control seepage in the area. The borrow area (approximate 4.5 acres) to construct the levee raise and berm for this item is located on the land side of the levee in a pasture land area.

110. Nashville Ave. to Napoleon Ave. Floodwall, LA, Floodwall, Item 100-L. This item of work is 1.37 miles long floodwall and located on the left descending bank opposite river mile 100. The item consist of removing the existing I-wall and replacing with a pile-founded, concrete T-wall.

111. Barataria Blvd., LA, Levee, Item 99.5-R. This item of work is 0.1 miles long and located on the right descending bank opposite river mile 99.5. The item consists of raising the levee an average of 1.5 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (less than an acre) to construct the levee raise for this item is located on the land side of the levee in a pasture land area.

112. Louisiana Avenue Wharves C&D, LA, Floodwall, Item 98.7-L. This item of work is a 0.14 mile long floodwall and is located on the left descending bank opposite river mile 92.7. The item consists of removing the existing I-wall and replacing with a pile-founded, concrete T-wall.

113. Harvey Lock Forebay – Levee, LA, Levee or Floodwall, Item 98.3-R. This item of work is 0.3 miles long and located on the right descending bank opposite river mile 98.3. The item consists of either raising the levee or installing a floodwall. The levee raise would be an average of 3.5 feet extending over the length of the Work Item with a flood side shift of the centerline. The item for a floodwall would consist of raising the current elevation of levee with a new pile-founded concrete T-wall an average of 3.5 feet for 0.3 miles. The borrow area (approximate 1 acre) to construct the levee raise for this item is located on the land side of the levee in a pasture land area.

114. Louisiana Ave to Jackson Ave Floodwall, LA, Floodwall, Item 98.1-L. This item of work is 0.28 mile long floodwall and is located on the left descending bank opposite river mile 97.2. The item consist of removing the existing I-wall and replacing with a pile-founded, concrete T-wall

115. Gretna Phase II 97-97.8 R, LA, Levee or Floodwall, Item 97.4-R. This item of work is 0.2 miles long and located on the right descending bank opposite river mile 97.4. The item consist of either raising the levee or installing a floodwall. The levee raise would be an average of 1.5 feet extending over the length of the Work Item with a land side shift of the centerline. The item for a floodwall would consist of raising the current elevation of levee with a new pile-founded concrete T-wall an average of 1.5 feet for 0.2 miles. The borrow

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area (less than an acre) to construct the levee raise for this item is located on the land side of the levee in a pasture land area.

116. Jackson to Thalia, LA Floodwall, Item 96.5-L. This item of work is a 1.18 mile long floodwall and is located on the left descending bank opposite river mile 95.6. The item consists of removing the existing I-wall and replacing with a pile-founded, concrete T-wall.

117. Thalia St. to Poydras St. Floodwall, LA, Floodwall, Item 95.3-L. This item of work is a 0.64 mile long floodwall and is located on the left descending bank opposite river mile 95. The item consists of removing the existing I-wall and replacing with a pile-founded, concrete T-wall.

118. Spanish Plaza, LA, Floodwall, Item 95-L. This item of work is a 0.02 mile long floodwall and is located on the left descending bank opposite river mile 95. The item consists of removing the existing I-wall and replacing with a pile-founded, concrete T-wall.

119. Canal St. to Toulouse St. Floodwall, LA, Floodwall, Item 94.8-L. This item of work is a 0.43 mile long capped and uncapped floodwall and is located on the left descending bank opposite river mile 94.9. The item consists of removing the existing I-wall and replacing with a pile-founded, concrete T-wall.

120. Algiers Point 93.75-95.5 R, LA, Levee or Floodwall, Item 94.6-R. This item of work is 0.5 miles long and located on the right descending bank opposite river mile 94.6. The item consists of either raising the levee or installing a floodwall. The levee raise would be an average of 1.5 feet extending over the length of the Work Item with a land side shift of the centerline. The item for a floodwall would consist of raising the current elevation of levee with a new pile-founded concrete T-wall an average of 1.5 feet for 0.5 miles. The borrow area (approximate 1 acre) to construct the levee raise for this item is located on the land side of the levee in a cropland area and pasture land area.

121. Dumaine St. Floodwall, LA, Floodwall, Item 94.5-L. This item of work is a 0.47 mile long floodwall and is located on the left descending bank opposite river mile 94.5. The item consists of removing the existing I-wall and replacing with a pile-founded, concrete T-wall.

122. Barracks St. to Montegut St. Floodwall, LA, Floodwall, Item 94.1-L. This item of work is a 0.67 mile long floodwall and is located on the left descending bank opposite river mile 93.9. The item consists of removing the existing I-wall and replacing with a pile-founded, concrete T-wall.

123. Montegut St. to Independence St. Floodwall, LA, Floodwall, Item 93.6-L. This item of work is 0.35 miles long floodwall and located on the left descending bank opposite river mile 93.3. The item consist of removing the existing I-wall and replacing with a pile-founded, concrete T-wall.

124. Independence St. to I.H.N.C. Floodwall, LA, Floodwall, Item 93-L. This item of work is a 0.6 mile long floodwall and is located on the left descending bank opposite river mile 92.8. The item consists of removing the existing I-wall and replacing with a pile-founded, concrete T-wall.

125. IHNC Lock Forebay 92.6L - Levee, LA, Levee, Item 92.6-L. This item of work is 3.2 miles long and located on the left descending bank opposite river mile 92.6. The item consists of raising the levee an average of 2.0 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (approximate 7 acres) to construct the levee raise for this item is located on the land side of the levee in a marsh wetland area.

126. Holy Cross, LA, Levee, Item 92-L. This item of work is 0.4 miles long and located on the left descending bank opposite river mile 92. The item consists of raising the levee an average of 2.0 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (approximate 1 acre) to construct the levee raise for this item is located on the land side of the levee in a marsh wetland area.

127. Arabi Levee and Floodwall, LA, Floodwall, Item 91.2-L. This item of work is a 0.43 mile long capped and uncapped floodwall and is located on the left descending bank opposite river mile 91.2. The item consists of work on the floodwall only, removing the existing I-wall and replacing with a pile-founded, concrete T-wall.

128. Domino Sugar, LA, Relief Wells, Item 91-L. This item of work is 0.6 miles long and located on the left descending bank opposite river mile 91. The item consists of installation of relief wells to control seepage in the area.

129. Amstar Levee and Floodwall, LA, Floodwall, Item 90.8-L. This item of work is a 0.16 mile long capped and uncapped floodwall and is located on the left descending bank opposite river mile 90.8. The item consists of work on the floodwall only, removing the existing I-wall and replacing with a pile-founded, concrete T-wall.

130. US Coast Guard Reservation, LA, Levee, Item 90.6-R. This item of work is 3.3 miles long and located on the right descending bank opposite river mile 90.6. The item consists of raising the levee an average of 2.0 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (approximate 6.5 acres) to construct the levee raise for this item is located on the land side of the levee in a cropland area / pasture land area.

131. Chalmette Slip, LA, Levee or Floodwall, Item 90-L. This item of work is 0.4 miles long and located on the left descending bank opposite river mile 90. The item consists of either raising the levee or installing a floodwall. The levee raise would be an average of 1.5 feet extending over the length of the Work Item with a land side shift of the centerline. The item for a floodwall would consist of raising the current elevation of the floodwall an average of 1.5 feet for 0.4 miles. In order to meet the current design grade, the existing floodwall will be replaced completely with a new pile-founded concrete T-wall. The borrow area (approximate 1 acre) to construct the levee raise for this item is located on the land side of the levee in a bottomland hardwood area.

132. Chalmette Battle Field (1), LA, Levee or Floodwall, Item 88.5-L. This item of work is 0.4 miles long and located on the left descending bank opposite river mile 88.5. The item consists of either raising the levee or installing a floodwall. The levee raise would be an average of 1.5 feet extending over the length of the Work Item with a land side shift of the

centerline. The item for a floodwall would consist of raising the current elevation of the floodwall an average of 1.5 feet for 1.25 miles. In order to meet the current design grade, the existing floodwall will be replaced completely with a new pile-founded concrete T-wall. The borrow area (approximate 3 acres) to construct the levee raise for this item is located on the land side of the levee in a bottomland hardwood area.

133. Algiers Lock – Levee, LA, Levee, Item 88-R. This item of work is 0.5 miles long and located on the right descending bank opposite river mile 88. The item consists of raising the levee an average of 2.0 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (approximate 1.5 acres) to construct the levee raise for this item is located on the land side of the levee in a cropland area / pasture land area.

134. Chalmette Battle Field (2), LA, Levee, Item 86.1-L. This item of work is 0.4 miles long and located on the left descending bank opposite river mile 86.1. The item consists of raising the levee an average of 1.5 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (approximate 1 acre) to construct the levee raise for this item is located on the land side of the levee in a bottomland hardwood area.

135. Stanton, LA, Levee, Item 84.3-R. This item of work is 0.6 miles long and located on the right descending bank opposite river mile 84.3. The item consists of raising the levee an average of 1.5 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (approximate 1 acre) to construct the levee raise for this item is located on the land side of the levee in a cropland area and pasture land area.

136. Oakville to Alliance, LA, Levee, Item 67-R. This item of work is 6.6 miles long and located on the right descending bank opposite river mile 67. The item consists of raising the levee an average of 2.0 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (approximate 10 acres) to construct the levee raise for this item is located on the land side of the levee in a pasture land area.

137. Carnaevon to Phoenix, LA, Levee, Item 67-L. This item of work is 7.0 miles long and located on the left descending bank opposite river mile 67. The item consists of raising the levee an average of 2.0 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (approximate 12 acres) to construct the levee raise for this item is located on the land side of the levee in a bottomland hardwood wetland area.

138. Alliance to Ironton, LA, Levee, Item 61.5-R. This item of work is 2.8 miles long and located on the right descending bank opposite river mile 61.5. The item consists of raising the levee an average of 2.0 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (approximate 5 acres) to construct the levee raise for this item is located on the land side of the levee in a pasture land area.

139. Ironton to Deer Range, LA, Levee, Item 58-R. This item of work is 3.2 miles long and located on the right descending bank opposite river mile 58. The item consists of raising the levee an average of 2.0 feet extending over the length of the Work Item with a land

side shift of the centerline. The borrow area (approximate 6 acres) to construct the levee raise for this item is located on the land side of the levee in a pasture land area.

140. Deer Range to W. Point a la Hache, LA, Levee, Item 52.5-R. This item of work is 7.7 miles long and located on the right descending bank opposite river mile 52.5. The item consists of raising the levee an average of 2.0 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (approximate 12 acres) to construct the levee raise for this item is located on the land side of the levee in a pasture land area.

141. Phoenix to Bohemia, LA, Levee, Item 51-L. This item of work is 10.5 miles long and located on the left descending bank opposite river mile 51. The item consists of raising the levee an average of 2.5 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (approximate 19 acres) to construct the levee raise for this item is located on the land side of the levee in a bottomland hardwood wetland and marsh area.

142. W. Pt a la Hache to St. Jude, LA, Levee, Item 47.5-R. This item of work is 2.1 miles long and located on the right descending bank opposite river mile 47.5. The item consists of raising the levee an average of 2.0 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (approximate 5 acres) to construct the levee raise for this item is located on the land side of the levee in a pasture land area.

143. Port Sulphur, LA, Levee, Item 37-R. This item of work is 1.1 miles long and located on the right descending bank opposite river mile 37. The item consists of raising the levee an average of 1.5 feet extending over the length of the Work Item with a land side shift of the centerline. The borrow area (approximate 2.5 acres) to construct the levee raise for this item is located on the land side of the levee in a pasture land area.

Appendix B: Point of Contacts (POC)

CONTACT INFORMATION FOR SIGNATORIES AND FEDERALLY RECOGNIZED TRIBES

Signatories shall provide USACE with updated contact information as it becomes available, and revisions to this Appendix B will be made without an amendment to this Agreement. This Appendix B will be updated annually by USACE and included in the Annual Report.

The Appendix captures that some consultations will be all email (excepting reports), while others will be all paper. This is captured so that the district archaeologist/Tribal Liaison has the right tool to communicate.

Federally-Recognized Tribes	
Absentee-Shawnee Tribe of Indians Primary: Ms. Devon Frazier, THPO Office of the Governor Building 2025 S Gordon Cooper Drive Shawnee, OK 74801 (405) 275-4030 x 6243 dfrazier@astribe.com Method of contact for project notification and documentation: email to Primary contact email. Method of contact for other communication: email, phone call	**Absentee-Shawnee Tribe of Indians** Secondary: Edwina Butler-Wolfe, Governor Office of the Governor Building 2025 S Gordon Cooper Drive Shawnee, OK 74801
Alabama-Coushatta Tribe of Texas Primary: Bryant Celestine, THPO Alabama-Coushatta Tribe of Texas 571 State Park Rd. 56 Livingston, TX 77351 (936) 563-1181 celestine.bryant@actribe.org Method of contact for project notification and documentation: email to histpres@actribe.org and copy to Primary contact email. Method of contact for other communication: email, phone call	**Alabama-Coushatta Tribe of Texas** Secondary: Joann Battise, Chairwoman Alabama-Coushatta Tribe of Texas 571 State Park Rd. 56 Livingston, TX 77351 (936) 563-1181 Email: histpres@actribe.org

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Alabama-Quassarte Tribal Town Primary: Samantha Robison, THPO PO Box 187 Wetumka, OK 74883 (405) 452-3881 rwind@alabama-quassarte.org; jlowe@alabama-quassarte.org Method of contact for project notification and documentation: email to Primary contact email. Method of contact for other communication: email, phone call	**Alabama-Quassarte Tribal Town** Secondary: Nelson Harjo, Chief Tarpie Yargee, Town King PO Box 187 Wetumka, OK 74883 chief@alabama-quassarte.org
Apache Tribe of Oklahoma Primary: Wamblee Smith, Apache EPA PO Box 1330 Anadarko, OK 73005 (405) 247-9493 x111/109 apachetribeepa@gmail.com epa4apachetribeok@gmail.com Method of contact for project notification and documentation: email to Primary contact email. Method of contact for other communication: email, phone call	**Apache Tribe of Oklahoma** Secondary: Bobby Komardley, Chairman PO Box 1330 Anadarko, OK 73005
Caddo Nation Primary: Derrick Hill, THPO Caddo Nation 117 Memorial Lane Binger, OK 73009 (405) 656-2344 dhill@mycaddonation.com Method of contact for project notification and documentation: email to Primary contact email. Method of contact for other communication: email, phone call	**Caddo Nation** Secondary: Tamara Francis Fourkiller, Chairman Caddo Nation PO Box 487 Binger, OK 73009 tffourkiller.cn@gmail.com

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Cherokee Nation Primary: Elizabeth Toombs, THPO PO Box 948 Tahlequah, OK 74465-0948 (918) 453-5389 elizabeth-toombs@cherokee.org Method of contact for project notification and documentation: email to Primary contact email. Method of contact for other communication: email, phone call	**Cherokee Nation** Secondary: Chuck Hoskin Jr. Principal Chief PO Box 948 Tahlequah, OK 74465-0948 (918) 458-5580 Chuck-hoskin@cherokee.org
Chickasaw Nation Primary: Karen Brunso, THPO Division of Historic Preservation PO Box 1548 Ada, Oklahoma 74821 (580) 272-1106 Karen.Brunso@chickasaw.net HPO@chicksaw.net Method of contact for project notification and documentation: email to HPO@chicksaw.net. Method of contact for other communication: email, phone call	**Chickasaw Nation** Secondary: Bill Anoatubby, Governor PO Box 1548 Ada, Ok 74821 (580) 436-2603
Chitimacha Tribe of Louisiana Primary: Kimberly S. Walden, THPO Chitimacha Tribe of Louisiana 155 Chitimacha Loop Charenton, LA 70523 (337) 923-9923 kim@chitimacha.gov Method of contact for project notification and documentation: email to Primary contact. Method of contact for other communication: email, phone call	**Chitimacha Tribe of Louisiana** Secondary: Chairman Melissa Darden Chitimacha Tribe of Louisiana 155 Chitimacha Loop Charenton, LA 70523 (337) 924-4973

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Choctaw Nation of Oklahoma Primary: Ian Thomson Historic Preservation Department Choctaw Nation of Oklahoma P.O. Box 1210 Durant, OK 74702 (580) 924-8280 ithompson@choctawnation.com Lindsey D. Bilyeu, MS Senior Compliance Review Officer lbilyeu@choctawnation.com Method of contact for project notification and documentation: email Senior Compliance Review Officer with a copy to THPO. Method of contact for other communication: email, phone call	**Choctaw Nation of Oklahoma** Secondary: Gary Batton, Chief Choctaw Nation of Oklahoma Attn: Choctaw Nation Historic Preservation Department P.O. Box 1210 Durant, OK 74702-1210 (800) 522-6170 gbatton@choctawnation.com
Coushatta Tribe of Louisiana Primary: Dr. Linda Langley Cultural Preservation Officer Coushatta Tribe of Louisiana 1940 C.C. Bell Road Elton, LA 70532 (337) 584-1567 llangley@coushattatribela.org Jonas Johns, Director of the Coushatta Heritage Department. E-mail: jonasj@coushattatribela.org Kassie Dawsey, Section 106 Coordinator. khenry@coushattatribela.org Method of contact for project notification and documentation: email to Primary contact with a copy to Director of Heritage Dept. and Section 106 coordinator. Method of contact for other communication: email, phone call	**Coushatta Tribe of Louisiana** Secondary: Chairman Kevin Sickey Coushatta Tribe of Louisiana 1940 C.C. Bell Road Elton, LA 70532 (337) 584-2998

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Delaware Nation Primary: Nekole Allgood, NAGPRA Coordinator Delaware Nation Historic Preservation Office PO Box 825 Anadarko, OK 73005 (405) 247-2448 NAllgood@delawarenation-nsn.gov Method of contact for project notification and documentation: email to Primary contact email. Method of contact for other communication: email, phone call	**Delaware Nation** Secondary: Deborah Dotson, President Delaware Nation PO Box 825 Anadarko, Ok 73005 (405) 247-2448
Delaware Tribe of Indians Primary: Brice Obermeyer, Director Delaware Tribe Historic Preservation Office 1200 Commercial St. Roosevelt Hall, RM 212 Emporia, KS 66801 (918) 335-7026 bobermeyer@delawaretribe.org Method of contact for project notification and documentation: email to Primary contact email. Method of contact for other communication: email, phone call	**Delaware Tribe of Indians** Secondary: Chester Brooks, Chief 5100 Tuxedo Blvd. Bartlesville, Ok 74006 (918) 337-6590 cbrookes@delawaretribe.org
Eastern Band of Cherokee Indians Primary: Russell Townsend, THPO Qualla Boundary Reservation PO Box 455 Cherokee, NC 28719 (828) 497-1584 russtown@nc-cherokee.com Method of contact for project notification and documentation: email to Primary contact email. Method of contact for other communication: email, phone call	**Eastern Band of Cherokee Indians** Secondary: Richard Sneed, Principal Chief PO Box 1927 Cherokee, NC 28719 (828) 359-7002

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Eastern Shawnee Tribe of Oklahoma Primary: Brett Barnes, THPO 12705 E. 705 Road Wyandotte, OK 74370 (918) 666-2435 x1845 bbarnes@estoo.net Method of contact for project notification and documentation: email to Primary contact email. Method of contact for other communication: email, phone call	**Eastern Shawnee Tribe of Oklahoma** Secondary: Glenna J. Wallace, Chief 12755 S. 705 Rd. Wyandotte, OK 74370 (918) 666-2435
Jena Band of Choctaw Indians Primary: Alina J. Shively, THPO Jena Band of Choctaw Indians PO Box 14 Jena, LA 71342 (318) 992-1205 ashively@jenachoctaw.org Method of contact for project notification and documentation: email to Primary contact. Method of contact for other communication: email, phone call	**Jena Band of Choctaw Indians** Secondary: B. Cheryl Smith, Chief Jena Band of Choctaw Indians 1052 Chanaha Hina Street Trout, LA 71371 (318) 992-2717 chief@jenachoctaw.org
Kaw Nation Primary: Crystal Douglas, THPO PO Box 50 Kaw City, OK 74641 (580) 269-2552 x235 crystal_douglas@kawnation.com Method of contact for project notification and documentation: email to Primary contact. Method of contact for other communication: email, phone call	**Kaw Nation** Secondary: Lynn Williams, Tribal Chair PO Box 50 Kaw City, OK 74641 (580) 269-2552 lwilliams@kawnation.com

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Kialegee Tribal Town Primary: Henry Harjo, EPA Director PO Box 332 Wetumka, OK 74883 (405) 452-3262 dc13.dc4@gmail.com Method of contact for project notification and documentation: email to Primary contact. Method of contact for other communication: email, phone call	**Kialegee Tribal Town** Secondary: Tiger Hobbia, Mekko PO Box 332 Wetumka, OK 74883 (405) 452-3262
Kickapoo Tribe of Kansas Primary: Fred Thomas, Vice Chair PO Box 271 Horton, KS 66439 (785) 486-2601 x8 eric.sheets@ktik-nsn.gov Method of contact for project notification and documentation: email to Primary contact. Method of contact for other communication: email, phone call	**Kickapoo Tribe of Kansas** Secondary: Lester Randall, Chairman 824 111th Drive Horton, KS 66439 (785) 486-2131
Menominee Indian Tribe of Wisconsin Primary: David Grignon, THPO and Director Menominee Cultural Museum and Logging Museum W3426 Cty VV West Keshena, WI 54135-0910 (715) 799-5258 dgrignon@mitw.org Method of contact for project notification and documentation: email to Primary contact. Method of contact for other communication: email, phone call	**Menominee Indian Tribe of Wisconsin** Secondary: Johnathan Wilber, Tribal Administrator PO Box 910 Keshena, WI 54135 (715) 799-5154 jwilber@mitw.org

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Miami Tribe of Oklahoma Primary: Diane Hunter, THPO PO Box 1326 Miami, OK 74355 (918) 541-8966 dhunter@miamination.com Method of contact for project notification and documentation: email to Primary contact. Method of contact for other communication: email, phone call	**Miami Tribe of Oklahoma** Secondary: Douglas G. Langford, Chief PO Box 1326 Miami, OK 74355 (918) 541-1300 dlankford@miamination.com
Mississippi Band of Choctaw Indians Primary: Ken Carleton, Tribal Archeologist Mississippi Band of Choctaw Indians 101 Industrial Road Choctaw, MS 39350 (601) 656-5251 ken.carleton@choctaw.org Method of contact for project notification and documentation: email to Primary contact. Method of contact for other communication: email, phone call	**Mississippi Band of Choctaw Indians** Secondary: Ben Cyrus, Chief Mississippi Band of Choctaw Indians 101 Industrial Road Choctaw, MS 39350 (601) 656-5251 info@choctaw.org
Muscogee (Creek) Nation Primary: Ms. Corain Lowe-Zepeda, THPO Muscogee (Creek) Nation Historic & Cultural Preservation Office P.O. Box 580 Okmulgee, OK 74447 (918) 732-7733 clowe@mcn-nsn.gov Section106@mcn-nsn.gov Method of contact for project notification and documentation: email to Section106@mcn-nsn.gov and a copy to the Primary contact. Method of contact for other communication: email, phone call	**Muscogee (Creek) Nation** Secondary: Principal Chief, Mr. James Floyd Muscogee (Creek) Nation Historic & Cultural Preservation Office P.O. Box 580 Okmulgee, OK 74447

Osage Nation Primary: Dr. Andrea A. Hunter Tribal Historic Preservation Officer/Director Osage Nation 627 Grandview Avenue Pawhuska, OK 74056 918-287-5671 ahunter@osagenation-nsn.gov Method of contact for project notification and documentation: postal mail/courier (post-pandemic). Email to Deputy THPO and CC the THPO until return to normal business. Method of contact for other communication: email, phone call	**Osage Nation** Secondary: Jess Hendrix Deputy THPO Osage Nation 627 Grandview Avenue Pawhuska, OK 74056 918-287-5427 Jess.Hendrix@osagenation-nsn.gov Method of contact for project notification and documentation: postal mail/courier Method of contact for other communication: email, phone call
Otoe-Missouria Tribe of Oklahoma Primary: Elsie Whitehorn, THPO 8151 Hwy 177 Red Rock, OK 74056 (580) 723-4466 x202 ewhitehorn@omtribe.org Method of contact for project notification and documentation: email to Primary contact. Method of contact for other communication: email, phone call	**Otoe-Missouria Tribe of Oklahoma** Secondary: John R. Shotton, Chairman 8151 Hwy 177 Red Rock, OK 74651 (580) 723-4466 x107 jshotton@omtribe.org
Peoria Tribe of Indians of Oklahoma Primary: Logan Pappenfort, THPO and Second Chief Peoria Tribe of Indians of Oklahoma 118 S. Eight Tribes Trail Miami, Ok 74354 (918) 540-2535 x33 lpappenfort@peoriatribe.com Method of contact for project notification and documentation: email to Primary contact. Method of contact for other communication: email, phone call	**Peoria Tribe of Indians of Oklahoma** Secondary: Craig Harper, Chief 118 S. Eight Tribes Trail Miami, Ok 74354 (918) 540-2535 chiefharper@peoriatribe.com

Poarch Band of Creek Indians Primary: Larry Haikey, THPO 5811 Jack Springs Road Atmore, AL 36502 (251) 368-9136 x2072 lhaikey@pci-nsn.gov Method of contact for project notification and documentation: email to Primary contact. Method of contact for other communication: email, phone call	**Poarch Band of Creek Indians** Secondary: Stephanie A. Bryan, Tribal Chair and CEO 5811 Jack Springs Road Atmore, AL 36502 (251) 368-9136 x2202
Ponca Tribe of Oklahoma Primary: Staci Hesler, THPO 121 White Eagle Drive Ponca City, OK 74601 (580) 763-0120 staci.hesler@ponca.com Method of contact for project notification and documentation: email to Primary contact. Method of contact for other communication: email, phone call	**Ponca Tribe of Oklahoma** Secondary: Douglas Rhodd, Chairman 20 White Eagle Drive Ponca City, Ok 74601 (580) 763-0120
Quapaw Nation Primary: Everett Bandy, Historic Preservation Officer Quapaw Nation Historic Preservation Program PO Box 765 Quapaw, O.K. 74363-0765 Telephone: (918) 238-3100 ebandy@quapawnation.com Routine: Section email. Section106@quapawnation.com / specific responses directed to THPO. Method of contact for project notification and documentation: hard copy letter directly to THPO (post-pandemic) and email to Primary contact. In the meantime, continue email. Method of contact for other communication: email, phone call	**Quapaw Nation** Secondary: Joseph Byrd, Quapaw Nation Chairman PO Box 765 Quapaw, O.K. 74363-0765 joseph.byrd@quapawnation.com Follow guidance in letter. CC to Chairman

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Sac and Fox Nation of Missouri in Kansas and Nebraska Primary: Historic Preservation Office Sac and Fox Nation of Missouri in Kansas and Nebraska 920883 S. Hwy 99 Bldg A Stroud, OK 74079 Method of contact for project notification and documentation: address to Primary contact and email to Secondary Contact. Method of contact for other communication: email, phone call	**Sac and Fox Nation of Missouri in Kansas and Nebraska** Secondary: Tiauna Carnes, Chair 305 N. Main Street Reserve, KS 66434 tiauna.carnes@sacandfoxks.com
Sac and Fox Nation of Oklahoma Primary: Mr. Jeremy Fincher , EPA Director 305 N. Main Street Reserve, KS 66434 (918) 968-3526 jfincher@sacandfoxnation-nsn.gov Method of contact for project notification and documentation: email to Primary contact. Method of contact for other communication: email, phone call	**Sac and Fox Nation of Oklahoma** Secondary: Kay Rhoads, Principal Chief Sac and Fox Nation Administration Building 920883 S. Hwy 99 Bldg A Stroud, Ok 74079 (918) 968-9526
Seminole Nation of Oklahoma Primary: Mr. Theodore Isham THPO Seminole Nation of Oklahoma P.O. Box 1498 Wewoka, OK 74884 Telephone: (405) 257-7200 isham.t@sno-nsn.gov Method of contact for project notification and documentation: email to Primary Contact. Method of contact for other communication: email, phone call	**Seminole Nation of Oklahoma** Secondary: Principal Chief Greg Chilcoat Seminole Nation of Oklahoma P.O. Box 1498 Wewoka. OK 74884 Telephone: (405) 257-7200 principalChief@seminolenation.com

Seminole Tribe of Florida Primary: Paul Backhouse, Ph.D., THPO Seminole Tribe of Florida Ah-Ta-Thi-Ki Museum 30290 Josie Billie Hwy, PMB 1004 Clewiston, FL 33440 (863) 983-6549 x12244 THPOCompliance@semtribe.com; paulbackhouse@semtribe.com Method of contact for project notification and documentation: email to THPOCompliance@semtribe.com and copy to Primary Contact. Method of contact for other communication: email, phone call	**Seminole Tribe of Florida** Secondary: Marcellus W. Osceola, Chairman Seminole Tribe of Florida 6300 Sterling Road Hollywood, FL 33024 (954) 966-6300 trishanastrom@semtribe.com
Shawnee Tribe Primary: Ms. Tonya Tipton, THPO PO Box 189 Miami, OK 74355 shawneetribe@shawnee-tribe.com Method of contact for project notification and documentation: email to Primary contact. Method of contact for other communication: email, phone call	**Shawnee Tribe** Secondary: Ron Sparkman, Chief 29 S Hwy 69A Miami OK 74355 rondede1@gmail.com
Thlopthlocco Tribal Town Primary: Terry Clouthier, THPO PO Box 188 Okemah, OK 74859 (918) 560-6113 thpo@tttown.org Method of contact for project notification and documentation: email to Primary contact. Method of contact for other communication: email, phone call	**Thlopthlocco Tribal Town** Secondary: Ryan Morrow, Town King PO Box 188 Okemah, OK 74859 (918) 560-6198

Tunica-Biloxi Tribe of Louisiana Primary: Mr. Earl J. Barbry, Jr., THPO Tunica-Biloxi Tribal Historic Preservation Office P.O. Box 1589 Marksville, LA 71351 Telephone: (318) 253-8174 x 6451 earlii@tunica.org Method of contact for project notification and documentation: email to Primary Contact. Method of contact for other communication: email, phone call	**Tunica-Biloxi Tribe of Louisiana** Secondary: Vice-Chairman Marshall Pierite Tunica-Biloxi Tribe of Louisiana 151 Melancon Drive Marksville, LA 71351 Telephone: (318) 253-1946 joeypbarbry@tunica.org
United Keetoowah Band of Cherokee Indians in Oklahoma Primary: Ms. Whitney Warrior, Environmental Services & Historic Preservation Director PO Box 746 Tahlequah, OK 74464 wwarrior@ukb-nsn.gov kpritchett@ukb-nsn.gov Phone: (918) 871-2800 x2838 Method of contact for project notification and documentation: email to Primary contact. Method of contact for other communication: email, phone call	**United Keetoowah Band of Cherokee Indians in Oklahoma** Secondary Chief Joe Bunch PO Box 746 Tahlequah, OK 74464 (918) 871-2800

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SHPOS & Other Non-Federal Organizations	
Advisory Council on Historic Preservation Primary: Christopher Daniel, Program Analyst Advisory Council on Historic Preservation 401 F Street NW, Suite 308 Washington DC 20001-2637 (202) 517-0223 e106@achp.gov; cdaniel@achp.gov Method of contact for project notification and documentation: email to e106@achp.gov and copy to Primary contact email. Method of contact for other communication: email, phone call	**Advisory Council on Historic Preservation** Secondary: Aimee Jorjani, Chairman Tom McCulloch, Assistant Director Office of Federal Agency Programs Advisory Council on Historic Preservation 401 F. Street NW, Suite 308 Washington, DC 20001-2637 (202) 517-02280222 achp@achp.gov tmcculloch@achp.gov Method of contact for project notification and documentation: email to e106@achp.gov and copy to Primary contact email. Method of contact for other communication: email, phone call
Arkansas Historic Preservation Program Primary: Eric Mills 1100 North Street Little Rock, AR 72201 (501) 324-9784 Email Consultation to be directed to 106 Mail Box. Method of contact for project notification and documentation: email at **Section106@arkansas.gov** Archaeological Site Forms: Submit to Registrar's Office Arkansas Archeological Survey 2475 N Hatch Ave Fayetteville, AR 72704 479-575-6552 Reports: Email to S106 Inbox. Method of contact for other communication: email, phone call	**Arkansas Historic Preservation Program** Secondary Scott Kaufman Deputy SHPO 1100 North Street Little Rock, AR 72201 (501) 324-9785 scot.kaufman@arkansas.gov

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Illinois Historic Preservation Agency Primary: Robert Appleman, Deputy SHPO 1 Old State Capitol Plaza Springfield, IL 62701 shpo.review@illinois.gov Method of contact for project notification and documentation: email at shpo.review@illinois.gov cc as necessary. Archaeological Site Forms: Submit to via email: archaeology.sitefiles@illinoisstatemuseum.org Reports: 2 Hard copies and 1 PDF on CD Method of contact for other communication: email, phone call	**Illinois Historic Preservation Agency** Secondary: Jeff Kruchten Chief Archaeologist Illinois State Historic Preservation Office Attn: Review and Compliance 1 Old State Capitol Plaza Springfield, Illinois 62701 (217) 785-1279 Jeffery.Kruchten@illinois.gov
Kentucky Heritage Council Primary: Christopher M. Gunn, Ph.D. Archaeology Review Coordinator The Barstow House 410 High Street Frankfort, KY 40601 Telephone: (502) 892-3615 chris.gunn@ky.gov Method of contact for project notification and documentation: Mail to Primary address, with KHC Coversheet; email to Secondary Contact for visibility. Archaeological Site Forms: Submit via email to Secondary Contact. Reports: PDF and hardcopy mailed to Primary Contact. Method of contact for other communication: email, phone call	**Kentucky Heritage Council** Secondary: Jennifer Ryall Environmental Review Coordinator The Barstow House 410 High Street Frankfort, KY 40601 (502) 892-3619 jennifer.ryall@ky.gov

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Louisiana State Historic Preservation Officer Primary: Chip McGimsey State Archaeologist Division of Archaeology PO Box 44247 Baton Rouge, LA 70804-4241 (225) 219-4598 cmcgimsey@crt.la.gov Method of contact for project notification and documentation: email at section106@crt.la.gov Archaeological Site Forms: Submit to LA Division of Archaeology via email to siteforms@crt.la.gov. Reports: Hard copy and PDF on CD Method of contact for other communication: email, phone call	**Louisiana State Historic Preservation Officer** Secondary: Rachel Watson Division of Archaeology PO Box 44247 Baton Rouge, LA 70804-4241 (225) 342-8165 rwatson@crt.la.gov Method of contact for project notification and documentation: section106@crt.la.gov Archaeological Site Forms: Submit to LA Division of Archaeology via email to siteforms@crt.la.gov. Reports: Hard copy and PDF on CD Method of contact for other communication: email, phone call
Mississippi Department of Archives and History Primary: Hal Bell State Historic Preservation Office Mississippi Department of Archives and History Historic Preservation Division P.O. 571 Jackson, Mississippi 39205-0571 Telephone: Office (601) 576-6957 hbell@mdah.ms.gov Method of contact for project notification and documentation: email at section106@mdah.ms.gov with a copy to the Primary and Secondary contact. Archaeological Site Forms: Submit to via email Reports: Hard copy and PDF on CD Method of contact for other communication: email, phone call	**Mississippi Department of Archives and History** Secondary: Cindy Carter-Davis, Chief Archaeologist PO Box 571 Jackson, MS 39205-0571 Telephone(office): 601-576-6945 Telephone (cell): 601-307-0133 E-mail: ccarterdavis@mdah.ms.gov

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MO State Historic Preservation Office Primary: Dr. Toni M. Prawl, Director Section 106 Review PO Box 176 Jefferson City, MO 65102-0176 Method of contact for project notification and documentation: hardcopy mail to address of primary contact. During Pandemic (tempE106@dnr.mo.gov) Archaeological Site Forms: Submit to via email amy.rubingh@dnr.mo.gov Public Notice – MOSection106@dnr.mo.gov Reports: 1 Hard copy and PDF on CD Method of contact for other communication: email, phone call	**MO State Historic Preservation Office** Secondary: Amy Rubingh Section 106 Review PO Box 176 Jefferson City, MO 65102-0176
Tennessee SHPO Primary: Casey Lee Historic Preservation Specialist, Section 106 Tennessee Historical Commission State Historic Preservation Office 2941 Lebanon Pike Nashville, TN 37214 (615) 253-3163 Email: Casey.Lee@tn.gov Method of contact for project notification and documentation: email and hard copy Archaeological Site Forms: Submit to TN Division of Archaeology via email Reports: Hard copy and PDF on CD Method of contact for other communication: email, phone call	**Tennessee SHPO** Secondary: Jennifer Barnett Archaeologist Supervisor Tennessee Division of Archaeology 1216 Foster Avenue Cole Building #3 Nashville, TN 37243 (615) 687-4780 Email: Jennifer.Barnett@tn.gov Method of contact for project notification and documentation: email and hard copy Archaeological Site Forms: Submit to TN Division of Archaeology via email Reports: Hard copy and PDF on CD Method of contact for other communication: email, phone call

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U.S. Army Corps of Engineers (USACE) Districts	
Memphis District (CEMVM) Primary: Pam Lieb, Archeologist and District Tribal Liaison 167 N. Main, B-202 Clifford Davis/Odell Horton Federal Building Memphis, TN 38103-1894 (901) 544-0710 Pamela.Lieb@usace.army.mil	**Memphis District (CEMVM)** Secondary: Edward P. Lambert Chief, Environmental Compliance Branch Regional Planning and Environmental Division South, USACE 167 N. Main St., Room B-202, Memphis, TN 38103-1894 Telephone: Office (901)544-0707 Mobile (901) 634-2461 E-mail: Edward.P.Lambert@usace.army.mil
New Orleans District (CEMVN) Primary Jason A. Emery, Cultural Resources RTS and District Tribal Liaison CEMVN-PDS-N 4700 Leake Ave. New Orleans, LA 70118 (504) 862-2364 Jason.a.emery@usace.army.mil Method of contact for project notification and documentation: email or receipt of hard copy Method of contact for other communication: email, phone call	**New Orleans District (CEMVN)** Secondary: Edward P. Lambert Chief, Environmental Compliance Branch Regional Planning and Environmental Division South, USACE 167 N. Main St., Room B-202, Memphis, TN 38103-1894 Telephone: Office (901)544-0707 Mobile (901) 634-2461 E-mail: Edward.P.Lambert@usace.army.mil
USACE Vicksburg District (CEMVK) Primary Tribal: Kristen Camp, District Tribal Liaison CEMVK-PP-D 4155 East Clay Street Vicksburg, MS 39183 (601) 631-7934 Kristen.F.Camp@usace.army.mil Primary Cultural: Ashley Fedoroff, Archeologist CEMVN-PDS-N 4155 East Clay Street Vicksburg, MS 39183 (601) 631-5278 ashley.m.fedoroff@usace.army.mil	**USACE Vicksburg District (CEMVK)** Secondary: Edward P. Lambert Chief, Environmental Compliance Branch Regional Planning and Environmental Division South, USACE 167 N. Main St., Room B-202, Memphis, TN 38103-1894 Telephone: Office (901)544-0707 Mobile (901) 634-2461 E-mail: Edward.P.Lambert@usace.army.mil

Appendix C: (Reserved)

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Appendix D: Programmatic Allowances

Introduction

USACE has determined in consultation with the other Consulting Parties, that the Programmatic Allowances (Allowances) enumerated below will have either no effect or a minimal effect only, on historic properties, if implemented as specified in this Appendix. It is agreed by the Consulting Parties that the activities specified in the Allowances will not require review by the SHPO of jurisdiction or Federally-recognized Tribe(s). Should a post-review discovery, or discovery of human remains occur, work must stop and compliance with Stipulations X and XI is required.

The activities identified in Appendix A and those anticipated as part of any co-location project can be divided into two (2) categories, and sub-divided into seven (7) project types.

Category 1: Work Items to address ***seepage deficiencies*** include construction of four (4) project types:

1. Seepage Berms, are berms placed on the protected side of the levee to increase the weight of the soil and decrease its permeability thereby forcing seepage away from the toe of the levee. This technique requires the use of suitable borrow material from a close source.
2. Relief Wells, are relatively small wells placed near the toe of the protected side of the levee to capture the seeping water and pump/redirect it. This strategy uses existing drainage ditches as much as possible, but could require excavation of collector ditches, re-ditching, and/or hardening of ditches (e.g. rip-rap) to provide proper erosion control to account for the volume of captured water from the wells.
3. Slurry Trenches, are trenches excavated to a determined depth to stop levee under-seepage on the river side of the existing levee and filled with impervious materials or sheet piling. This activity typically requires temporary access roads, clearing and grubbing of the work area, deep excavation and stockpiling of materials.
4. Sheet Pile Cut-offs, involve the installation of a sheet pile cut-off wall within the existing levee section. This typically requires the construction of temporary access roads, clearing and grubbing of the levee, degrading of the levee to a certain elevation, installation of sheet pile, and reconstruction of the authorized levee profile.

Category 2: Work Items to address ***levee deficiencies*** include construction of three (3) project Types:

1. Floodwall Replacement, typically occurs in urban areas where there is little space to expand the footprint of a flood protection feature. This type of undertaking involves driving additional piles and tying those into the existing structure to ensure increased resistance to water loads, or the removal of the existing wall to place new floodwalls to meet the current design elevation, referred to as the authorized grade. While these undertakings typically have a smaller footprint than other activities to address grade deficiencies, they occur in areas with dense urban archaeological deposits and are more likely to affect NRHP-eligible or listed districts including National Historic Landmark Districts.
2. Levee Enlargement, involves raising the elevation of the top of the levee to its proper grade through the placement of suitable material. This technique requires clearing and grubbing, the use of suitable borrow material from close sources, and, typically, additional land side/protected site right-of-way to account for the additional widening or shifting of the centerline of the levee.
3. Slope Flattening, this activity goes beyond ordinary maintenance with the objective of reducing the slope of the levee by increasing the ratio of height to width of the levee profile along reaches of the levee with recurrent levee slides (e.g. moving from a 1:3 to a 1:5 ratio). This action typically requires clearing and grubbing, re-working of the damaged levee section, and, like the Levee Enlargement, the addition of suitable borrow material from a close source, as well as increasing the right-of-way.

Allowances by Activity

Allowances *can only be used by staff meeting the applicable SOI Professional Qualifications Standards in accordance with Stipulation VI. of this Agreement.* In accordance with Stipulation VII.A, Undertakings composed entirely of work described by the Allowances do not require further Section 106 review.

I. **ADMINISTRATIVE ACTIONS:** USACE has determined that the following types of activities have limited or no potential to affect historic properties.

A. Monitoring, existing data gathering, or non-ground disturbing data gathering, and reporting in support of project design, internal QA/QC reviews such as, District Quality Control (DQC), Agency Technical Review (ATR), and the like.

B. Permissions for planning, studies, design and engineering costs that involve no commitment of resources other than staffing and associated funding.

C. Funding the administrative action of acquisition or lease of existing facilities where planned uses conform to past use.

II. **GROUND DISTURBING ACTIVITIES AND SITE WORK.** Project review should take into account the entirety of the proposed activities including staging, site access, site cleanup, and possible site work (e.g. grading for positive drainage, vegetation removal), and excavation of borrow material as potential ground-disturbing activities.

A. General. If a cultural resources survey to the current guidelines has been completed, consultation and concurrence with the SHPO of jurisdiction and the Federally-recognized Tribe(s) has occurred (in the past 15 years or meets current state standards), the Civil Works feature is less than 50-years old, and no known eligible or unassessed historic properties are within the area of project activities, then the following activities can be proceed without further consultation. Otherwise standard Project Review per Stipulation VII.C., will apply.

1. Relief Well construction.
2. Seepage Berms
3. Sheet Pile Cut-offs
4. Slurry Trenches
5. Flood Wall Replacement
6. Levee Enlargements
7. Slope Flattening
8. Excavation of Borrow Material
    a. In addition to the specifics above, USACE will inspect the borrow site to ensure that the borrow material is not a mound or other cultural resource.
    b. Alternative means of certifying a borrow area are: If it was included in a previous cultural resources review as part of a state certification; or present on Borrow Listing as maintained by the state of jurisdiction; or is in certified and in active use

B. Haul Roads. This assumes NO timber clearing or other grubbing for new routes.

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1. Re-establishment, armoring, and/or minor upgrading of existing roadway ditches.

2. In-kind repair or in-kind replacement of traffic control devices such as traffic signs or signals.

3. Installation and removal of temporary traffic control devices, (e.g., pre-formed concrete barriers and fencings).

4. In-kind repair or in-kind replacement of roadway safety elements such as barriers, guardrails, and impact-attenuation devices. In the case of guardrails, the addition of safety end treatments is permitted.

5. Enhancement of existing utilized roadway corridors, with gravel and other road surfaces.

6. Transportation of borrow Material to Work Items via existing or enhanced roadways.

III. STANDING STRUCTURES.

A. Demolition activities related to the removal of buildings or structures less than forty-five (45)-years of age (construction date as noted in the project documentation, or by the NFS, or by a photograph/site visit) so long as the demolition activity is substantially limited to the existing footprint and vertical disturbance and the buildings or structures are not located within or adjacent to a National Register-listed or eligible historic district or within five hundred (500) feet of a known eligible or unassessed archaeological site or cemetery. Project review should take into account the entirety of the proposed activities including staging, site access, site cleanup, and possible site work (e.g. grading for positive drainage, vegetation removal), and excavation of borrow material as potential project activities, additionally documentation of an existing cultural resources survey to the current guidelines and subsequent consultation and concurrence with the SHPO of jurisdiction and the Federally-recognized Tribe(s) (in the past 15 years or meeting current state standards), otherwise standard Project Review per Stipulation VII.C., will apply.

Appendix E: Treatment Measures

As provided in Stipulation VII C. 7, if an Undertaking may adversely affect a historic property, USACE may propose to resolve the adverse effect through the application of one or more of the Treatment Measures set out below. The selected measures will be developed by USACE after discussions with the SHPO of jurisdiction, appropriate Federally-recognized Tribe(s), and other Consulting Parties, as appropriate, and will be documented in writing (in a Treatment Plan). USACE will provide the SHPO of jurisdiction, appropriate Federally-recognized Tribe(s), and other Consulting Parties, as appropriate, with the opportunity to concur on the proposed Treatment Measures as set out in VII.C.7.A.3.

The Treatment Plan shall identify, at a minimum and as appropriate: the responsible party/entity that will implement and complete each treatment measure; the scope of work and the standards that will apply to the preparation and distribution of a deliverable; the deliverable(s) (e.g. the quantity, approximate size, materials, content, final ownership/copyrights); measures to ensure that any treatment measure documenting the condition of or requiring the data recovery on the historic property is implemented before the property is adversely affected; any professional qualifications that will be required to prepare deliverable(s) described in the Treatment Measure(s); the repositories and/or parties that will receive copies of a deliverable and the disposition of any deliverable that is not curated; points when USACE, NFS, agent or contractor, SHPO/THPO, and/or Federally-recognized Tribes, and other Consulting Parties, as appropriate, will be given the opportunity to review and comment on the deliverable; and timeframes for each review and deliverable.

USACE will provide written notice to the SHPO of jurisdiction, appropriate Federally-recognized Tribe(s), and other Consulting Parties, as appropriate, within sixty (60) days of the completion of the Treatment Measures as required by Stipulation VII. C.7. USACE shall include information pertaining to the progress of and completion of all Treatment Measures in the annual report pursuant to Stipulation III. A. 16. USACE Roles and Responsibilities.

Any dispute regarding the implementation of a Treatment Plan will be resolved following the process set out in Stipulation XII, Dispute Resolution.

This Appendix may be amended in accordance with the process set out in Stipulation XIV B. of this Agreement for amending appendices.

Reminder should there be human remains associated with/anticipated during implementation of a Treatment Plan, review Stipulation X Treatment of Human Remains to ensure accepted protocols are followed.

If USACE, in consultation with the SHPO of jurisdiction, Federally-recognized Tribes, and other Consulting Parties, determines that a treatment measure, including Alternative Mitigation*, *not included* in the list below is in the public interest and is the most appropriate means to resolve an adverse effect, USACE will initiate consultation to develop an MOA or a Programmatic Agreement as set out in Stipulation VII.C.7 (b) or (c).

*Alternate Mitigation means something alternative to either the location or the action that is agreed to be a meaningful offsetting of the adverse effects. Easy examples are for survey of lands unaffected by the project in exchange for no mitigation/data recovery for the specified archaeological site. Agencies have a difficult time justifying the funding for these actions, unless it can clearly be demonstrated to be in the public interest.

List of Treatment Measures:

1. **PHOTOGRAPHIC RECORDATION:** USACE, in consultation with the SHPO of jurisdiction, and/or, Federally-recognized Tribe(s), and other Consulting Parties, will select the photographic medium or mediums from the options described below and identify a list of photographs that will serve to document the historic property that will be adversely affected by an Undertaking. The photographic specifications set out below were previously determined by USACE, in consultation with the appropriate SHPO, to meet archival standards and are provided for guidance. Photographic images may include existing drawings and plans. If the parties determine that it is in the public interest to document a property through the preparation of measured drawings, USACE will initiate consultation to develop an MOA.

A. **Recordation for Standing Structures (Flexible Standards):** The responsible entity will **ensure that a trained professional** photographs the exterior and/or interior, if it is accessible, in the selected photographic format(s) with an emphasis on documenting those portions of the exterior and/or interior that will be altered. The trained professional will take photographs of the views identified by USACE, in consultation with the NFS, agent or contractor, SHPO of Jurisdiction, and/or Federally-recognized Tribe(s), and other Consulting Parties, as appropriate, and will print specifically identified images

1. Digital Photography: The digital photography and color photographs must comply with the “Best” category of requirements from the National Register Photo Policy Fact Sheet: http://www.nps.gov/nr/publications/bulletins/photopolicy/Photo_Policy_update_2013_05_15.pdf, with the following additional requirements:

   - Image files must be saved as both TIFF and JPEG files.
   - Color images must be produced in RGB (Red/Green/Blue) color mode as 24-bit or 48-bit color files.
   - In addition to the requirements specified by the latest National Register Photo Policy, photographs will be digitally labeled to state the address (name of facility, street number, street name, city, and state); date of photograph; description of view, including direction of camera; and name of photographer/agency.

2. 35mm Black/White and Color Photography: Photographs must be taken with a 35MM SLR Camera or a 35 MM point-and-shoot camera using 35 MM black/white or color film. Photographs taken with disposable cameras are not acceptable.

   - The 35 mm film black/white or color film photography package will include one (1) full set of 35mm film black/white or color photographs printed on acid free paper specifically designed for color prints, the corresponding 35mm film negatives in acid free sleeves.
   - Photographs will be labeled in pencil on the back to state the address, name of facility, street number, street name, city, and state; date of photograph; description of view, including direction of camera; and name of photographer/agency.

3. Large Format Photography: Photographs must be taken with a large-format view camera with ample movement for perspective correction. The minimal complement of lenses includes a sharp rectilinear wide angle, a normal, and a mildly telephoto lens.
   - Acceptable film formats are 4x5, 5x7, and 8x10. Acceptable polyester-based films include those of medium and slow speed (100 and 400 ASA) produced by Kodak, Ilford, and others.
   - The large format film photography package will include one (1) full set of 4 x 5 or 5 x 7-inch photographs printed on acid free paper, the corresponding 4 x 5 or 5 x 7-inch negatives in acid free sleeves.

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- Photographs will be labeled in pencil on the back to state the address name of facility, street number, street name, city, and state; date of photograph; description of view, including direction of camera; and name of photographer/agency.

4. Video: A video documentary regarding the historic property may include on-camera interviews, archival footage and/or images, current footage of the historic property, and current footage of other similar historic properties. The content and length of the video will be described in the treatment measure.

5. Narrative History: A narrative history may be prepared to provide a context for the photographs following the Historic American Building Survey (HABS) Historical Reports: Short or Outline format.

6. Recordation Package: The recordation package will include a photo log, printed copies of selected photographs, digital copies of photographs, and may include a narrative history. The recordation package may include reproductions of historic photographs, existing building plans, contemporary sketch plans, and/or maps. All materials will be packaged in archival sleeves and boxes. Archival disks will be used for all digital materials.

7. Review: The responsible entity may informally consult with USACE and SHPO, and/or Tribe(s) to select photographs and other images that will be included in the recordation materials. The process to review and finalize the photographs and other images will be described in the treatment measure.

8. Distribution: The responsible entity will prepare a minimum of three archival quality copies of the recordation materials and will forward two copies to SHPO of jurisdiction and one copy to the U.S, Army Corps of Engineers, Office of History, Humpreys Engineer Center. In consultation with the NFS, SHPO of jurisdiction, and/or Federally-recognized Tribe(s), and other Consulting Parties, as appropriate, may identify additional archives and/or parties that will receive copies of the recordation materials. The responsible entity will provide USACE with documentation confirming that the recordation materials have been archived as described in the treatment measure.

B. **Recordation for Standing Structures (Established Standards):** The treatment plan will document the proposed Level and Standard that will be most appropriate to capturing the significance of the historic property prior to alteration and define the responsible entity. Choices will be made between the **Historic American Building Standards (HABS), the Historic American Engineering Standards (HAER); or the Historic American Landscape Standards (HALS) at Level III, Level II or Level I**. During the development of the Treatment Plan USACE will coordinate with the NPS, SHPO of jurisdiction and appropriate Federally-recognized Tribe(s), as necessary to make the selection. For any project requiring recordation to any of these standards, USACE will ensure that a trained professional photographs the exterior and/or interior, if it is accessible, in the selected standard with an emphasis on documenting those portions of the historic property that will be altered or demolished. The trained professional will take photographs of the views identified by USACE, in consultation with the NFS, SHPO of jurisdiction, and/or the appropriate Federally-recognized Tribe(s), and other Consulting Parties, as appropriate, and will print specifically identified images and produce the required historical narrative:

2. Public Interpretation

USACE, and/or the NFS shall consult with the SHPO of jurisdiction, appropriate Federally-recognized Tribe(s), and other consulting parties, as appropriate, to design an educational or public interpretive plan. The educational or public interpretive plan may include historical markers, signs, displays, educational pamphlets, websites, workshops, videos, and other similar mechanisms to educate the public on historic properties within the local community, state, or region. In certain instances the SHPO of jurisdiction may request that the proposed historical marker conform to the requirements of the state in question, and request that the NFS apply to state programs to provide for a uniform interpretive program.

3. **Historical Context Statements**
   USACE, and/or the NFS shall consult with the SHPO of jurisdiction, appropriate Federally-recognized Tribe(s), and other Consulting Parties, as appropriate to identify the topic; audience; framework of a historic context statement; and format for the final deliverable. The context statement may focus on an individual property, a historic district, a set of related properties, or relevant themes as identified in the specific statewide preservation plan or the National Park Service's National Historic Landmark Thematic Framework.

4. **Oral History Documentation**
   USACE, and/or the NFS shall consult with the SHPO of jurisdiction, appropriate Federally-recognized Tribe(s), and other Consulting Parties, as appropriate, to identify the list of potential interview candidates; the parameters of the oral history project; qualifications of the individual or individuals conducting the oral interviews; the process for any ongoing coordination with the appropriate SHPO and relevant Tribe(s); and format for the final deliverable.

5. **Historic Property Inventory**
   USACE, and/or the NFS shall consult with the SHPO of jurisdiction, appropriate Federally-recognized Tribe(s), and other Consulting Parties, as appropriate, to establish the appropriate level of effort to accomplish an inventory/re-inventory. Efforts may be directed toward the resurvey of previously designated historic properties, per 36 CFR 800.16(l), which have undergone change or lack sufficient documentation, or the survey of new historic properties and/or districts that lack formal designation. The proposed treatment measure will describe the boundaries of the survey area and the data collection method in keeping with the SHPO of jurisdiction's guidance for surveys and define the survey objective.

6. **National Register and National Historic Landmark Nominations**
   USACE, and/or the NFS shall consult with the SHPO of jurisdiction, appropriate Federally-recognized Tribe(s), and other Consulting Parties, as appropriate , to identify the individual properties that would benefit from a completed National Register of Historic Places (NRHP) or National Historic Landmark (NHL) nomination form. Once the parties have agreed to a property, the responsible entity will continue to coordinate with USACE, the SHPO of jurisdiction, appropriate Federally-recognized Tribe(s), and other Consulting Parties, as appropriate, through the drafting of the NRHP nomination form or will contact the NHL Program to begin the nomination process. The SHPO of jurisdiction and/or Federally-recognized Tribe(s) will provide adequate guidance to the responsible entity during the preparation of the nomination form. The responsible entity will work with the SHPO of jurisdiction to ensure the completed NRHP form is presented to the particular state's National Register Review Committee in a timely manner for consideration by the State Historic Preservation Officer and the Keeper of the Register.

7. **Geo-References of Historical Maps and Aerial Photographs**
   USACE, and/or the NFS shall consult with the SHPO of jurisdiction, appropriate Federally-recognized Tribe(s), and other Consulting Parties, as appropriate, to identify the historical maps and/or aerial photographs for scanning and geo-referencing. Once a list of maps and/or aerial photographs have been agreed upon, the responsible entity will continue to coordinate with USACE, the appropriate SHPO, Tribe(s), and other Consulting Parties, , as appropriate, through the scanning and geo-referencing process and will submit drafts of paper maps and electronic files to USACE, the appropriate SHPO, Tribe(s), and other Consulting Parties, as appropriate, for review. The final deliverable produced by the responsible entity will include a 1) paper copy of each scanned image, 2) a geo-referenced copy of each scanned image, 3) original high-resolution digital image of map/aerial photograph in TIFF file format, 4) copies of the user agreements for every geo-

referenced image with transferability of use to all parties, 5) a process report outlining the research, and 6) the metadata relating to both the original creation of the paper maps and the digitization process.

8. **Archaeological Research Design and Data Recovery Plan**
USACE shall develop and implement a data recovery plan with a research design in consultation with the SHPO of jurisdiction, appropriate Federally-recognized tribe(s), and other Consulting Parties, as appropriate, to recover data from archaeological properties listed in, or eligible for listing in the NRHP, which will be adversely affected by ground-disturbing activities that are part of the Undertaking. The research design and data recovery plan will be consistent with the Secretary of the Interior's Guidelines for Archaeological Documentation (http://www.nps.gov/history/local-law/arch_stnds_7.htm) ACHP's recommendations on the recovery of significant information from archaeological sites. http://www.achp.gov/archguide.html. All work shall conform to the most current guidelines per the SHPO of jurisdiction and as augmented by Federally-recognized Tribal or other local guidelines, as provide in Stipulation VI. Standards, and, if applicable, Stipulation X. Treatment of Human Remains and Items of Religious and Cultural Importance.

9. **Marketing Plan for Demolition or Abandonment**
USACE and/or the NFS shall consult with the SHPO of jurisdiction, appropriate Federally-recognized tribe(s), and other Consulting Parties, as appropriate, to develop and implement a feasible marketing plan to advertise the availability of historic structures identified for demolition, abandonment, for sale and/or relocation. A good faith and reasonable marketing plan will include publicizing and advertising the property in newspapers, magazines, and/or websites of record for a specific period of time. The plan may require the purchaser to relocate the property outside of the Special Flood Hazard Area (100-year floodplain), and the plan will give preference to a purchaser who proposes to use a professional house mover that follows the recommendations in Moving Historic Buildings by John Obed Curtis (1975, reprinted 1991 by W. Patram for the International Association of Structural Movers) or other similar updated reference material. If a good faith and reasonable marketing effort does not result in the identification of a party or parties willing to purchase and, if necessary, relocate the property, the property may be demolished or abandoned. This marketing plan will be used in conjunction with Treatment Measure I, Recordation Package. USACE will ensure that the property is recorded prior to relocation or demolition.

10. **Salvage**
The NFS or contractor shall work with USACE, the SHPO of jurisdiction, and/or appropriate Federally-recognized Tribe(s), and other Consulting Parties, as appropriate, to identify selective architectural elements that may be salvaged from a building/structure slated for demolition. The elements will be removed at the agent or contractor's expense. The salvaged elements may be re-used in another structure or in displays for educational purposes. As an alternative, the agent or contractor, in consultation with USACE, NFS, SHPO, and/or Tribe(s), and other Consulting Parties will attempt to identify a private or public not-for-profit local or regional historic preservation organization interested in receiving a donation of the architectural features. The organization may sell the architectural features to the general public for the specific purpose of raising funds to support future historic preservation activities in the region. . Any income derived by the agent or contractor from the sale of architectural features may be considered project income by the program to be deducted from proceeds of the grant. Salvage activities shall not occur at or below grade in order to avoid affecting unevaluated archaeological resources.

11. **Assessment and Reduction of Vibratory Affects**
USACE and/or the NFS shall consult with the SHPO of jurisdiction, appropriate Federally-recognized tribe(s), and other Consulting Parties, as appropriate, to develop and implement a feasible vibratory reduction strategy. The plan will follow the best practices outlined in NCHRP 25-25, *Current Practices to Address Construction Vibration and Potential Effects to Historic Buildings Adjacent to Transportation Projects* (2012) or similar. Generalized steps are the following: 1)

E-5

consultation between historic building owner, Project Delivery Team and reviewing agencies such as SHPO and local planning departments to identify potential risks, negotiate changes and agreement on protective measures; 2) documentation of the condition of the building prior to commencement of adjacent work, including a detailed photo survey of existing damage as specified in the particular treatment plan; 3) establishment of vibration limits not to be exceeded based on condition of building, founding soil conditions, and type of construction vibration; 4) implementation of protective measures at both the construction site and the historic building, which could include specific means and methods to be used and those that will not be used and as specified in the BCOES; 5) implementation of regular monitoring during construction to identify damage, evaluate the efficacy of protective measures already in place and to identify and implement additional corrective steps. The results of any implemented plan will be shared with the Consulting Parties to the particular adverse effect and summarized in the annual plan.

7.2 PROGRAMMATIC AGREEMENT MEETING AGENDA

AGENDA
January 15, 2019, 1:00-5:00 pm CT
4th Section 106 Consultation Meeting for the Development of a Programmatic Agreement Regarding the Mississippi River and Tributaries Project (Mississippi River Levee Features) [1]
Memphis (MVM), Vicksburg (MVK), and New Orleans Districts (MVN)
Teleconference and Webmeeting

Teleconference: (877) 402-9757; Access Code 910 3542; Security Code 1234. If asked for participant number, hit #.

Webmeeting: https://usace.webex.com/meet/jason.a.emery Mtg #: 968 824 807

I. **Welcome and Introductions** (USACE)

II. **Review of Comments on Draft Programmatic Agreement (PA)** (All Parties)
   - A. Several Changes Made Globally
     1. Federally-recognized Tribes for Tribes.
     2. Added all states where appropriate, used language to define “SHPO with Jurisdiction” in other places.

III. **Discuss Comments For:**
   - A. Stip I – Applicability—revised.
   - B. Stip II - Points of Contact – revised.
   - C. Stip III – Roles and Responsibilities –revised.
   - D. Specifically – comments related to how to refer to various SHPOs/THPOs, Divisions, etc. with differing authorities related to maintenance of historic property data.
   - E. Data sharing/costs (all parties)
   - F. Stip IV – Confidentiality—revised.
   - G. Stip. V. Consultation Standards, Timeframes, and Correspondence.- comments
   - H. Stip. VI. Standards—revised.
   - I. Added Appendix A – Work Item List and Descriptions

IV. **Next Steps:**
   - A. State Burial Law References- Stipulation (To Be Developed)
     1. Summary of Laws and process – establishment of minimum standard.
     2. Separation in to Federal and State laws.

V. **Consultation Schedule** (USACE)
   - A. Moving to a 2-week cycle, with more limited per meeting objectives.
   - B. 4th Consultation Meeting: ½ day meeting via Teleconference January 15, 2020.
   - C. 5th Consultation Meeting: Teleconference on January 30, 2020.
   - D. 6th Consultation Meeting:
   - E. 7th Consultation Meeting: Review Final Draft PA and discuss signature process (initiate legal reviews)
   - F. Begin Signature Process (counterpart)

[1] This PA is intended to support USACE’s Supplement No. 2 (SEIS II) to the Final Environmental Impact Statement, Mississippi River and Tributaries (MR&T) Project, Mississippi River Mainline Levees and Channel Improvement of 1976 (1976 EIS) which will evaluate impacts on the quality of the human environment of constructing the remaining authorized work for the Mississippi River mainline levees (MRL) feature. Supplement No.1, Mississippi River and Tributaries Project, Mississippi River Mainline Levee Enlargement and Seepage Control was completed in 1998 (SEIS I).

7.3 MDAH COORDINATION LETTER

MISSISSIPPI DEPARTMENT *of* ARCHIVES AND HISTORY

MDAH

HISTORIC PRESERVATION DIVISION
P. O. BOX 571
Jackson, MS 39205-0571
Phone 601-576-6940 Fax 601-576-6955
Website: mdah.ms.gov

December 14, 2020

Mr. John Thron
U.S. Army Corps of Engineers, Vicksburg District
4155 Clay Street
Vicksburg, MS 39183-3435

RE: The Final Supplement II (Final SEIS II) to the 1976 Environmental Impact Statement (FEIS), Mississippi River and Tributaries (MR&T) Project, Mississippi River Mainline Levees (MRL) (MDAH Project Log 11-065-20)

Dear Mr. Thron:

We have reviewed the Final Supplement II (SEIS) for the above referenced project, in accordance with our responsibilities under Section 106 of the National Historic Preservation Act and 36 CFR Part 800. After review of the information provided, MDAH concurs that the proposed undertaking will have an impact on historic resources. MDAH has been a participant in the negotiations for the *Programmatic Agreement Among the U.S. Army Corps of Engineers (USACE), Memphis, New Orleans, and Vicksburg Districts, the Chickasaw Nation; the Choctaw Nation of Oklahoma; the Osage Nation; the Quapaw Nation; the Arkansas State Historic Preservation Officer; the Illinois State Historic Preservation Officer; the Kentucky State Historic Preservation Officer; the Louisiana State Historic Preservation Officer; the Mississippi State Historic Preservation Officer; the Missouri State Historic Preservation Officer; the Tennessee State Historic Preservation Officer; and the Advisory Council on Historic Preservation Regarding the Mississippi River and Tributaries Project: Mississippi River Levee Features.* MDAH anticipates signing the agreement once the execution document is sent out for signature. Thus, MDAH has no further comment at this time.

If there are any changes to the scope of work, or should unexpected cultural materials be encountered during the project, MDAH requests that our office be notified so that we can provide comment in accordance with 36 CFR 800.13.

If you have any questions, please contact us at (601) 576-6945.

Sincerely,

Barry White

Barry White
Deputy State Historic Preservation Officer

FOR: Katie Blount
State Historic Preservation Officer

7.4 DRAFT REPORT TRIBAL/SHPO REVIEW LETTERS

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
7400 LEAKE AVENUE
NEW ORLEANS, LOUISIANA 70118

REPLY TO
ATTENTION OF

December 9, 2019

Regional Planning and
Environment Division South

Cecilia Flores, Tribal Council Chairperson
Alabama-Coushatta Tribe of Texas
571 State Park Rd 56
Livingston, TX 77351

The U.S. Army Corps of Engineers, New Orleans District, has prepared a draft report entitled "Lake Pontchartrain and Vicinity General Re-Evaluation Report with Integrated Draft Environmental Impact Statement (LPV GRR-DEIS)." This GRR-DEIS reevaluates the performance of the LPV system given the combined effects of consolidation, settlement, subsidence, sea level rise, and new datum over time, and determine if additional actions are recommended to address the economic and life safety risks associated with flooding due to hurricanes and coastal storms.

The draft report and appendices are available online for your review and comment at the below website:

https://www.mvn.usace.army.mil/About/Projects/BBA-2018/studies/LPV-GRR/

The USACE is initiating consultation for Section 106 of the National Historic Preservation Act (NHPA), with the State Historic Preservation Officer (SHPO) and with Federally-recognized Tribes with this letter for the referenced project. No determination of effect under the NHPA is being made at this time. Consultation will follow the standard Section 106 process.

NHPA consultation will address the Area of Potential Effects for portions of the project that are outside of the undertakings previously reviewed under Individual Environmental Reviews (IER) and Comprehensive Environmental Documents available at (https://www.mvn.usace.army.mil/Missions/Environmental/NEPA-Compliance-Documents/HSDRRS-Projects/). The LPV study includes the actions described in IERs #1, #2, #3, #4, #5, #6, #7, #8, #9, #10, #11, and #27. The Section 106 consultation will provide the results of any Phase I Cultural Resources Survey (if necessary), and USACE's determination of effect to historic properties. This will provide an opportunity to for consulting parties to review NHPA specific documentation, per 36 CFR 800.11. The determination of effect and any conditions will be documented in the Final Record of Decision (ROD) before it is signed.

For purposes of understanding the undertaking, please review the documents at the link above. Should your tribe or agency want to provide comments upon the NEPA document, please provide comments by February 7, 2020. All comments postmarked on or before the expiration of the comment period will be considered and addressed as appropriate in the final report. A public open house will be held the week of January 20th and details will be posted on the New Orleans District website: https://www.mvn.usace.army.mil/Media/Public-Meetings/

Comments should be mailed to the attention of Mr. Bradley Drouant; U.S. Army Corps of Engineers; New District; CEMVN-PMO-L; Room 361; 7400 Leake Avenue, New Orleans, Louisiana 70118. Comments may also be provided by email to CEMVN-LPVGRR@usace.army.mil. Mr. Drouant may be contacted at (504) 862-1516 if questions arise.

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Date: 2019.12.05 15:56:24 -06'00'

Marshall K. Harper
Chief, Environmental Planning Branch

CC: An electronic copy of this letter with enclosures will be provided to Mr. Bryant J. Celestine, Historic Preservation Officer, Alabama Coushatta Tribe of Texas, celestine.bryant@actribe.org.

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
7400 LEAKE AVENUE
NEW ORLEANS, LOUISIANA 70118

REPLY TO
ATTENTION OF

December 9, 2019

Regional Planning and
Environment Division South

Tamara Francis-Fourkiller, Chairman
Caddo Nation of Oklahoma
117 Memorial Lane
P.O. Box 487
Binger, OK 73009

The U.S. Army Corps of Engineers, New Orleans District, has prepared a draft report entitled "Lake Pontchartrain and Vicinity General Re-Evaluation Report with Integrated Draft Environmental Impact Statement (LPV GRR-DEIS)." This GRR-DEIS reevaluates the performance of the LPV system given the combined effects of consolidation, settlement, subsidence, sea level rise, and new datum over time, and determine if additional actions are recommended to address the economic and life safety risks associated with flooding due to hurricanes and coastal storms.

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Comments should be mailed to the attention of Mr. Bradley Drouant; U.S. Army Corps of Engineers; New District; CEMVN-PMO-L; Room 361; 7400 Leake Avenue, New Orleans, Louisiana 70118. Comments may also be provided by email to CEMVN-LPVGRR@usace.army.mil. Mr. Drouant may be contacted at (504) 862-1516 if questions arise.

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Date: 2019.12.05 15:57:01 -06'00'

Marshall K. Harper
Chief, Environmental Planning Branch

CC: An electronic copy of this letter will be provided to Mr. Derrick Hill, THPO, Caddo Nation of Oklahoma, dhill@caddo.xyz

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
7400 LEAKE AVENUE
NEW ORLEANS, LOUISIANA 70118

REPLY TO
ATTENTION OF

December 9, 2019

Regional Planning and
Environment Division South

Gary Batton, Chief
Choctaw Nation of Oklahoma
Attn: Choctaw Nation Historic Preservation Department
P.O. Box 1210
Durant, OK 74702-1210

The U.S. Army Corps of Engineers, New Orleans District, has prepared a draft report entitled "Lake Pontchartrain and Vicinity General Re-Evaluation Report with Integrated Draft Environmental Impact Statement (LPV GRR-DEIS)." This GRR-DEIS reevaluates the performance of the LPV system given the combined effects of consolidation, settlement, subsidence, sea level rise, and new datum over time, and determine if additional actions are recommended to address the economic and life safety risks associated with flooding due to hurricanes and coastal storms.

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Comments should be mailed to the attention of Mr. Bradley Drouant; U.S. Army Corps of Engineers; New District; CEMVN-PMO-L; Room 361; 7400 Leake Avenue, New Orleans, Louisiana 70118. Comments may also be provided by email to CEMVN-LPVGRR@usace.army.mil. Mr. Drouant may be contacted at (504) 862-1516 if questions arise.

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Marshall K. Harper
Chief, Environmental Planning Branch

CC: An electronic copy of this letter with enclosures will be provided to Dr. Ian Thompson, Director/Tribal Historic Preservation Officer, Choctaw Nation of Oklahoma, ithompson@choctawnation.com and Ms. Lindsey Bilyeu, NHPA Section 106 Reviewer, Choctaw Nation of Oklahoma, lbilyeu@choctawnation.com.

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
7400 LEAKE AVENUE
NEW ORLEANS, LOUISIANA 70118

REPLY TO
ATTENTION OF

December 9, 2019

Regional Planning and
Environment Division South

David Sickey, Chairman
Coushatta Tribe of Louisiana
P.O. Box 818
Elton, LA 70532

The U.S. Army Corps of Engineers, New Orleans District, has prepared a draft report entitled "Lake Pontchartrain and Vicinity General Re-Evaluation Report with Integrated Draft Environmental Impact Statement (LPV GRR-DEIS)." This GRR-DEIS reevaluates the performance of the LPV system given the combined effects of consolidation, settlement, subsidence, sea level rise, and new datum over time, and determine if additional actions are recommended to address the economic and life safety risks associated with flooding due to hurricanes and coastal storms.

The draft report and appendices are available online for your review and comment at the below website:

https://www.mvn.usace.army.mil/About/Projects/BBA-2018/studies/LPV-GRR/

The USACE is initiating consultation for Section 106 of the National Historic Preservation Act (NHPA), with the State Historic Preservation Officer (SHPO) and with Federally-recognized Tribes with this letter for the referenced project. No determination of effect under the NHPA is being made at this time. Consultation will follow the standard Section 106 process.

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Comments should be mailed to the attention of Mr. Bradley Drouant; U.S. Army Corps of Engineers; New District; CEMVN-PMO-L; Room 361; 7400 Leake Avenue, New Orleans, Louisiana 70118. Comments may also be provided by email to CEMVN-LPVGRR@usace.army.mil. Mr. Drouant may be contacted at (504) 862-1516 if questions arise.

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Date: 2019.12.05 15:58:18 -06'00'

Marshall K. Harper
Chief, Environmental Planning Branch

CC: An electronic copy of this letter with enclosures will be provided to Dr. Linda Langley, Tribal Historic Preservation Officer, Coushatta Tribe of Louisiana, llangley@coushattatribela.org.

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
7400 LEAKE AVENUE
NEW ORLEANS, LOUISIANA 70118

REPLY TO
ATTENTION OF

December 9, 2019

Regional Planning and
Environment Division South

Melissa Darden, Chairman
Chitimacha Tribe of Louisiana
P.O. Box 661
Charenton, LA 70523

The U.S. Army Corps of Engineers, New Orleans District, has prepared a draft report entitled "Lake Pontchartrain and Vicinity General Re-Evaluation Report with Integrated Draft Environmental Impact Statement (LPV GRR-DEIS)." This GRR-DEIS reevaluates the performance of the LPV system given the combined effects of consolidation, settlement, subsidence, sea level rise, and new datum over time, and determine if additional actions are recommended to address the economic and life safety risks associated with flooding due to hurricanes and coastal storms.

The draft report and appendices are available online for your review and comment at the below website:

https://www.mvn.usace.army.mil/About/Projects/BBA-2018/studies/LPV-GRR/

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Date: 2019.12.05 15:59:03 -06'00'

Marshall K. Harper
Chief, Environmental Planning Branch

CC: An electronic copy of this letter with enclosures will be provided to Mrs. Kimberly Walden, M. Ed., Cultural Director/Tribal Historic Preservation Officer, Chitimacha Tribe of Louisiana, kim@chitimacha.gov.

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
7400 LEAKE AVENUE
NEW ORLEANS, LOUISIANA 70118

REPLY TO
ATTENTION OF

December 9, 2019

Regional Planning and
Environment Division South

B. Cheryl Smith, Principal Chief
Jena Band of Choctaw Indians
P.O. Box 14
Jena, LA 71342

The U.S. Army Corps of Engineers, New Orleans District, has prepared a draft report entitled "Lake Pontchartrain and Vicinity General Re-Evaluation Report with Integrated Draft Environmental Impact Statement (LPV GRR-DEIS)." This GRR-DEIS reevaluates the performance of the LPV system given the combined effects of consolidation, settlement, subsidence, sea level rise, and new datum over time, and determine if additional actions are recommended to address the economic and life safety risks associated with flooding due to hurricanes and coastal storms.

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https://www.mvn.usace.army.mil/About/Projects/BBA-2018/studies/LPV-GRR/

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Comments should be mailed to the attention of Mr. Bradley Drouant; U.S. Army Corps of Engineers; New District; CEMVN-PMO-L; Room 361; 7400 Leake Avenue, New Orleans, Louisiana 70118. Comments may also be provided by email to CEMVN-LPVGRR@usace.army.mil. Mr. Drouant may be contacted at (504) 862-1516 if questions arise.

HARPER.MARSHALL.KEVIN.1536114358
Digitally signed by HARPER.MARSHALL.KEVIN.1536114358
Date: 2019.12.05 16:01:38 -06'00'

Marshall K. Harper
Chief, Environmental Planning Branch

CC: An electronic copy of this letter with enclosures will be provided to Mrs. Alina Shively, Tribal Historic Preservation Officer, Jena Band of Choctaw Indians, ashively@jenachoctaw.org.

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
7400 LEAKE AVENUE
NEW ORLEANS, LOUISIANA 70118

REPLY TO
ATTENTION OF

December 9, 2019

Regional Planning and
Environment Division South

Cyrus Ben, Chief
Mississippi Band of Choctaw Indians
P.O. Box 6257
Choctaw, MS 39350

The U.S. Army Corps of Engineers, New Orleans District, has prepared a draft report entitled "Lake Pontchartrain and Vicinity General Re-Evaluation Report with Integrated Draft Environmental Impact Statement (LPV GRR-DEIS)." This GRR-DEIS reevaluates the performance of the LPV system given the combined effects of consolidation, settlement, subsidence, sea level rise, and new datum over time, and determine if additional actions are recommended to address the economic and life safety risks associated with flooding due to hurricanes and coastal storms.

The draft report and appendices are available online for your review and comment at the below website:

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HARPER.MARSHALL.KEVIN.1536114358 Digitally signed by HARPER.MARSHALL.KEVIN.1536114358 Date: 2019.12.05 16:02:36 -06'00'

Marshall K. Harper
Chief, Environmental Planning Branch

CC: An electronic copy of this letter with enclosures will be provided to Mr. Kenneth H. Carleton, Tribal Historic Preservation Officer/Archaeologist, Mississippi Band of Choctaw Indians, kcarleton@choctaw.org.

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
7400 LEAKE AVENUE
NEW ORLEANS, LOUISIANA 70118

REPLY TO
ATTENTION OF

December 9, 2019

Regional Planning and
Environment Division South

Mr. James Floyd, Principal Chief
Muscogee (Creek) Nation
Attn: Historic and Cultural Preservation Office
P.O. Box 580
Okmulgee, OK 74447

The U.S. Army Corps of Engineers, New Orleans District, has prepared a draft report entitled "Lake Pontchartrain and Vicinity General Re-Evaluation Report with Integrated Draft Environmental Impact Statement (LPV GRR-DEIS)." This GRR-DEIS reevaluates the performance of the LPV system given the combined effects of consolidation, settlement, subsidence, sea level rise, and new datum over time, and determine if additional actions are recommended to address the economic and life safety risks associated with flooding due to hurricanes and coastal storms.

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HARPER.MARSHALL.KEVIN.1536114358
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Date: 2019.12.05 16:03:44 -06'00'

Marshall K. Harper
Chief, Environmental Planning Branch

CC: An electronic copy of this letter with enclosures will be provided to Ms. Corain Lowe-Zepeda, Tribal Historic Preservation Officer, Muscogee (Creek) Nation, section106@mcn-nsn.gov.

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
7400 LEAKE AVENUE
NEW ORLEANS, LOUISIANA 70118

REPLY TO
ATTENTION OF

December 9, 2019

Regional Planning and
Environment Division South

Greg Chilcoat, Principal Chief
Seminole Nation of Oklahoma
P.O. Box 1498
Wewoka, OK 74884

The U.S. Army Corps of Engineers, New Orleans District, has prepared a draft report entitled "Lake Pontchartrain and Vicinity General Re-Evaluation Report with Integrated Draft Environmental Impact Statement (LPV GRR-DEIS)." This GRR-DEIS reevaluates the performance of the LPV system given the combined effects of consolidation, settlement, subsidence, sea level rise, and new datum over time, and determine if additional actions are recommended to address the economic and life safety risks associated with flooding due to hurricanes and coastal storms.

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HARPER.MARSHALL.KEVIN.1536114358 Digitally signed by HARPER.MARSHALL.KEVIN.1536114358 Date: 2019.12.05 16:06:29 -06'00'

Marshall K. Harper
Chief, Environmental Planning Branch

CC: An electronic copy of this letter with enclosures will be provided to Mr. Theodore Isham, Tribal Historic Preservation Officer, Seminole Nation of Oklahoma, isham.t@sno-nsn.gov.

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
7400 LEAKE AVENUE
NEW ORLEANS, LOUISIANA 70118

REPLY TO
ATTENTION OF

December 9, 2019

Regional Planning and
Environment Division South

Marcellus W. Osceola, Chairman
Seminole Tribe of Florida
6300 Sterling Road
Hollywood, FL 33024

The U.S. Army Corps of Engineers, New Orleans District, has prepared a draft report entitled "Lake Pontchartrain and Vicinity General Re-Evaluation Report with Integrated Draft Environmental Impact Statement (LPV GRR-DEIS)." This GRR-DEIS reevaluates the performance of the LPV system given the combined effects of consolidation, settlement, subsidence, sea level rise, and new datum over time, and determine if additional actions are recommended to address the economic and life safety risks associated with flooding due to hurricanes and coastal storms.

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HARPER.MARSHALL.KEVIN.1536114358 Digitally signed by HARPER.MARSHALL.KEVIN.1536114358 Date: 2019.12.05 16:09:40 -06'00'

Marshall K. Harper
Chief, Environmental Planning Branch

CC: An electronic copy of this letter with enclosures will be provided to Dr. Paul N. Backhouse, Tribal Historic Preservation Officer, Seminole Tribe of Florida, THPOCompliance@semtribe.com.

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
7400 LEAKE AVENUE
NEW ORLEANS, LOUISIANA 70118

REPLY TO
ATTENTION OF

December 9, 2019

Regional Planning and
Environment Division South

Joey Barbry, Chairman
Tunica-Biloxi Tribe of Louisiana
P.O. Box 1589
Marksville, LA 71351

The U.S. Army Corps of Engineers, New Orleans District, has prepared a draft report entitled "Lake Pontchartrain and Vicinity General Re-Evaluation Report with Integrated Draft Environmental Impact Statement (LPV GRR-DEIS)." This GRR-DEIS reevaluates the performance of the LPV system given the combined effects of consolidation, settlement, subsidence, sea level rise, and new datum over time, and determine if additional actions are recommended to address the economic and life safety risks associated with flooding due to hurricanes and coastal storms.

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HARPER.MARSHALL.KEVIN.1536114358 Digitally signed by HARPER.MARSHALL.KEVIN.1536114358 Date: 2019.12.05 16:10:38 -06'00'

Marshall K. Harper
Chief, Environmental Planning Branch

CC: An electronic copy of this letter with enclosures will be provided to Mr. Earl J. Barbry, Jr., Cultural Director, Tunica-Biloxi Tribe of Louisiana, earlii@tunica.org.

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
7400 LEAKE AVENUE
NEW ORLEANS, LOUISIANA 70118

REPLY TO
ATTENTION OF

December 9, 2019

Regional Planning and
Environment Division South

Kristin Sanders, SHPO
LA State Historic Preservation Officer
P.O. Box 44247
Baton Rouge, LA 70804-4241

The U.S. Army Corps of Engineers, New Orleans District, has prepared a draft report entitled "Lake Pontchartrain and Vicinity General Re-Evaluation Report with Integrated Draft Environmental Impact Statement (LPV GRR-DEIS)." This GRR-DEIS reevaluates the performance of the LPV system given the combined effects of consolidation, settlement, subsidence, sea level rise, and new datum over time, and determine if additional actions are recommended to address the economic and life safety risks associated with flooding due to hurricanes and coastal storms.

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HARPER.MARSHALL.KEVIN.1536114358 Digitally signed by HARPER.MARSHALL.KEVIN.1536114358 Date: 2019.12.05 16:05:22 -06'00'

Marshall K. Harper
Chief, Environmental Planning Branch

CC: An electronic copy of this letter with enclosures will be provided to the Section 106 Inbox, section106@crt.la.gov.

7.5 FINAL TRIBAL/SHPO LETTERS

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, NEW ORLEANS DISTRICT
7400 LEAKE AVENUE
NEW ORLEANS, LOUISIANA 70118

REPLY TO
ATTENTION OF

Regional Planning and
Environment Division, South
Environmental Planning Branch

Herbert Johnson, Tribal Council Chairperson
Alabama-Coushatta Tribe of Texas
571 State Park Rd 56
Livingston, TX 77351

RE: Section 106 Review Consultation
Undertaking: Lake Pontchartrain and Vicinity and West Bank and Vicinity Louisiana General Re-Evaluation Reports with Integrated Environmental Impact Statement.
Determination: No Adverse Effects To Historic Properties

Dear Mikko Skaalaba Johnson:

The U.S. Army Corps of Engineers, New Orleans District (CEMVN) is proposing to increase the level of flood risk reduction provided by the Hurricane & Storm Damage Risk Reduction System (HSDRRS) around the New Orleans metropolitan area through a series of levee lifts, floodwall replacements, and foreshore protection. This letter summarizes and confirms the findings of previous HSDRRS consultations from June 2007 to December 2010. The proposed project is located within St. Charles, Jefferson, Orleans, Plaquemines, and St. Bernard Parishes, Louisiana.

In partial fulfillment of responsibilities under the National Environmental Policy Act and Section 106 of the National Historic Preservation Act, the U.S. Army Corps of Engineers, New Orleans District (CEMVN), offers you the opportunity to review and comment on the potential of the proposed action described in this letter to affect historic properties.

Description of the Undertaking
The proposed undertaking has been divided into two sections. The Lake Pontchartrain and Vicinity (LPV) projects refer to the HSDRRS levees, Mississippi River Levees (MRL) and associated features located on the east bank of the Mississippi River. The West Bank and Vicinity (WBV) projects refer to the HSDRRS levees, MRLs and associated features located on the west bank of the Mississippi River.

The construction for all proposed work would generally occur in the same footprint as the existing LPV/WBV project and existing MRL levees. Project features would consist of

levee lifts along the existing levee alignment, with construction timing to occur before the combined effects of consolidation, settlement, subsidence, and sea level rise reduce the levee elevations in each levee reach below the required design elevation. In some reaches, levee lifts may need to occur more than once during the period of analysis. Additionally, the project would include floodwall replacements or new floodwall along the existing alignment to be constructed prior to the combined effects causing the design requirements to be exceeded for each structure. Approximately 19 miles of MRL levees will be added as co-located features across both the LPV/WBV project.

The proposed plan also includes targeted areas of foreshore protection along Lake Pontchartrain in areas where foreshore protection already exists. Water-based construction would be required for construction of the foreshore protection along the shore of Lake Pontchartrain. This would require some dredging with a bucket dredge and temporary material stockpiling to provide access to deliver and place the stone for foreshore protection and bring it back up to the required elevation for levee protection. In order to allow construction equipment to access the shoreline, construction access channels would be dredged, and dredged material would be temporarily stockpiled adjacent to the channels. Construction access channels and stockpile areas would be brought back to original elevations subsequent to completion of construction activities. In addition, rock foreshore protection would be placed on top of existing foreshore protection in Lake Pontchartrain to bring the stone back up to the required elevation for proper levee protection.

Area of Potential Effects (APE)
The APE for the proposed project would be limited to the existing right of ways of the HSSDRS and areas surrounding MRL features. The APE for LPV is represented as Figure 1, and the APE for WBV Is represented as Figure 2. The direct and indirect APEs are the same areas as provided for and consulted upon in several of the IERs, noted below, except for the APEs that will be defined as part of the implementation of a programmatic agreement focused on the Mississippi River Levees, discussed further below.

The LPV APE is located within the coastal zone on the east bank of the Mississippi River south of Lake Pontchartrain within St. Charles, Jefferson, Orleans, and St. Bernard parishes in southeast Louisiana. The western end of the LPV APE abuts the Bonnet Carré spillway. The eastern end of the APE is located in the Bayou Sauvage National Wildlife Refuge and along the now deauthorized Mississippi River Gulf Outlet (MRGO).

The WBV APE extends from eastern St. Charles Parish to northern Plaquemines Parish along the right descending bank of the Mississippi River. The APE is part of the Barataria Basin.

Background and Identification
For HSDRRS planning and construction, USACE completed studies of the potentially significant historic properties in the areas that would have been impacted by work associated with HSDRRS corridors. The HSDRRS review was broken into Individual Environmental Reports(IERs) that covered the entire project system. 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. Phase I cultural resource surveys were conducted in the form of pedestrian surface surveys with systematic shovel test pit excavations and delineations of site boundaries, when necessary. Where applicable, Phase II site evaluations were conducted for assessing the National Register of Historic Places (NRHP) eligibility. In all cases, the cultural resource survey areas exceeded the size of the preliminary APE, which allowed the USACE project archaeologists to adjust the APE, as needed, to avoid any damage to historic properties with potential eligibility for the NRHP.

USACE sent letters to the Louisiana SHPO and THPOs of the 12 federally recognized tribes with an interest in the region, 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 avoidance measures. Section 106 consultation for the HSDRRS projects was then concluded.

A comprehensive summary of these studies, identified cultural resources, and previous Section 106 consultation for HSDRRS construction are presented in IERs #1, #2, #3, #4, #5, #6, #7, #8, #9, #10, #11, #12, #13, #14, #15, #16, #17, #27, and #33 and complied and summarized in the Comprehensive Environmental Document Phase 1.https://www.mvn.usace.army.mil/Missions/Environmental/NEPA-Compliance-Documents/HSDRRS-Projects/.

Consultation History
On December 9, 2019, consultation initiation letters for the LPV/WBV GRR study were sent to the Louisiana SHPO and Alabama-Coushatta Tribe of Texas (ACTT); Caddo Nation (CN); Chitimacha Tribe of Louisiana (CTL); Choctaw Nation of Oklahoma (CNO); Coushatta Tribe of Louisiana (CT); Jena Band of Choctaw Indians (JBCI); Mississippi Band of Choctaw Indians (MBCI); Muscogee (Creek) Nation (MCN); Quapaw Tribe of Oklahoma (QTO); Seminole Nation of Oklahoma (SNO); Seminole Tribe of Florida (STF); and Tunica-Biloxi Tribe of Louisiana (TBTL), (Tribes). The letters outlined how the proposed LPV/WBV levee lifts would fit within the previous consultations conducted for the individual IERs and that new potential impacts would be subjected to standard Section 106 of the NHPA review procedures.

After sending the initiation letter, USACE determined that the new potential impacts of the LPV/WBV GRR could be addressed by the programmatic agreement being developed for the Mississippi River Levee Supplemental Environmental Impact Statement (MRL SEIS II).

At a meeting on January 15, 2020, USACE proposed to consulting parties the concept of folding the LPV/WBV GRR study into the MRL SEIS PA to avoid a duplication of effort and the creation of redundant agreement documents. LPV/WBV GRR inclusion within the PA was included in discussions during the next 8 consultation meetings and the final update meeting. No party objected. The MRL SEIS II PA was developed over the course of 2020 including the inclusion of LPV/WBV GRR into the document and was executed on March 4, 2021.

Determinations
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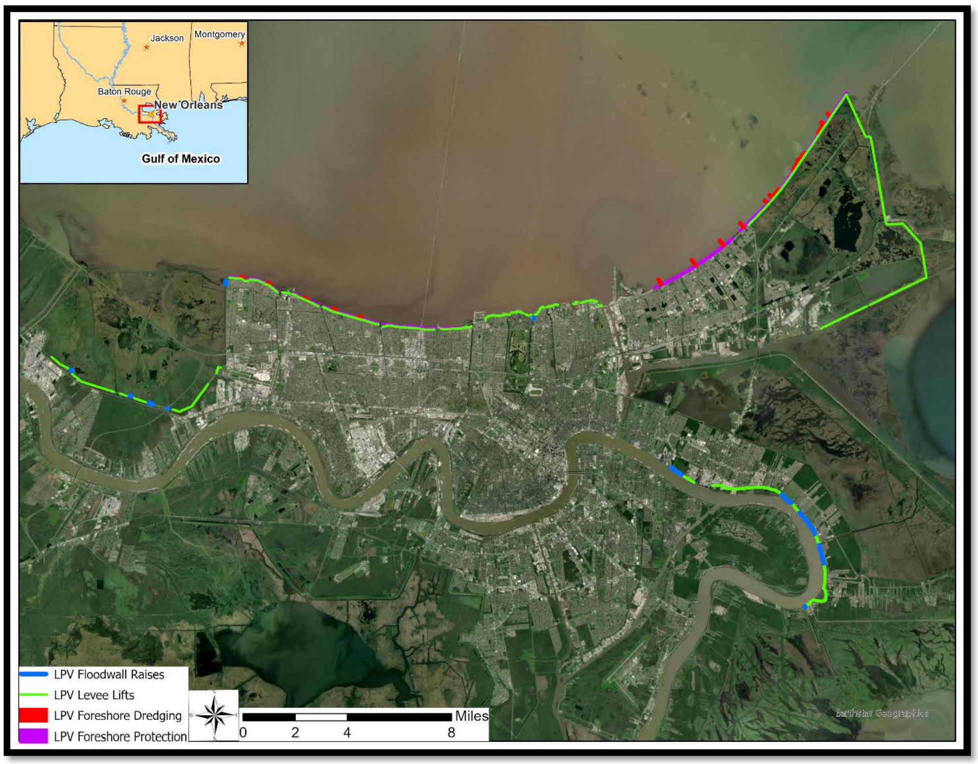
We look forward to your concurrence with this determination. Should you have any questions or need additional information regarding this undertaking, please contact Noah Fulmer at 504-862-1983, or by email at noah.j.fulmer@usace.army.mil, with any questions or concerns you may have regarding this project.

Sincerely,
WILLIAMS.ERIC.MITCHELL.1065454323 Digitally signed by WILLIAMS.ERIC.MITCHELL.1065454323 Date: 2021.03.09 08:53:40 -06'00'
for MARSHALL K. HARPER
Chief, Environmental Planning Branch

CC: File
An electronic copy of this letter with enclosures will be provided to Mr. Bryant J. Celestine, Historic Preservation Officer, Alabama Coushatta Tribe of Texas, celestine.bryant@actribe.org.
Enclosures

FIGURE 1: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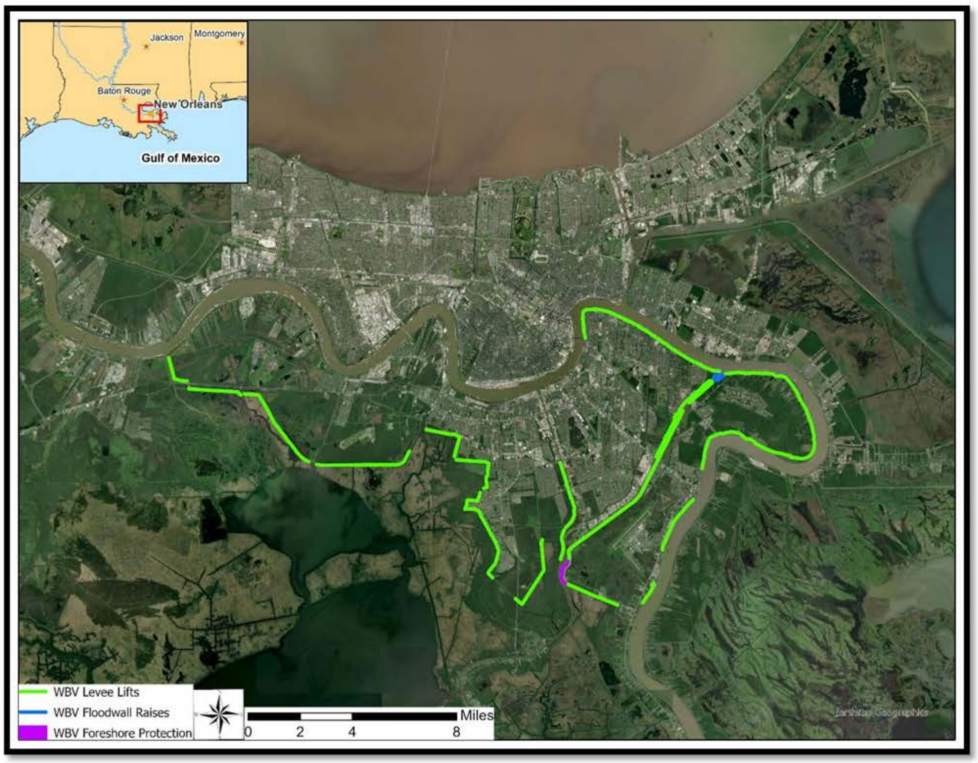
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DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, NEW ORLEANS DISTRICT
7400 LEAKE AVENUE
NEW ORLEANS, LOUISIANA 70118

REPLY TO
ATTENTION OF

Regional Planning and
Environment Division, South
Environmental Planning Branch

Tamara Francis-Fourkiller, Chairman
Caddo Nation of Oklahoma
117 Memorial Lane
P.O. Box 487
Binger, OK 73009

RE: Section 106 Review Consultation
Undertaking: Lake Pontchartrain and Vicinity and West Bank and Vicinity Louisiana General Re-Evaluation Reports with Integrated Environmental Impact Statement.
Determination: No Adverse Effects To Historic Properties

Dear Chairman Francis-Fourkiller:

The U.S. Army Corps of Engineers, New Orleans District (CEMVN) is proposing to increase the level of flood risk reduction provided by the Hurricane & Storm Damage Risk Reduction System (HSDRRS) around the New Orleans metropolitan area through a series of levee lifts, floodwall replacements, and foreshore protection. This letter summarizes and confirms the findings of previous HSDRRS consultations from June 2007 to December 2010. The proposed project is located within St. Charles, Jefferson, Orleans, Plaquemines, and St. Bernard Parishes, Louisiana.

In partial fulfillment of responsibilities under the National Environmental Policy Act and Section 106 of the National Historic Preservation Act, the U.S. Army Corps of Engineers, New Orleans District (CEMVN), offers you the opportunity to review and comment on the potential of the proposed action described in this letter to affect historic properties.

Description of the Undertaking
The proposed undertaking has been divided into two sections. The Lake Pontchartrain and Vicinity (LPV) projects refer to the HSDRRS levees, Mississippi River Levees (MRL) and associated features located on the east bank of the Mississippi River. The West Bank and Vicinity (WBV) projects refer to the HSDRRS levees, MRLs and associated features located on the west bank of the Mississippi River.

The construction for all proposed work would generally occur in the same footprint as the existing LPV/WBV project and existing MRL levees. Project features would consist of

levee lifts along the existing levee alignment, with construction timing to occur before the combined effects of consolidation, settlement, subsidence, and sea level rise reduce the levee elevations in each levee reach below the required design elevation. In some reaches, levee lifts may need to occur more than once during the period of analysis. Additionally, the project would include floodwall replacements or new floodwall along the existing alignment to be constructed prior to the combined effects causing the design requirements to be exceeded for each structure. Approximately 19 miles of MRL levees will be added as co-located features across both the LPV/WBV project.

The proposed plan also includes targeted areas of foreshore protection along Lake Pontchartrain in areas where foreshore protection already exists. Water-based construction would be required for construction of the foreshore protection along the shore of Lake Pontchartrain. This would require some dredging with a bucket dredge and temporary material stockpiling to provide access to deliver and place the stone for foreshore protection and bring it back up to the required elevation for levee protection. In order to allow construction equipment to access the shoreline, construction access channels would be dredged, and dredged material would be temporarily stockpiled adjacent to the channels. Construction access channels and stockpile areas would be brought back to original elevations subsequent to completion of construction activities. In addition, rock foreshore protection would be placed on top of existing foreshore protection in Lake Pontchartrain to bring the stone back up to the required elevation for proper levee protection.

Area of Potential Effects (APE)
The APE for the proposed project would be limited to the existing right of ways of the HSSDRS and areas surrounding MRL features. The APE for LPV is represented as Figure 1, and the APE for WBV Is represented as Figure 2. The direct and indirect APEs are the same areas as provided for and consulted upon in several of the IERs, noted below, except for the APEs that will be defined as part of the implementation of a programmatic agreement focused on the Mississippi River Levees, discussed further below.

The LPV APE is located within the coastal zone on the east bank of the Mississippi River south of Lake Pontchartrain within St. Charles, Jefferson, Orleans, and St. Bernard parishes in southeast Louisiana. The western end of the LPV APE abuts the Bonnet Carré spillway. The eastern end of the APE is located in the Bayou Sauvage National Wildlife Refuge and along the now deauthorized Mississippi River Gulf Outlet (MRGO).

The WBV APE extends from eastern St. Charles Parish to northern Plaquemines Parish along the right descending bank of the Mississippi River. The APE is part of the Barataria Basin.

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USACE sent letters to the Louisiana SHPO and THPOs of the 12 federally recognized tribes with an interest in the region, 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 avoidance measures. Section 106 consultation for the HSDRRS projects was then concluded.

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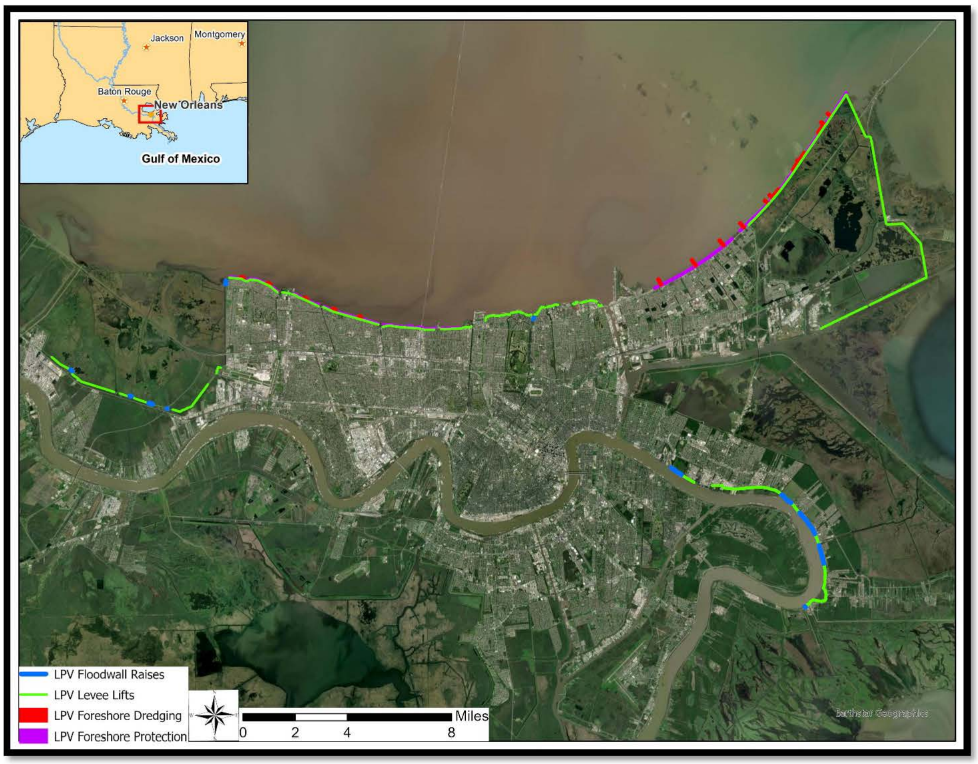
Digitally signed by WILLIAMS.ERIC.MITCHELL.1065454323
Date: 2021.03.09 08:55:23 -06'00'
for MARSHALL K. HARPER
Chief, Environmental Planning Branch

CC: File
An electronic copy of this letter will be provided to Mr. Derrick Hill, THPO, Caddo Nation of Oklahoma, dhill@mycaddonation.com

Enclosures

National Historic Preservation Act compliance

FIGURE 1: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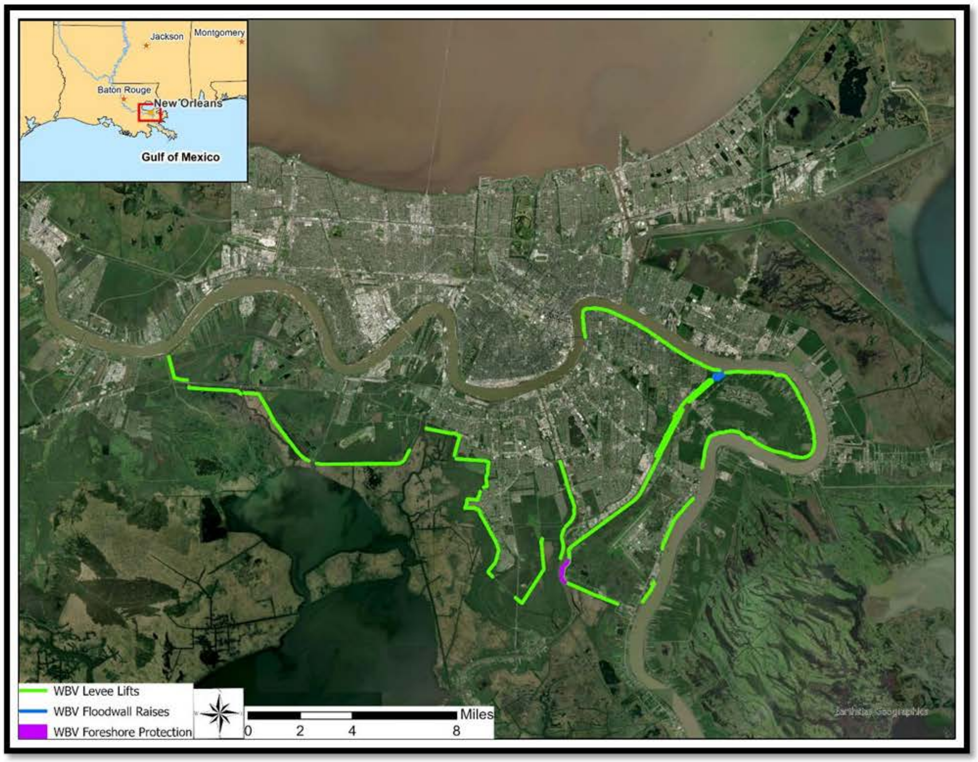
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DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, NEW ORLEANS DISTRICT
7400 LEAKE AVENUE
NEW ORLEANS, LOUISIANA 70118

REPLY TO
ATTENTION OF

Regional Planning and
Environment Division, South
Environmental Planning Branch

Gary Batton, Chief
Choctaw Nation of Oklahoma
Attn: Choctaw Nation Historic Preservation Department
P.O. Box 1210
Durant, OK 74702-1210

RE: Section 106 Review Consultation
Undertaking: Lake Pontchartrain and Vicinity and West Bank and Vicinity Louisiana General Re-Evaluation Reports with Integrated Environmental Impact Statement.
Determination: No Adverse Effects To Historic Properties

Dear Chief Batton:

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for MARSHALL K. HARPER
Chief, Environmental Planning Branch

CC: File
An electronic copy of this letter with enclosures will be provided to Dr. Ian Thompson, Director/Tribal Historic Preservation Officer, Choctaw Nation of Oklahoma, ithompson@choctawnation.com and Ms. Lindsey Bilyeu, NHPA Section 106 Reviewer, Choctaw Nation of Oklahoma, lbilyeu@choctawnation.com.
Enclosures

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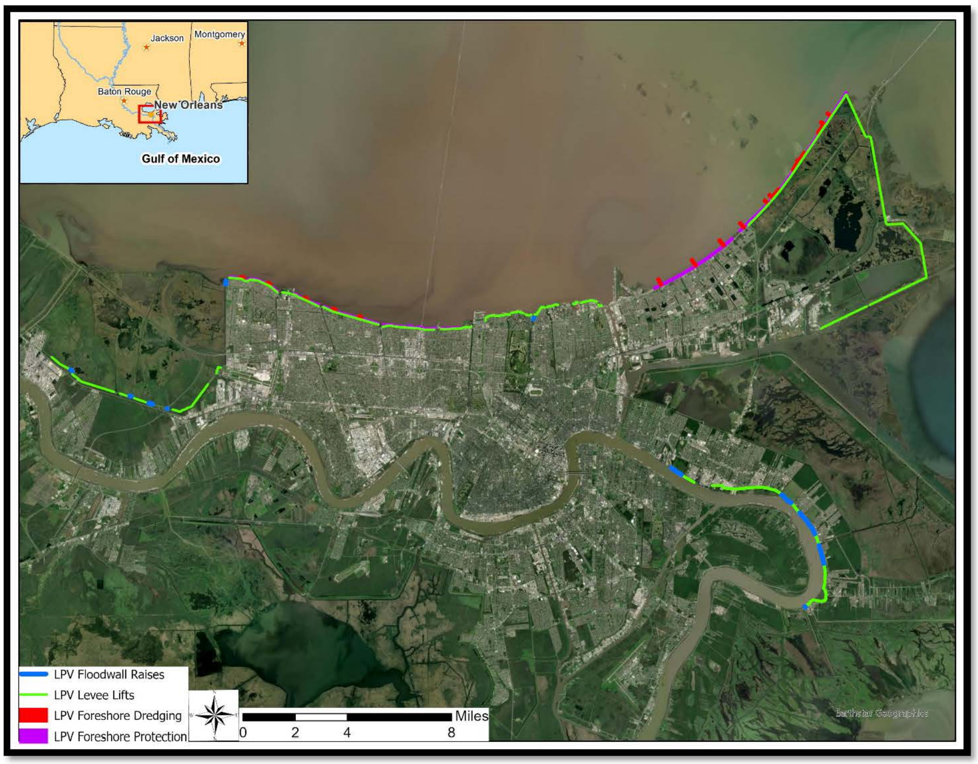
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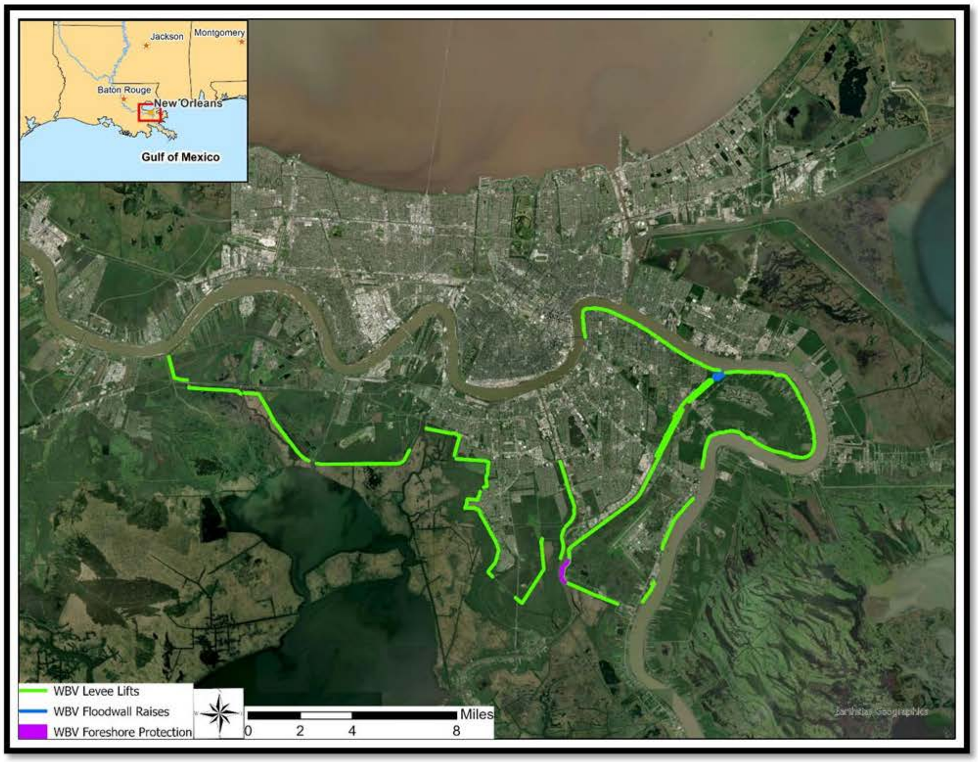
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DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, NEW ORLEANS DISTRICT
7400 LEAKE AVENUE
NEW ORLEANS, LOUISIANA 70118

REPLY TO
ATTENTION OF

Regional Planning and
Environment Division, South
Environmental Planning Branch

David Sickey, Chairman
Coushatta Tribe of Louisiana
P.O. Box 818
Elton, LA 70532

RE: Section 106 Review Consultation
Undertaking: Lake Pontchartrain and Vicinity and West Bank and Vicinity Louisiana General Re-Evaluation Reports with Integrated Environmental Impact Statement.
Determination: No Adverse Effects To Historic Properties

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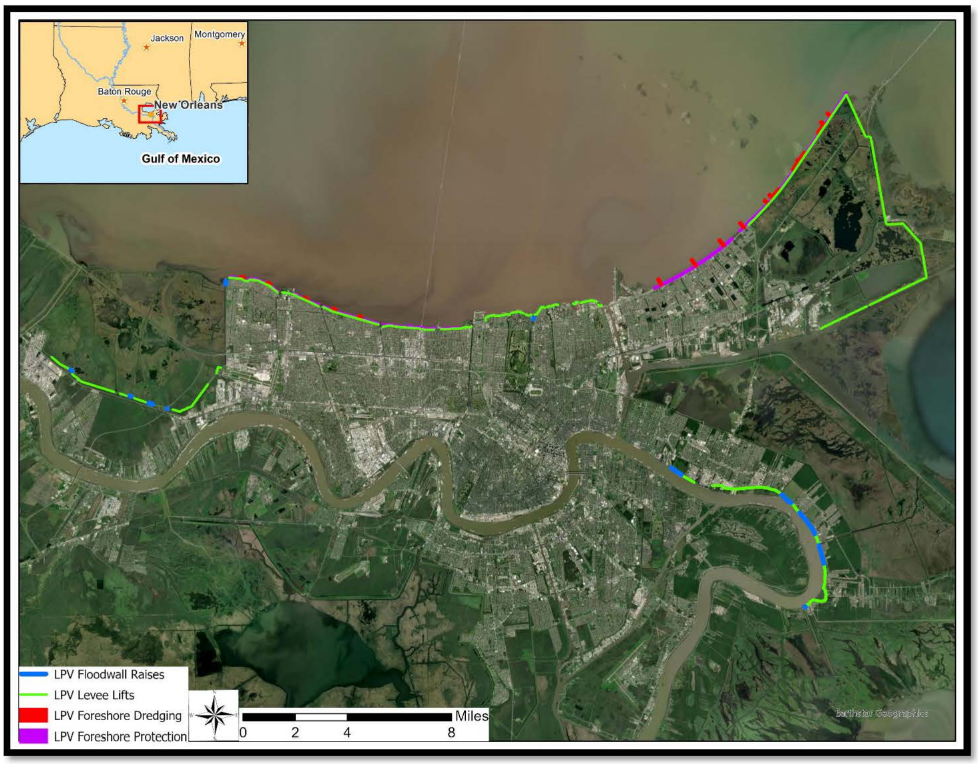
Determinations
CEMVN has determined a majority of actions proposed under the LPV/WBV Study were made compliant with section 106 of the NHPA through various IER consultations (IERs #1, #2, #3, #4, #5, #6, #7, #8, #9, #10, #11, #12, #13, #14, #15, #16, #17, #27, and #33); and, pursuant to 36 CFR 800.4 (2) and 800.5(3), CEMVN has phased the identification, evaluation, and determination of effects through implementing the provisions of the MRL SEIS II PA. Most of the proposed actions would be occurring within the existing HSDRSS footprint. These areas have all been subject to surveys as part of previous investigations, including the areas of shoreline protection and dredging on Lake Pontchartrain. All potential work in these areas would be subject to the implementation of the avoidance measures established in the original HSDRSS IER consultations. Therefore, CEMVN has determined a finding of **No Adverse Effect to Historic Properties** for work within these areas and is submitting it to you for your review and comment. The MRL levee work that was not part of the previous HSDRRS IERs, would be subject to further review and follow the processes established as part of the MRL SEIS II PA. CEMVN requests your comments within 30 days.

We look forward to your concurrence with this determination. Should you have any questions or need additional information regarding this undertaking, please contact Noah Fulmer at 504-862-1983, or by email at noah.j.fulmer@usace.army.mil, with any questions or concerns you may have regarding this project.

Sincerely,
WILLIAMS.ERIC.MITCHELL.1065454323
Digitally signed by WILLIAMS.ERIC.MITCHELL.1065454323
Date: 2021.03.09 08:59:03 -06'00'
for MARSHALL K. HARPER
Chief, Environmental Planning Branch

CC: File
An electronic copy of this letter with enclosures will be provided to Dr. Linda Langley, Tribal Historic Preservation Officer, Coushatta Tribe of Louisiana, llangley@coushattatribela.org and Mr. Johans Johns, jonasj@coushattatribela.org.
Enclosures

FIGURE 1: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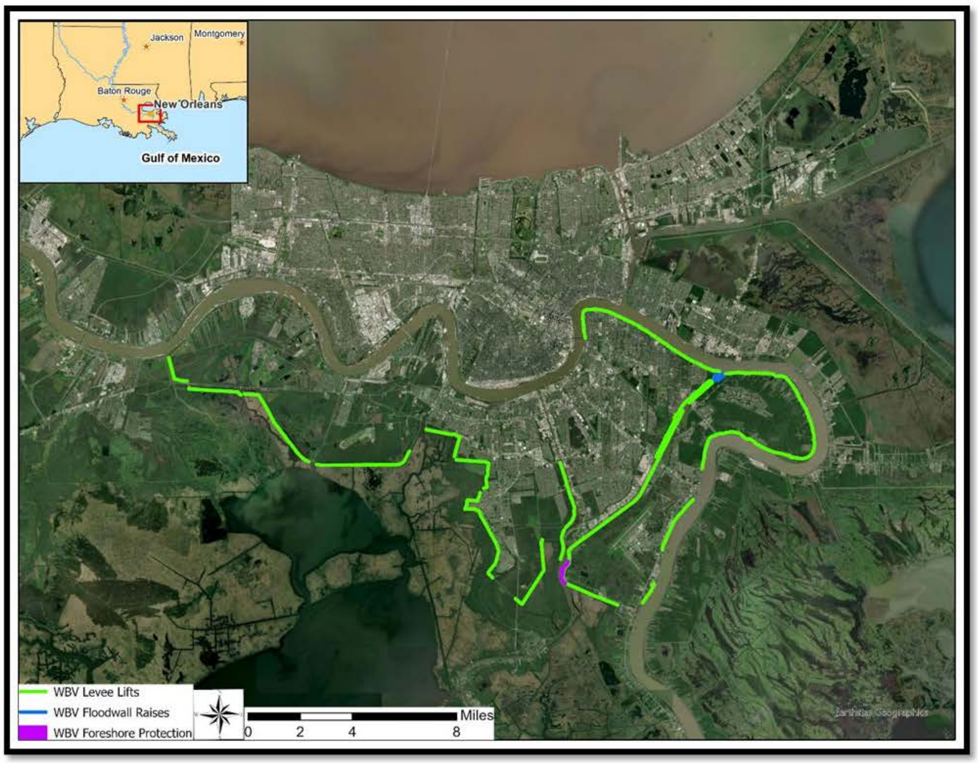
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DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, NEW ORLEANS DISTRICT
7400 LEAKE AVENUE
NEW ORLEANS, LOUISIANA 70118

REPLY TO
ATTENTION OF

Regional Planning and
Environment Division, South
Environmental Planning Branch

Melissa Darden, Chairman
Chitimacha Tribe of Louisiana
P.O. Box 661
Charenton, LA 70523

RE: Section 106 Review Consultation
Undertaking: Lake Pontchartrain and Vicinity and West Bank and Vicinity Louisiana General Re-Evaluation Reports with Integrated Environmental Impact Statement.
Determination: No Adverse Effects To Historic Properties

Dear Chairman Darden:

The U.S. Army Corps of Engineers, New Orleans District (CEMVN) is proposing to increase the level of flood risk reduction provided by the Hurricane & Storm Damage Risk Reduction System (HSDRRS) around the New Orleans metropolitan area through a series of levee lifts, floodwall replacements, and foreshore protection. This letter summarizes and confirms the findings of previous HSDRRS consultations from June 2007 to December 2010. The proposed project is located within St. Charles, Jefferson, Orleans, Plaquemines, and St. Bernard Parishes, Louisiana.

In partial fulfillment of responsibilities under the National Environmental Policy Act and Section 106 of the National Historic Preservation Act, the U.S. Army Corps of Engineers, New Orleans District (CEMVN), offers you the opportunity to review and comment on the potential of the proposed action described in this letter to affect historic properties.

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The proposed undertaking has been divided into two sections. The Lake Pontchartrain and Vicinity (LPV) projects refer to the HSDRRS levees, Mississippi River Levees (MRL) and associated features located on the east bank of the Mississippi River. The West Bank and Vicinity (WBV) projects refer to the HSDRRS levees, MRLs and associated features located on the west bank of the Mississippi River.

The construction for all proposed work would generally occur in the same footprint as the existing LPV/WBV project and existing MRL levees. Project features would consist of

levee lifts along the existing levee alignment, with construction timing to occur before the combined effects of consolidation, settlement, subsidence, and sea level rise reduce the levee elevations in each levee reach below the required design elevation. In some reaches, levee lifts may need to occur more than once during the period of analysis. Additionally, the project would include floodwall replacements or new floodwall along the existing alignment to be constructed prior to the combined effects causing the design requirements to be exceeded for each structure. Approximately 19 miles of MRL levees will be added as co-located features across both the LPV/WBV project.

The proposed plan also includes targeted areas of foreshore protection along Lake Pontchartrain in areas where foreshore protection already exists. Water-based construction would be required for construction of the foreshore protection along the shore of Lake Pontchartrain. This would require some dredging with a bucket dredge and temporary material stockpiling to provide access to deliver and place the stone for foreshore protection and bring it back up to the required elevation for levee protection. In order to allow construction equipment to access the shoreline, construction access channels would be dredged, and dredged material would be temporarily stockpiled adjacent to the channels. Construction access channels and stockpile areas would be brought back to original elevations subsequent to completion of construction activities. In addition, rock foreshore protection would be placed on top of existing foreshore protection in Lake Pontchartrain to bring the stone back up to the required elevation for proper levee protection.

Area of Potential Effects (APE)
The APE for the proposed project would be limited to the existing right of ways of the HSSDRS and areas surrounding MRL features. The APE for LPV is represented as Figure 1, and the APE for WBV Is represented as Figure 2. The direct and indirect APEs are the same areas as provided for and consulted upon in several of the IERs, noted below, except for the APEs that will be defined as part of the implementation of a programmatic agreement focused on the Mississippi River Levees, discussed further below.

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The WBV APE extends from eastern St. Charles Parish to northern Plaquemines Parish along the right descending bank of the Mississippi River. The APE is part of the Barataria Basin.

Background and Identification
For HSDRRS planning and construction, USACE completed studies of the potentially significant historic properties in the areas that would have been impacted by work associated with HSDRRS corridors. The HSDRRS review was broken into Individual Environmental Reports(IERs) that covered the entire project system. 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. Phase I cultural resource surveys were conducted in the form of pedestrian surface surveys with systematic shovel test pit excavations and delineations of site boundaries, when necessary. Where applicable, Phase II site evaluations were conducted for assessing the National Register of Historic Places (NRHP) eligibility. In all cases, the cultural resource survey areas exceeded the size of the preliminary APE, which allowed the USACE project archaeologists to adjust the APE, as needed, to avoid any damage to historic properties with potential eligibility for the NRHP.

USACE sent letters to the Louisiana SHPO and THPOs of the 12 federally recognized tribes with an interest in the region, 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 avoidance measures. Section 106 consultation for the HSDRRS projects was then concluded.

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L.1065454323
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Date: 2021.03.09 09:00:36 -06'00'
for MARSHALL K. HARPER
Chief, Environmental Planning Branch

CC: File
An electronic copy of this letter with enclosures will be provided to Mrs. Kimberly Walden, M. Ed., Cultural Director/Tribal Historic Preservation Officer, Chitimacha Tribe of Louisiana, kim@chitimacha.gov.
Enclosures

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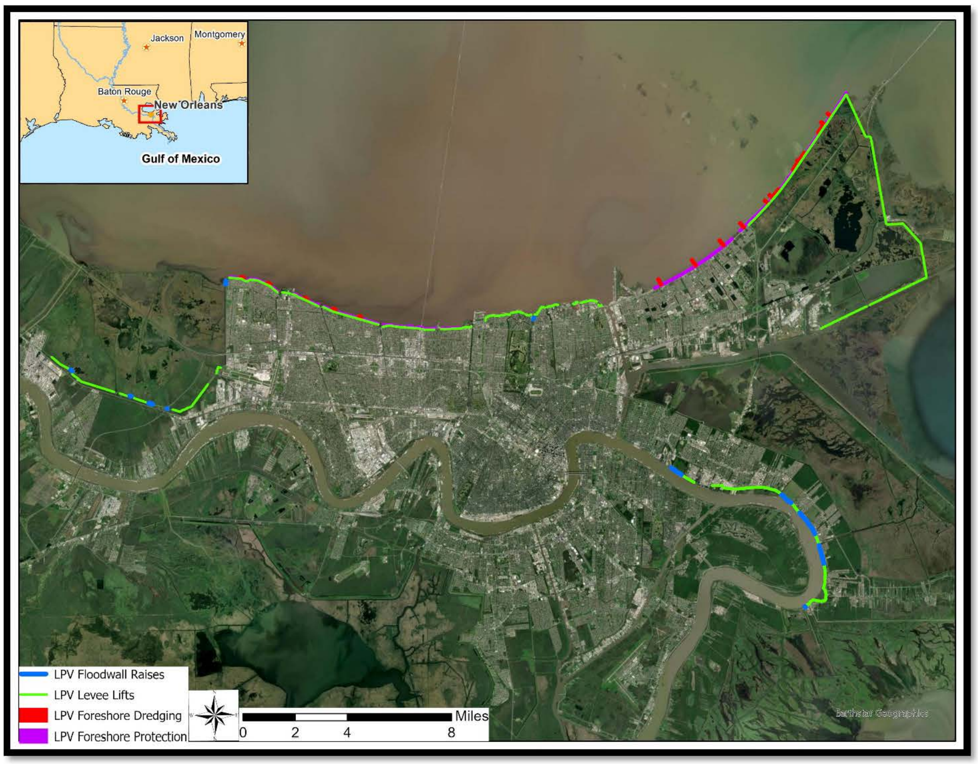
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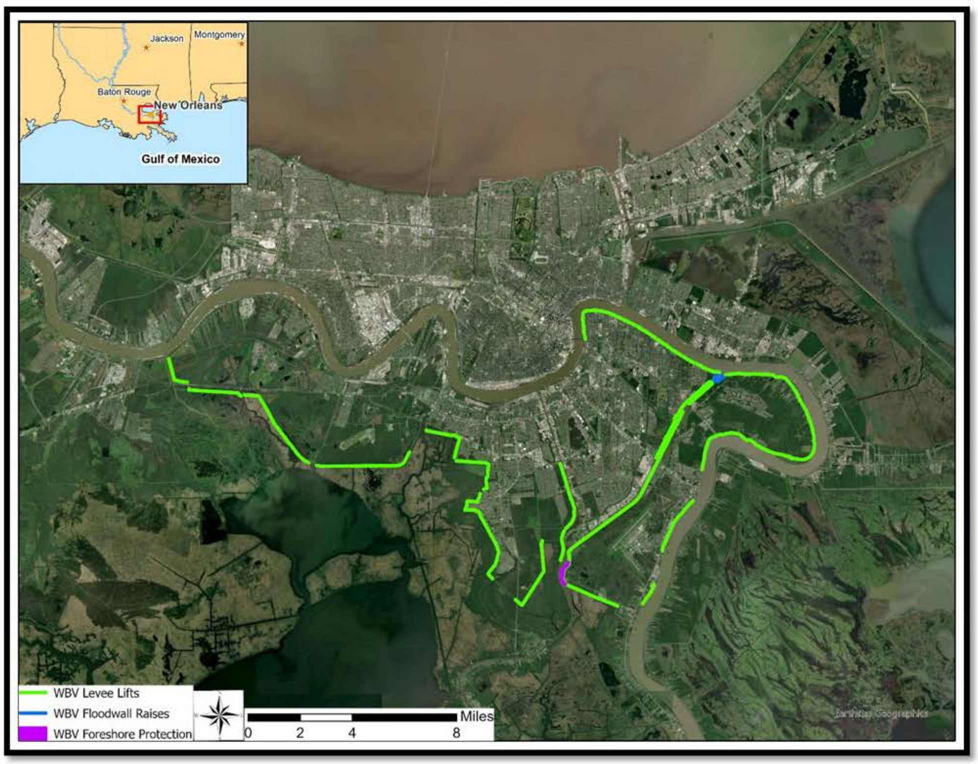
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DEPARTMENT OF THE ARMY
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NEW ORLEANS, LOUISIANA 70118

REPLY TO
ATTENTION OF

Regional Planning and
Environment Division, South
Environmental Planning Branch

B. Cheryl Smith, Principal Chief
Jena Band of Choctaw Indians
P.O. Box 14
Jena, LA 71342

RE: Section 106 Review Consultation
Undertaking: Lake Pontchartrain and Vicinity and West Bank and Vicinity Louisiana General Re-Evaluation Reports with Integrated Environmental Impact Statement.
Determination: No Adverse Effects To Historic Properties

Dear Principal Chief Smith:

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for MARSHALL K. HARPER
Chief, Environmental Planning Branch

CC: File
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Enclosures

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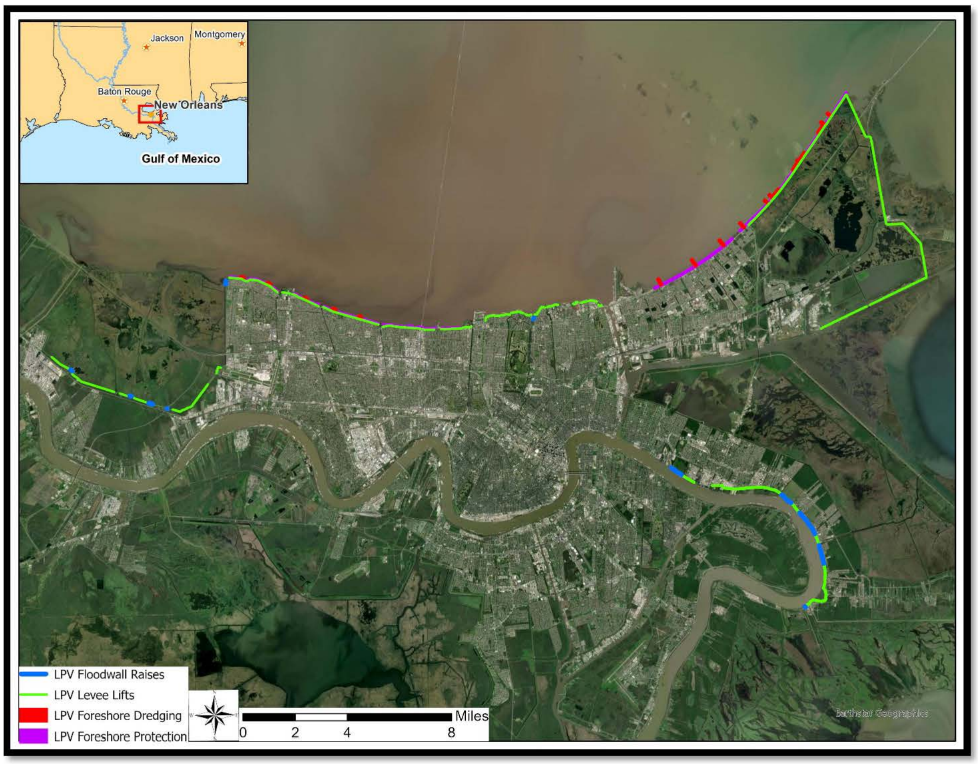
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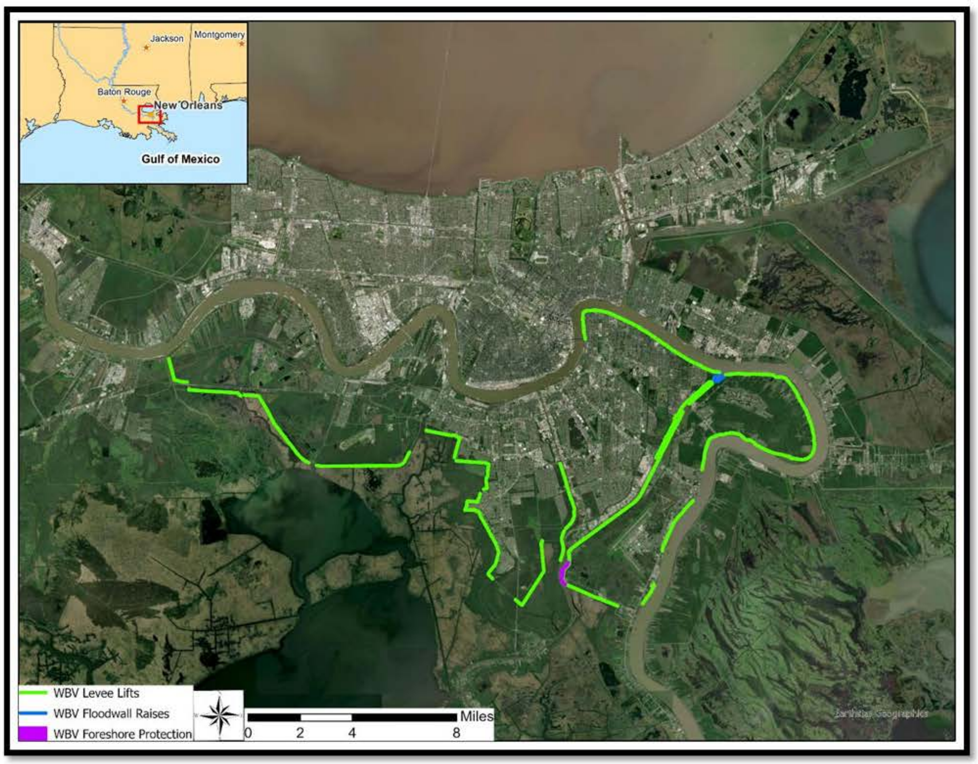
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DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, NEW ORLEANS DISTRICT
7400 LEAKE AVENUE
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REPLY TO
ATTENTION OF

Regional Planning and
Environment Division, South
Environmental Planning Branch

Cyrus Ben, Chief
Mississippi Band of Choctaw Indians
P.O. Box 6257
Choctaw, MS 39350

RE: Section 106 Review Consultation
Undertaking: Lake Pontchartrain and Vicinity and West Bank and Vicinity Louisiana General Re-Evaluation Reports with Integrated Environmental Impact Statement.
Determination: No Adverse Effects To Historic Properties

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Determinations

CEMVN has determined a majority of actions proposed under the LPV/WBV Study were made compliant with section 106 of the NHPA through various IER consultations (IERs #1, #2, #3, #4, #5, #6, #7, #8, #9, #10, #11, #12, #13, #14, #15, #16, #17, #27, and #33); and, pursuant to 36 CFR 800.4 (2) and 800.5(3), CEMVN has phased the identification, evaluation, and determination of effects through implementing the provisions of the MRL SEIS II PA. Most of the proposed actions would be occurring within the existing HSDRSS footprint. These areas have all been subject to surveys as part of previous investigations, including the areas of shoreline protection and dredging on Lake Pontchartrain. All potential work in these areas would be subject to the implementation of the avoidance measures established in the original HSDRSS IER consultations. Therefore, CEMVN has determined a finding of **No Adverse Effect to Historic Properties** for work within these areas and is submitting it to you for your review and comment. The MRL levee work that was not part of the previous HSDRRS IERs, would be subject to further review and follow the processes established as part of the MRL SEIS II PA. CEMVN requests your comments within 30 days.

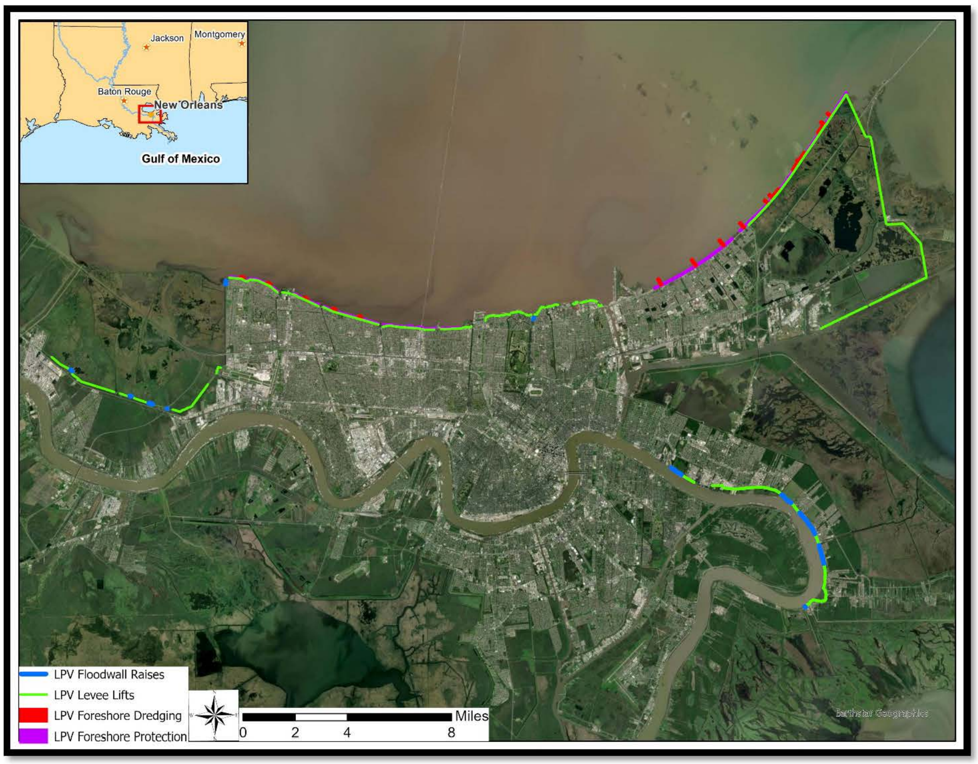
We look forward to your concurrence with this determination. Should you have any questions or need additional information regarding this undertaking, please contact Noah Fulmer at 504-862-1983, or by email at noah.j.fulmer@usace.army.mil, with any questions or concerns you may have regarding this project.

Sincerely,
WILLIAMS.ERIC.MITCHELL.1065454323
Digitally signed by WILLIAMS.ERIC.MITCHELL.1065454323
Date: 2021.03.09 09:01:52 -06'00'
for MARSHALL K. HARPER
Chief, Environmental Planning Branch

CC: File
An electronic copy of this letter with enclosures will be provided to Mr. Kenneth H. Carleton, Tribal Historic Preservation Officer/Archaeologist, Mississippi Band of Choctaw Indians, kcarleton@choctaw.org.

Enclosures

FIGURE 1: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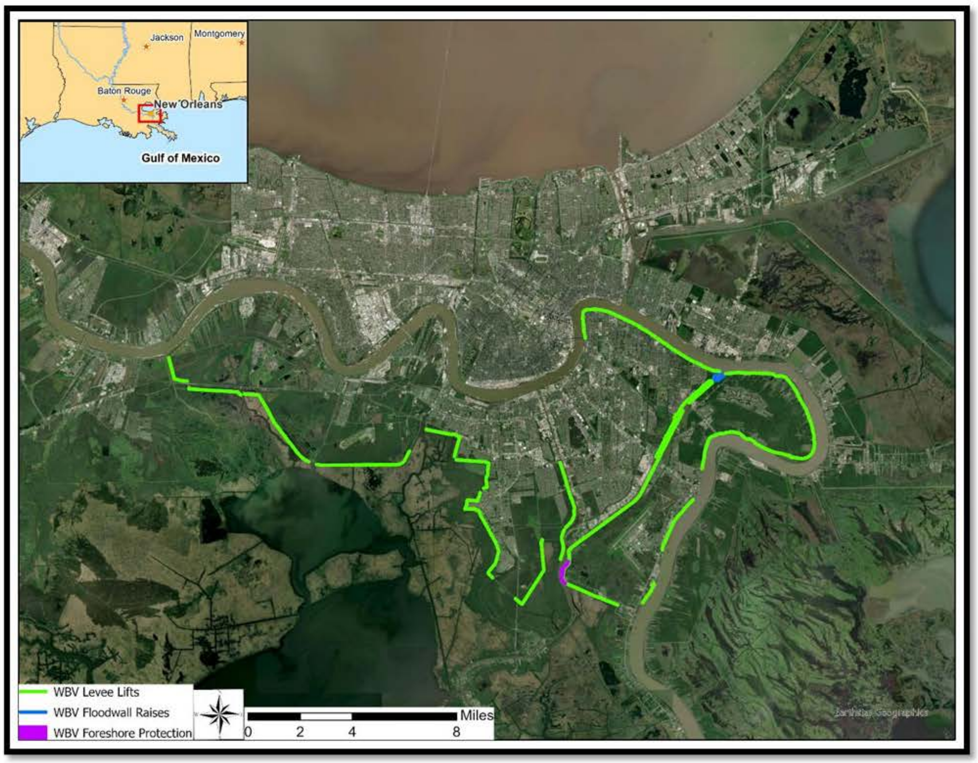
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DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, NEW ORLEANS DISTRICT
7400 LEAKE AVENUE
NEW ORLEANS, LOUISIANA 70118

REPLY TO
ATTENTION OF

Regional Planning and
Environment Division, South
Environmental Planning Branch

Mr. David Hill, Principal Chief
Muscogee (Creek) Nation
Attn: Historic and Cultural Preservation Office
P.O. Box 580
Okmulgee, OK 74447

RE: Section 106 Review Consultation
Undertaking: Lake Pontchartrain and Vicinity and West Bank and Vicinity Louisiana General Re-Evaluation Reports with Integrated Environmental Impact Statement.
Determination: No Adverse Effects To Historic Properties

Dear Principal Chief Hill:

The U.S. Army Corps of Engineers, New Orleans District (CEMVN) is proposing to increase the level of flood risk reduction provided by the Hurricane & Storm Damage Risk Reduction System (HSDRRS) around the New Orleans metropolitan area through a series of levee lifts, floodwall replacements, and foreshore protection. This letter summarizes and confirms the findings of previous HSDRRS consultations from June 2007 to December 2010. The proposed project is located within St. Charles, Jefferson, Orleans, Plaquemines, and St. Bernard Parishes, Louisiana.

In partial fulfillment of responsibilities under the National Environmental Policy Act and Section 106 of the National Historic Preservation Act, the U.S. Army Corps of Engineers, New Orleans District (CEMVN), offers you the opportunity to review and comment on the potential of the proposed action described in this letter to affect historic properties.

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The proposed undertaking has been divided into two sections. The Lake Pontchartrain and Vicinity (LPV) projects refer to the HSDRRS levees, Mississippi River Levees (MRL) and associated features located on the east bank of the Mississippi River. The West Bank and Vicinity (WBV) projects refer to the HSDRRS levees, MRLs and associated features located on the west bank of the Mississippi River.

The construction for all proposed work would generally occur in the same footprint as the existing LPV/WBV project and existing MRL levees. Project features would consist of

levee lifts along the existing levee alignment, with construction timing to occur before the combined effects of consolidation, settlement, subsidence, and sea level rise reduce the levee elevations in each levee reach below the required design elevation. In some reaches, levee lifts may need to occur more than once during the period of analysis. Additionally, the project would include floodwall replacements or new floodwall along the existing alignment to be constructed prior to the combined effects causing the design requirements to be exceeded for each structure. Approximately 19 miles of MRL levees will be added as co-located features across both the LPV/WBV project.

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Chief, Environmental Planning Branch

CC: File
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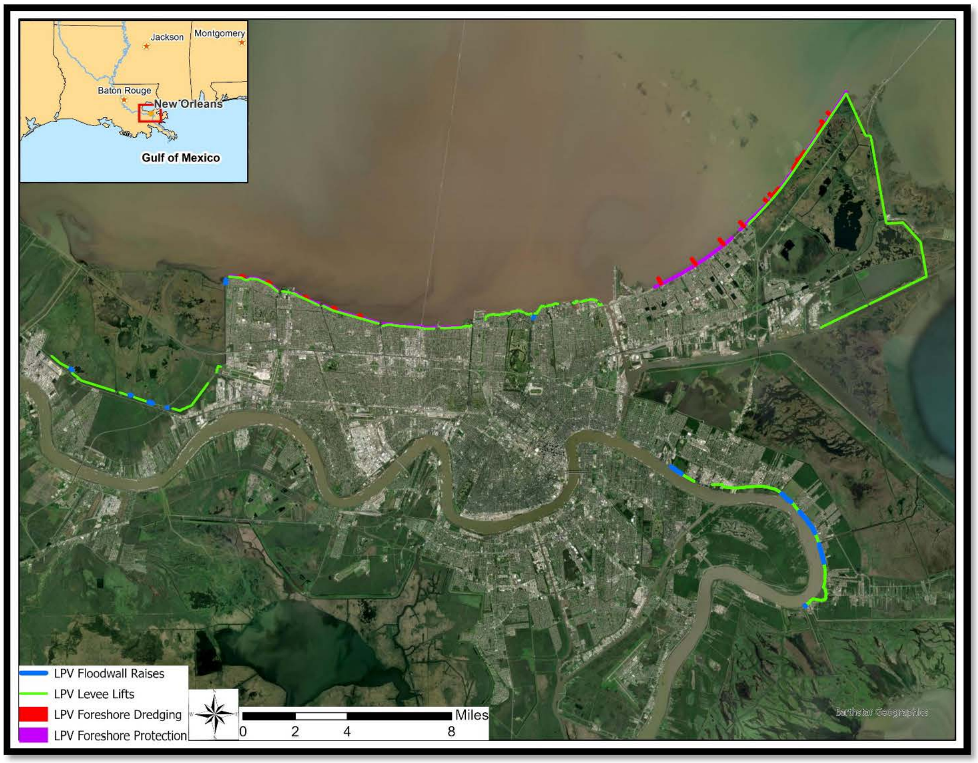
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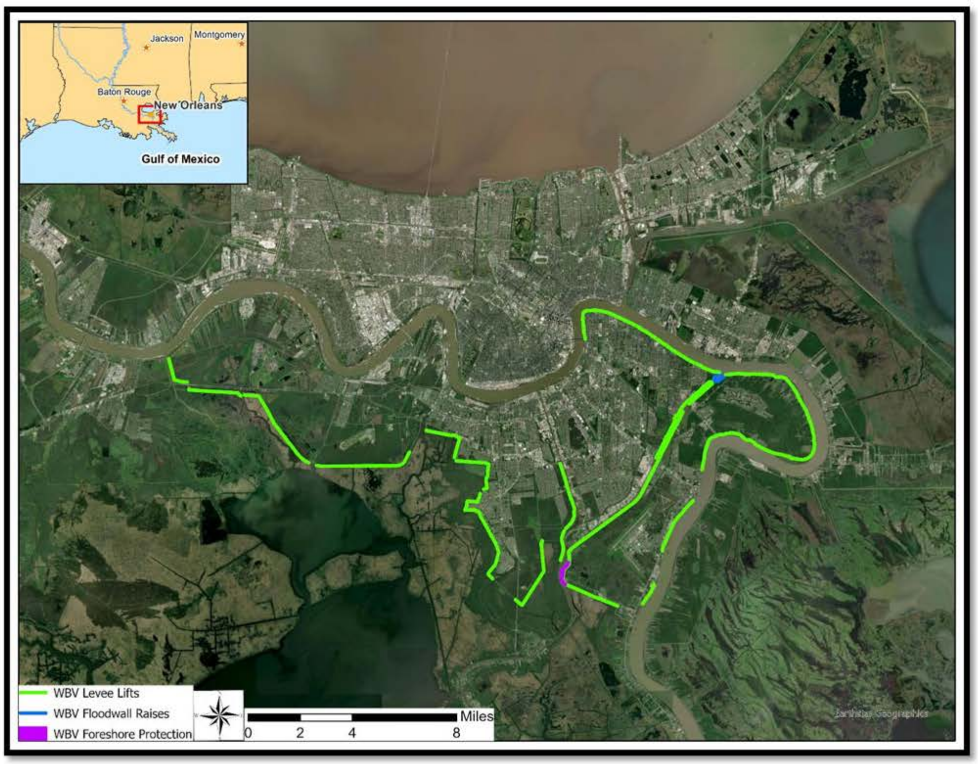
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DEPARTMENT OF THE ARMY
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NEW ORLEANS, LOUISIANA 70118

REPLY TO
ATTENTION OF

Regional Planning and
Environment Division, South
Environmental Planning Branch

Greg Chilcoat, Principal Chief
Seminole Nation of Oklahoma
P.O. Box 1498
Wewoka, OK 74884

RE: Section 106 Review Consultation
Undertaking: Lake Pontchartrain and Vicinity and West Bank and Vicinity Louisiana General Re-Evaluation Reports with Integrated Environmental Impact Statement.
Determination: No Adverse Effects To Historic Properties

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for MARSHALL K. HARPER
Chief, Environmental Planning Branch

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Enclosures

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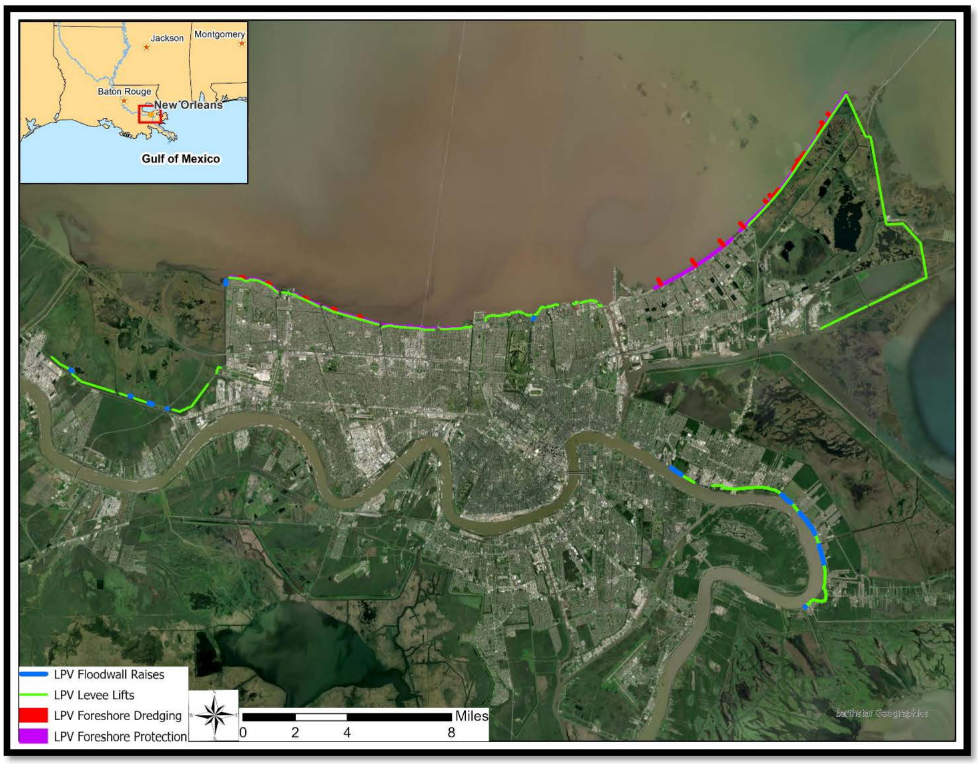
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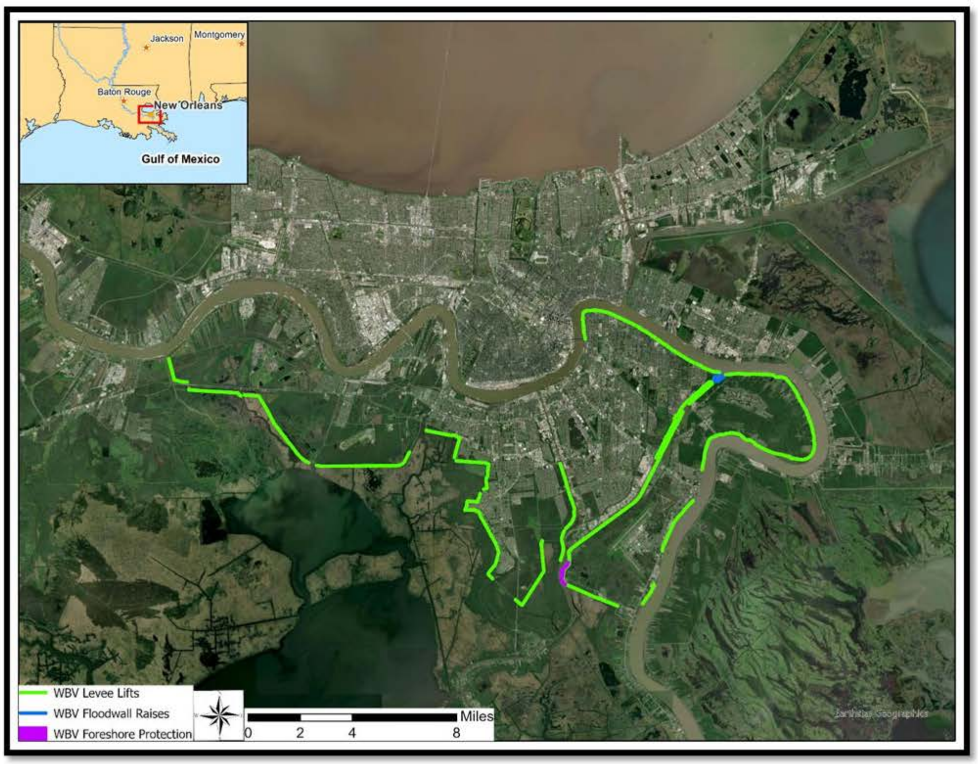
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DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, NEW ORLEANS DISTRICT
7400 LEAKE AVENUE
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REPLY TO
ATTENTION OF

Regional Planning and
Environment Division, South
Environmental Planning Branch

Marcellus W. Osceola, Chairman
Seminole Tribe of Florida
6300 Sterling Road
Hollywood, FL 33024

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Determination: No Adverse Effects To Historic Properties

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Determinations
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We look forward to your concurrence with this determination. Should you have any questions or need additional information regarding this undertaking, please contact Noah Fulmer at 504-862-1983, or by email at noah.j.fulmer@usace.army.mil, with any questions or concerns you may have regarding this project.

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for MARSHALL K. HARPER
Chief, Environmental Planning Branch

CC: File
An electronic copy of this letter with enclosures will be provided to Dr. Paul N. Backhouse, Tribal Historic Preservation Officer, Seminole Tribe of Florida, THPOCompliance@semtribe.com.
Enclosures

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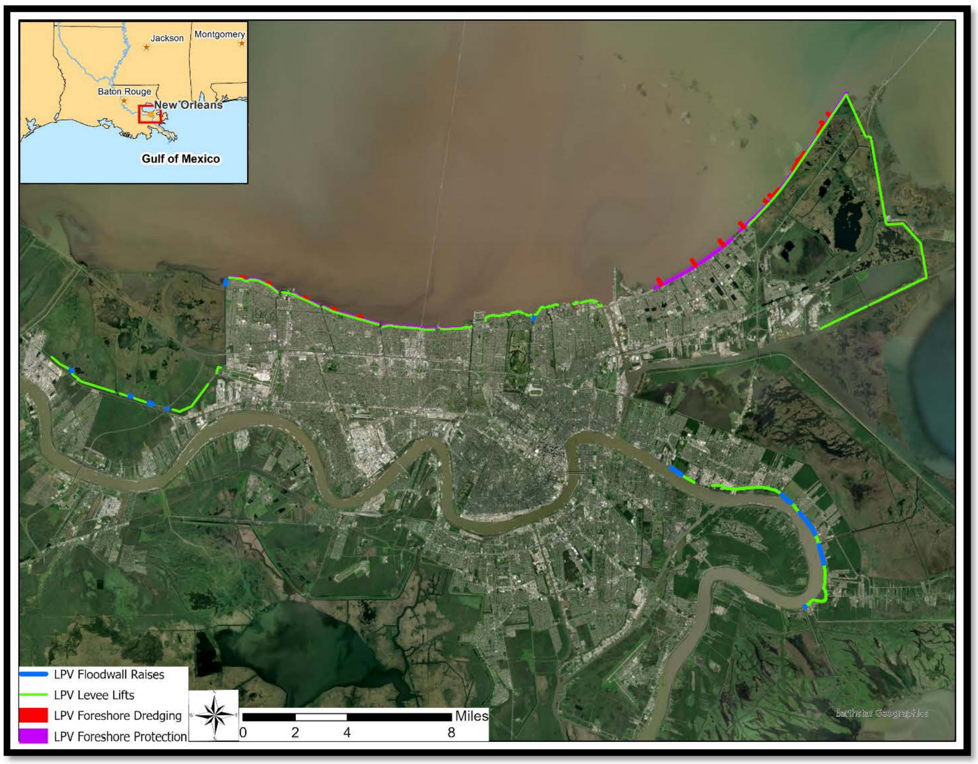
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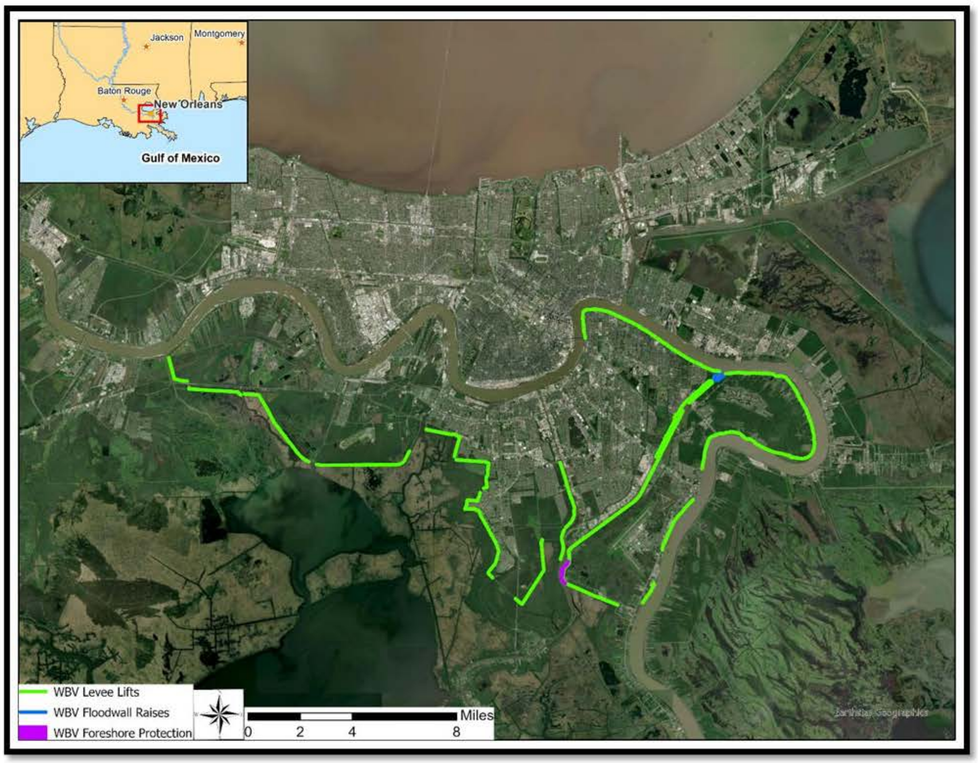
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DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, NEW ORLEANS DISTRICT
7400 LEAKE AVENUE
NEW ORLEANS, LOUISIANA 70118

REPLY TO
ATTENTION OF

Regional Planning and
Environment Division, South
Environmental Planning Branch

Joey Barbry, Chairman
Tunica-Biloxi Tribe of Louisiana
P.O. Box 1589
Marksville, LA 71351

RE: Section 106 Review Consultation
Undertaking: Lake Pontchartrain and Vicinity and West Bank and Vicinity Louisiana General Re-Evaluation Reports with Integrated Environmental Impact Statement.
Determination: No Adverse Effects To Historic Properties

Dear Chairman Barbry:

The U.S. Army Corps of Engineers, New Orleans District (CEMVN) is proposing to increase the level of flood risk reduction provided by the Hurricane & Storm Damage Risk Reduction System (HSDRRS) around the New Orleans metropolitan area through a series of levee lifts, floodwall replacements, and foreshore protection. This letter summarizes and confirms the findings of previous HSDRRS consultations from June 2007 to December 2010. The proposed project is located within St. Charles, Jefferson, Orleans, Plaquemines, and St. Bernard Parishes, Louisiana.

In partial fulfillment of responsibilities under the National Environmental Policy Act and Section 106 of the National Historic Preservation Act, the U.S. Army Corps of Engineers, New Orleans District (CEMVN), offers you the opportunity to review and comment on the potential of the proposed action described in this letter to affect historic properties.

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The proposed undertaking has been divided into two sections. The Lake Pontchartrain and Vicinity (LPV) projects refer to the HSDRRS levees, Mississippi River Levees (MRL) and associated features located on the east bank of the Mississippi River. The West Bank and Vicinity (WBV) projects refer to the HSDRRS levees, MRLs and associated features located on the west bank of the Mississippi River.

The construction for all proposed work would generally occur in the same footprint as the existing LPV/WBV project and existing MRL levees. Project features would consist of

levee lifts along the existing levee alignment, with construction timing to occur before the combined effects of consolidation, settlement, subsidence, and sea level rise reduce the levee elevations in each levee reach below the required design elevation. In some reaches, levee lifts may need to occur more than once during the period of analysis. Additionally, the project would include floodwall replacements or new floodwall along the existing alignment to be constructed prior to the combined effects causing the design requirements to be exceeded for each structure. Approximately 19 miles of MRL levees will be added as co-located features across both the LPV/WBV project.

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for MARSHALL K. HARPER
Chief, Environmental Planning Branch

CC: File
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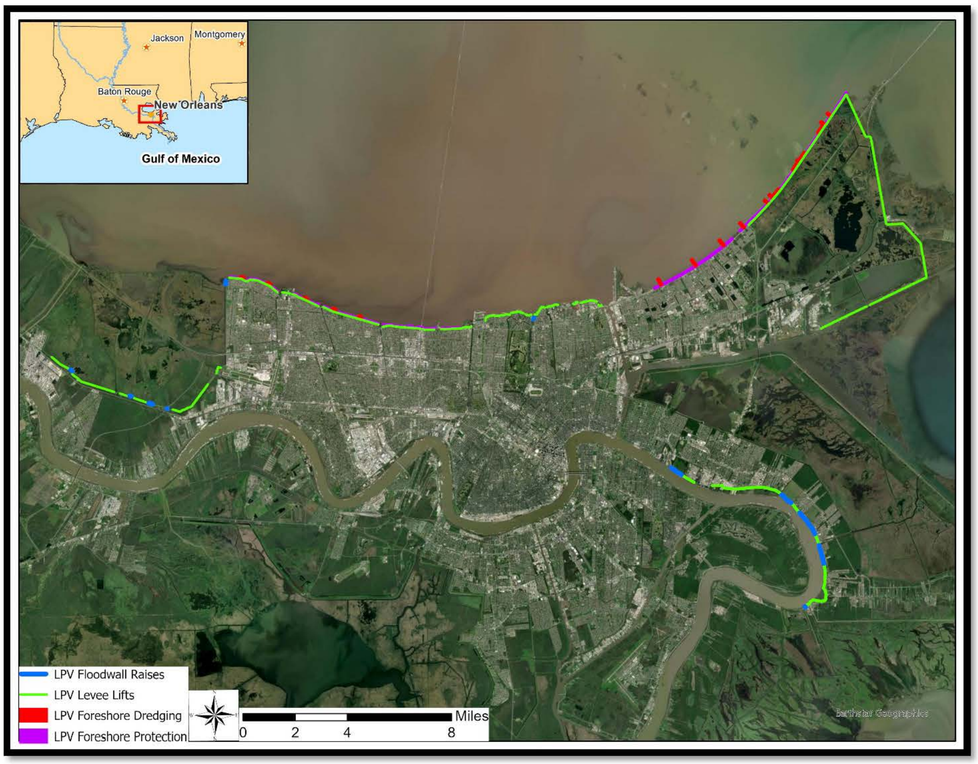
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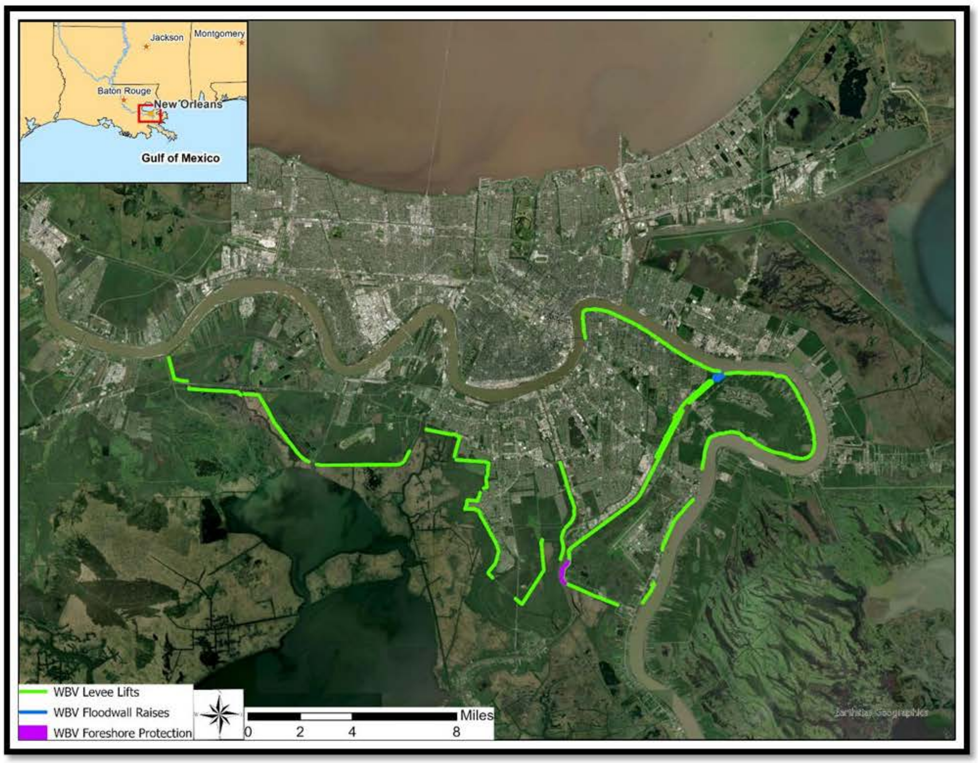
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DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, NEW ORLEANS DISTRICT
7400 LEAKE AVENUE
NEW ORLEANS, LOUISIANA 70118

REPLY TO
ATTENTION OF

Regional Planning and
Environment Division, South
Environmental Planning Branch

Kristin Sanders, SHPO
LA State Historic Preservation Officer
P.O. Box 44247
Baton Rouge, LA 70804-4241

RE: Section 106 Review Consultation
Undertaking: Lake Pontchartrain and Vicinity and West Bank and Vicinity Louisiana General Re-Evaluation Reports with Integrated Environmental Impact Statement.
Determination: No Adverse Effects To Historic Properties

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Chief, Environmental Planning Branch

CC: File

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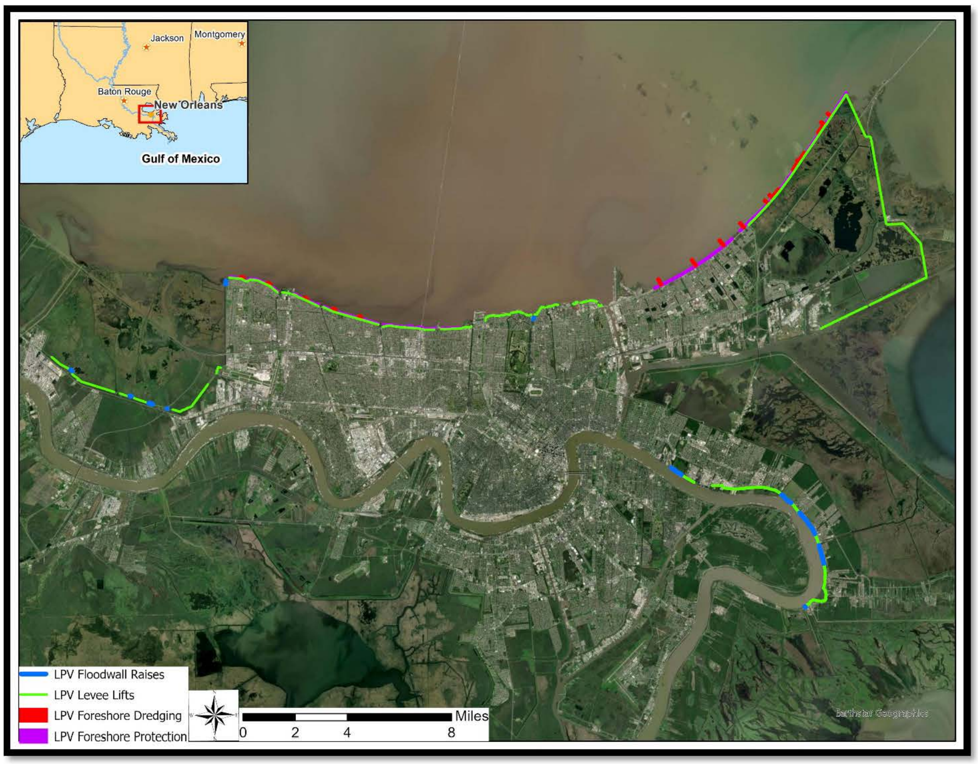
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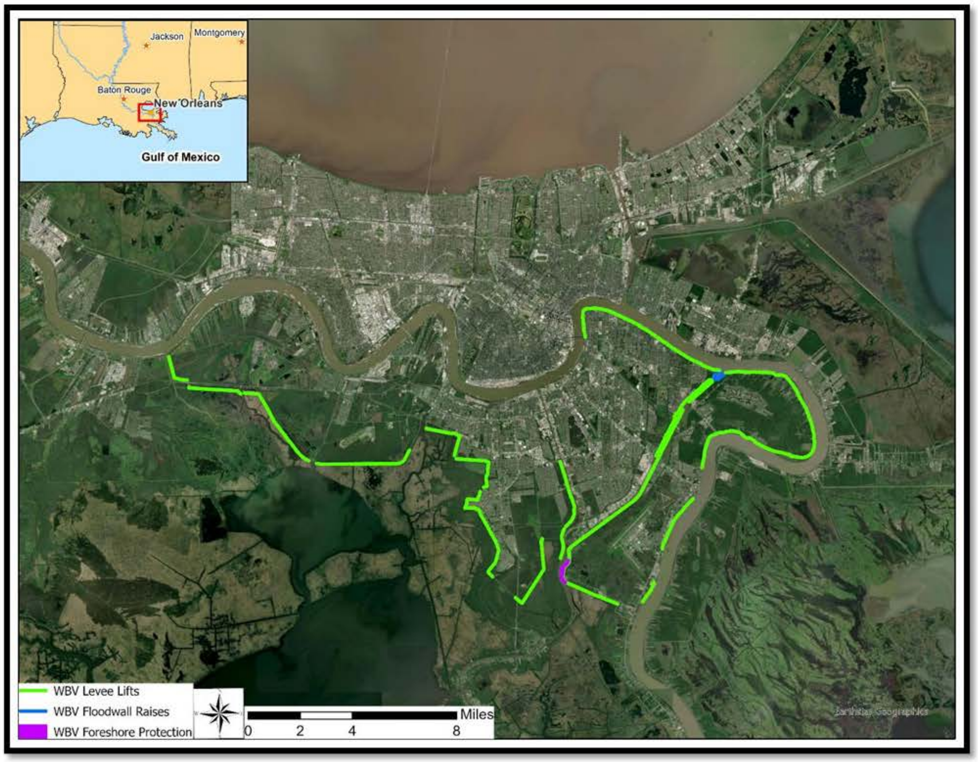
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7.6 SHPO CONCURRENCE

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, NEW ORLEANS DISTRICT
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REPLY TO
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The proposed undertaking will have no adverse effect on historic properties. Therefore, our office has no objection to the implementation of this project. This effect determination could change should new information come to our attention.

Kristin P. Sanders

Kristin P. Sanders Deputy
State Historic Preservation Officer

Date 03/22/2021

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In partial fulfillment of responsibilities under the National Environmental Policy Act and Section 106 of the National Historic Preservation Act, the U.S. Army Corps of Engineers, New Orleans District (CEMVN), offers you the opportunity to review and comment on the potential of the proposed action described in this letter to affect historic properties.

Description of the Undertaking
The proposed undertaking has been divided into two sections. The Lake Pontchartrain and Vicinity (LPV) projects refer to the HSDRRS levees, Mississippi River Levees (MRL) and associated features located on the east bank of the Mississippi River. The West Bank and Vicinity (WBV) projects refer to the HSDRRS levees, MRLs and associated features located on the west bank of the Mississippi River.

The construction for all proposed work would generally occur in the same footprint as the existing LPV/WBV project and existing MRL levees. Project features would consist of

levee lifts along the existing levee alignment, with construction timing to occur before the combined effects of consolidation, settlement, subsidence, and sea level rise reduce the levee elevations in each levee reach below the required design elevation. In some reaches, levee lifts may need to occur more than once during the period of analysis. Additionally, the project would include floodwall replacements or new floodwall along the existing alignment to be constructed prior to the combined effects causing the design requirements to be exceeded for each structure. Approximately 19 miles of MRL levees will be added as co-located features across both the LPV/WBV project.

The proposed plan also includes targeted areas of foreshore protection along Lake Pontchartrain in areas where foreshore protection already exists. Water-based construction would be required for construction of the foreshore protection along the shore of Lake Pontchartrain. This would require some dredging with a bucket dredge and temporary material stockpiling to provide access to deliver and place the stone for foreshore protection and bring it back up to the required elevation for levee protection. In order to allow construction equipment to access the shoreline, construction access channels would be dredged, and dredged material would be temporarily stockpiled adjacent to the channels. Construction access channels and stockpile areas would be brought back to original elevations subsequent to completion of construction activities. In addition, rock foreshore protection would be placed on top of existing foreshore protection in Lake Pontchartrain to bring the stone back up to the required elevation for proper levee protection.

Area of Potential Effects (APE)
The APE for the proposed project would be limited to the existing right of ways of the HSSDRS and areas surrounding MRL features. The APE for LPV is represented as Figure 1, and the APE for WBV Is represented as Figure 2. The direct and indirect APEs are the same areas as provided for and consulted upon in several of the IERs, noted below, except for the APEs that will be defined as part of the implementation of a programmatic agreement focused on the Mississippi River Levees, discussed further below.

The LPV APE is located within the coastal zone on the east bank of the Mississippi River south of Lake Pontchartrain within St. Charles, Jefferson, Orleans, and St. Bernard parishes in southeast Louisiana. The western end of the LPV APE abuts the Bonnet Carré spillway. The eastern end of the APE is located in the Bayou Sauvage National Wildlife Refuge and along the now deauthorized Mississippi River Gulf Outlet (MRGO).

The WBV APE extends from eastern St. Charles Parish to northern Plaquemines Parish along the right descending bank of the Mississippi River. The APE is part of the Barataria Basin.

Background and Identification
For HSDRRS planning and construction, USACE completed studies of the potentially significant historic properties in the areas that would have been impacted by work associated with HSDRRS corridors. The HSDRRS review was broken into Individual Environmental Reports(IERs) that covered the entire project system. 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. Phase I cultural resource surveys were conducted in the form of pedestrian surface surveys with systematic shovel test pit excavations and delineations of site boundaries, when necessary. Where applicable, Phase II site evaluations were conducted for assessing the National Register of Historic Places (NRHP) eligibility. In all cases, the cultural resource survey areas exceeded the size of the preliminary APE, which allowed the USACE project archaeologists to adjust the APE, as needed, to avoid any damage to historic properties with potential eligibility for the NRHP.

USACE sent letters to the Louisiana SHPO and THPOs of the 12 federally recognized tribes with an interest in the region, 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 avoidance measures. Section 106 consultation for the HSDRRS projects was then concluded.

A comprehensive summary of these studies, identified cultural resources, and previous Section 106 consultation for HSDRRS construction are presented in IERs #1, #2, #3, #4, #5, #6, #7, #8, #9, #10, #11, #12, #13, #14, #15, #16, #17, #27, and #33 and complied and summarized in the Comprehensive Environmental Document Phase 1.https://www.mvn.usace.army.mil/Missions/Environmental/NEPA-Compliance-Documents/HSDRRS-Projects/.

Consultation History
On December 9, 2019, consultation initiation letters for the LPV/WBV GRR study were sent to the Louisiana SHPO and Alabama-Coushatta Tribe of Texas (ACTT); Caddo Nation (CN); Chitimacha Tribe of Louisiana (CTL); Choctaw Nation of Oklahoma (CNO); Coushatta Tribe of Louisiana (CT); Jena Band of Choctaw Indians (JBCI); Mississippi Band of Choctaw Indians (MBCI); Muscogee (Creek) Nation (MCN); Quapaw Tribe of Oklahoma (QTO); Seminole Nation of Oklahoma (SNO); Seminole Tribe of Florida (STF); and Tunica-Biloxi Tribe of Louisiana (TBTL), (Tribes). The letters outlined how the proposed LPV/WBV levee lifts would fit within the previous consultations conducted for the individual IERs and that new potential impacts would be subjected to standard Section 106 of the NHPA review procedures.

After sending the initiation letter, USACE determined that the new potential impacts of the LPV/WBV GRR could be addressed by the programmatic agreement being developed for the Mississippi River Levee Supplemental Environmental Impact Statement (MRL SEIS II).

At a meeting on January 15, 2020, USACE proposed to consulting parties the concept of folding the LPV/WBV GRR study into the MRL SEIS PA to avoid a duplication of effort and the creation of redundant agreement documents. LPV/WBV GRR inclusion within the PA was included in discussions during the next 8 consultation meetings and the final update meeting. No party objected. The MRL SEIS II PA was developed over the course of 2020 including the inclusion of LPV/WBV GRR into the document and was executed on March 4, 2021.

Determinations
CEMVN has determined a majority of actions proposed under the LPV/WBV Study were made compliant with section 106 of the NHPA through various IER consultations (IERs #1, #2, #3, #4, #5, #6, #7, #8, #9, #10, #11, #12, #13, #14, #15, #16, #17, #27, and #33); and, pursuant to 36 CFR 800.4 (2) and 800.5(3), CEMVN has phased the identification, evaluation, and determination of effects through implementing the provisions of the MRL SEIS II PA. Most of the proposed actions would be occurring within the existing HSDRSS footprint. These areas have all been subject to surveys as part of previous investigations, including the areas of shoreline protection and dredging on Lake Pontchartrain. All potential work in these areas would be subject to the implementation of the avoidance measures established in the original HSDRSS IER consultations. Therefore, CEMVN has determined a finding of **No Adverse Effect to Historic Properties** for work within these areas and is submitting it to you for your review and comment. The MRL levee work that was not part of the previous HSDRRS IERs, would be subject to further review and follow the processes established as part of the MRL SEIS II PA. CEMVN requests your comments within 30 days.

We look forward to your concurrence with this determination. Should you have any questions or need additional information regarding this undertaking, please contact Noah Fulmer at 504-862-1983, or by email at noah.j.fulmer@usace.army.mil, with any questions or concerns you may have regarding this project.

Sincerely,

for MARSHALL K. HARPER
Chief, Environmental Planning Branch

CC: File
An electronic copy of this letter with enclosures will be provided to the Section 106 Inbox, section106@crt.la.gov.

Enclosures

2021

Lake Pontchartrain & Vicinity GRR
Appendix H – HTRW

US Army Corps of Engineers
New Orleans District

U.S. Army Corps of Engineers, New Orleans District

Non-Federal Sponsor: Coastal Protection and Restoration Authority Board of Louisiana

March 2021

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LAKE PONTCHARTRAIN & VICINITY GRR
APPENDIX H – HTRW

USACE regulations (Engineering Regulation (ER) 1165-2-132 and ER 200-2-3) and USACE New Orleans policy require procedures be established to facilitate early identification and appropriate consideration of potential HTRW in feasibility, preconstruction engineering and design, land acquisition, construction, operations and maintenance, repairs, replacement, and rehabilitation phases of water resources studies or projects by conducting HTRW Phase I Environmental Site Assessments (ESAs). USACE specifies that these assessments follow the process/standard practices for conducting Phase I ESAs published by the American Society for Testing and Materials (ASTM). This assessment was prepared using the following ASTM Standards:

- E1527-13: Standard Practice for Environmental Site Assessments – Phase I Environmental Site Assessment process
- E1528-06: Standard Practice for Limited Environmental Due Diligence: Transaction Screen Process (interview questionnaires)
- E2247-08 Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process for Forestland or Rural Property

The purpose of a Phase I ESA is to identify, to the extent feasible in the absence of sampling and analysis, the range of contaminants within the scope of the USEPA Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and petroleum products.

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 $14.6 billion, with restoration, accelerated construction, improvements, and enhancements of various risk reduction projects and ecosystem restoration projects within southeastern Louisiana. With the completion of the levees, floodwalls, gates, and pumps that together form the LPV and WBV, 1% AEP level of hurricane and storm damage risk reduction was brought to the areas within LPV and WBV. At this time, Phase I ESAs were performed for the selected project features and Recognized Environmental Conditions (RECs) were identified and remediated or avoided prior to construction. Some RECs were identified in the Phase I ESAs within the Rights-of-Way (ROW) for the LPV, 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.

During the feasibility phase, an abridged Phase I ESA was performed to determine the potential for HTRW problems which could impact or be impacted by potential project features. This abridged Phase I ESA was conducted in the current HSDRRS levee and floodwall ROW and the results are presented directly below. The abridged Phase I ESA included the following tasks: 1) the review of previous HSDRRS HTRW Phase I ESAs to identify previously recorded RECs that may have been found prior to the construction of the HSDRRS features and 2) a field survey to determine if new RECs are within the HSDRRS levee and floodwall ROW.

The abridged Phase I ESA tasks and results are:

Task 1 Results – According to the 2013 HSDRRS CED Phase I Volume I, RECs were avoided and the probability of encountering HTRW in the project area was low, and 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. After a thorough review of previous Phase I ESAs related to the original HSDRRS construction, only one REC was found within the LPV floodwall ROW. This was an abandoned drum filled with unknown material located on the canal side of the West Return Levee Floodwall (drum coordinates: 30º00’29.8” N, 90º16’45.9” W). The contractor recommended the removal and disposal of all wastes and vehicles and soil sampling near drums and vehicles to confirm no impact from spills/leaks. These actions would have been completed prior to any construction activities. Other than this one abandoned drum, the previous Phase I ESAs indicate that no RECS fell within the LPV levee or floodwall ROWs.

Task 2 Results – USACE study team personnel made a site visit to the LPV levee and floodwall ROWs on 03 April 2019, 04 April 2019, and 10 April 2019. The LPV levee and floodwall ROWs were inspected for the presence of pipes, containers, tanks or drums, ponds or lagoons, car bodies, tires, refrigerators, trash dumps, electrical equipment, oil drilling equipment, gas or oil wells, discoloration of vegetation or water sheens, discoloration of soils, out-of-place dirt mounds or depressions in the landscape, evidence of fire, stressed soils with lack of vegetation, discoloration of vegetation, animal remains, unusual animal behavior, biota indicative of a disturbed environment, and odors indicative of poor water quality or chemical presence. None of the aforementioned indicators were found during the site visits. Specifically, the REC location discovered under Task 1 above was visited on 03 April 2019, and the abandoned drum filled with unknown material was no longer present at the location. As mentioned above, REC removal and/or remediation would have occurred prior to HSDRRS construction activities.

2021

Lake Pontchartrain & Vicinity GRR
Appendix I - Cost Engineering
(Including Cost & Schedule Risk Analysis Report)

US Army Corps of Engineers
New Orleans District

U.S. Army Corps of Engineers, New Orleans District

Non-Federal Sponsor: Coastal Protection and Restoration Authority Board of Louisiana

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LAKE PONTCHARTRAIN AND VICINITY GENERAL RE-EVALUATION REPORT
COST ENGINEERING APPENDIX

TABLE OF CONTENTS

MII ESTIMATE

CSRA Risk Register See Risk Report

TOTAL PROJECT COST AND SCHEDULE

SCHEDULE

1. LAKE PONTCHARTRAIN AND VICINITY COST

1.1. GENERAL

COST ESTIMATE DEVELOPMENT

Alternative cost estimates were developed at a Class 4 Level of effort utilizing Parametric/Historical costs or the latest TRACES MII cost estimating software. The cost estimates used the standard approaches for a feasibility estimate structure regarding labor, equipment, materials, crews, unit prices, quotes, sub- and prime contractor markups. This philosophy was taken wherever practical within the time constraints. It was supplemented with estimating information from other sources where necessary such as quotes, bid data, and historical data. The intent was to provide or convey a “fair and reasonable” estimate that which depicts the local market conditions. The estimates assume a typical application of tiering subcontractors. All of the construction work (e.g., Embankment, Borrow Development, Excavation, Floodwalls, Pilings, Rock, Armoring etc.) is common to the gulf coast region. The construction sites are accessible from land. Access is easily provided from various local highways.

ESTIMATE STRUCTURE

The estimates are structured to reflect the projects performed. The estimates have been subdivided by alternative and USACE feature codes.

BID COMPETITION

It is assumed that there will not be an economically saturated market and that bidding competition will be present.

CONTRACT ACQUISITION STRATEGY

There is no declared contract acquisition plan/types at this time. Although it has not been declared, it is anticipated to be Hubzone or 8a small business.

LABOR SHORTAGES

It is assumed there will be a normal labor market.

LABOR RATES

Local labor market wages are above the local Davis-Bacon Wage Determination and actual rates have been used.

MATERIALS

Cost quotes are used on major construction items when available. Material prices quotes were taken from previous job or historical data. The estimate does anticipate government furnished materials.

QUANTITIES

Quantities for Levees were provided by MVN Civil Branch and quantities for Floodwalls was provided from MVN Structures Branch.

EQUIPMENT

Rates used are based from the latest USACE EP-1110-1-8, Region VI. Adjustments are made for fuel and facility capital cost of money (FCCM Full FCCM/Cost of Money rate is latest available; Mii program takes EP recommended discount, no other adjustments have been made to the FCCM. Equipment was chosen based on historical knowledge of similar projects.

SEVERE RATES

No Severe Rates were used.

FUELS

Fuels (gasoline, on and off-road diesel) were based on local market averages for on-road and off-road for the Gulf Coast area. Used latest fuel price attained.

CREWS

Major crew and productivity rates were developed and studied by senior USACE estimators familiar with the type of work. All of the work is typical to the gulf coast area and New Orleans District cost engineers. The crews and productivities were checked by local MVN estimators, discussions with contractors and comparisons with historical cost data and adjusted as necessary. Major crews include haul, earthwork, piling, armoring, floodwalls and concrete slope pavement.

Most crew work hours are assumed to be 10 hours 6 days/week which is typical to the area.

UNIT PRICES/BID PRICES

The unit prices/bid prices found within the various project estimates will fluctuate within a range between similar construction units such as floodwall concrete, armoring, concrete slope pavement, transitions and piling. Variances are a result of differing haul distances (trucked), small or large business markups, subcontracted items, designs and estimates by others.

RELOCATION COSTS

No Relocations.

MOBILIZATION

Contractor mobilization and demobilization are based on the assumption that most of the contractors will be coming from within the gulf coast/southern region. Mob/demob costs are based on historical studies of detailed Government estimate mob/demob which are in the range of approximately 3-5% of the construction costs. With undefined acquisition strategies and assumed individual project limits, the estimate utilizes a 5% value for Levees and 3% for Floodwalls at each contract.

FIELD OFFICE OVERHEAD

The estimate used a field office overhead rate based on the average of relevant armoring jobs and MRL. The reason this was done is because similar work is being done in the same areas. The job office overhead should also be similar.

OVERHEAD ASSUMPTIONS

Overhead assumptions may include superintendent, office manager, pickups, periodic travel, costs, communications, temporary offices (contractor and government), office furniture, office supplies, computers and software, as-built drawings and minor designs, tool trailers, staging setup, camp/facility/kitchen maintenance and utilities, utility service, toilets, safety equipment, security and fencing, small hand and power tools, project signs, traffic control, surveys, temp fuel tank station, generators, compressors, lighting, and minor miscellaneous.

HOME OFFICE OVERHEAD

Estimate percentages range based upon consideration of 8(a), small business and unrestricted prime contractors. The rates are based upon estimating and negotiating experience, and consultation with local construction representatives. Different percent are used when considering the contract acquisition strategy regarding small business 8(a), competitive small business and large business, high to low respectively. This project will assume an acquisition strategy of small business and assume a Home Office Overhead of 8%.

TAXES

Local taxes will be applied based on the parishes that contain the work. Reference the tax rate website for Louisiana: http://www.salestaxstates.com. The contracts are in many different parishes. Usually the tax rate ranges from 8 to 10%. For this project it was decided to use 9%.

BOND

Bond is assumed 1.5% applied against the prime contractor, assuming large contracts. No differentiation was made between large and small businesses.

PLANNING, ENGINEERING & DESIGN (PED)

The PED cost includes such costs as project management, engineering, planning, designs, investigations, studies, reviews, value engineering and engineering during construction (EDC). Historically a rate of approximately 12% for E&D plus small percentages for other support features is applied against the estimated construction costs. Other USACE civil works districts such as St. Paul, Memphis, and St. Louis have reported values ranging from 10-15% for E&D. Additional support features might include project management, engineering, planning, designs, investigations, studies, reviews, and value engineering. This project used 14% which was provided by the PM.

SUPERVISION & ADMINISTRATION (S&A)

Historically a range from 5% to 15% depending on project size and type applied against the estimated construction costs. Other USACE civil works districts such as St. Paul, Memphis, and St. Louis report values ranging from 7.5-10%. Consideration includes that a portion of the S&A effort could be performed by contractors. S&A costs are percentage based. This project has an S&A of 9% provided by the PM.

CONTINGENCIES

Contingencies were developed using the USACE Abbreviated Cost Risk Analysis (ARA) program based on cost risks determined by the PDT. The contingency for is 33%. For more information see risk report.

ESCALATION

Escalation used is based upon the latest version of the US Army Corps of Engineers Engineering Manual (EM) 1110-2-1304 Civil Works Construction Cost Index System (CWCCIS).

HTRW

The estimate does not include costs for any potential Hazardous, Toxic, and Radioactive Waste (HTRW) due to lack of any concerns.

SCHEDULE

The project schedule has been developed. The CSRA and TPCS has taken schedule into account. Schedule can be found in appendix.

1.2. SELECTED PLAN COST ESTIMATE

Table 1 show the baseline project cost for the Selected Plan This information is taken from the Total Project Cost Sheet (TPCS).

Table 1: LPV GRR 1% Alternative

Feature	Cost	Contingency	Total
01 Lands & Damages	$6,858	25%	$8,573
06 Fish & Wildlife Facilities	$2,230	33%	$2,966
11 Floodwall and Levee	$454,016	33%	$603,841
11 Floodwall and Levee	$214,345	33%	$285,079
30 PED	$93,883	33%	$124,864
31 Construction Management	$60,353	33%	$80,270
TOTAL	$831,685		$1,105,593

1.3. LEVEL III COST ESTIMATE

A level III cost estimate was completed on the further refined feasibility level of design after all review comments were received and the agency has endorsed the tentatively selected plan. After the higher level estimate was completed, cost was entered into the Cost Schedule Risk Analysis (CSRA). A CSRA is a report that uses probabilistic cost and schedule risk analysis methods within the framework of the Crystal Ball software. The risk analysis results are intended to serve several functions, one being the establishment of reasonable contingencies reflective of an 80 percent confidence level to successfully accomplish the project work within that established contingency amount. Furthermore, the scope of the report includes the identification and communication of important steps, logic, key assumptions, limitations, and decisions to help ensure that risk analysis results can be appropriately interpreted.

LPV GRR INTERM

Estimated by	Steven Lowrie
Designed by	Lauren Hatten
Prepared by	Steven Lowrie
Preparation Date	7/6/2021
Effective Date of Pricing	7/6/2021
Estimated Construction Time	Days

Date	Author	Note
10/21/2019	Notes	Assumption and Notes:Properties:1. Latest Labor template was used.2. Latest Equipment template was used. MII Equipment 2016 Region 033. Latest Cost Book was used. 2016 MII English Cost Book4. Fuel Price quote from 2020. 5. CMR: 1.1256. Sales Tax: 9%Markups:1. Ignore Index Dates. Since this project has lots of different year escalation, it was assume escalation will be done by fiscal year. FY xx to FY19.2. Field Office Overhead was calculated by taking the average of armoring jobs and relevant LPV jobs.3. Home Office Overhead was assumed to be 8%.4. Profit was assume to be 10%.5. Bond was assume to be 1.5%.6. Subcontractor was assumed to be 15%.6. Overtime: Assume a 6 day work week with a 10 hour day.Mobilization:1. The mobilization and demobilization cost is assume to be 5% of the cost of prime excluding armoring for levees and 3% for Floodwalls. 2. The mobilization and demobilization will be calculated per lift and per contract. Borrow Pit Development:1. The borrow pit was assume to have a 15’ depth2. The pit was assume to have a waste depth of 2’.3. The pit is assume to have Light and Heavy Clearing and Grubbing. Light Clearing and Grubbing quantity is assumed to be 75% of the total pit acres. Heavy Clearing and Grubbing quantity is assumed to be 25% of the total pit acres.4. An access road is assumed to be needed. The length of the road is assumed to be .5 mile long and 20’ wide.5. It was assumed that some light clearing will be need in order to construct the access road.6. The quantity unit of measure is bank cubic yards. The quantities were given in In-Place cubic yards. A 1.25 multiplier was added to the in-place quantity.Embankment, Compacted Fill1. The haul distance was assumed to be an average of 15 miles. The unit of measure for the haul item is Loose Cubic Yards. A 1.5 multiplier was added to the in-place quantity.2. A standard protection rate of 125 Cy/hr was used. 3. 2 Truck wash down rack were assumed to be need per lift.4. Standard testing will be done to embankment material.Silt Fence1. Price quote was given by J.C. Cheek Construction Co. within the last year. The price is an install price. Clearing and Grubbing1. The clearing and grubbing was assumed to be light. The production rate that was used is a standard rate.Fertilizing, Seeding, and Mulching1. Fertilizing, Seeding and Mulching: Price quote was given by J.C. Cheek Construction Co. within the last year. The price is an install price.2. Assumed that Lime and Sulfur Soil Amendment are needed. Lime Soil Amendment quantity was calculated multiplying the AC quantity by 1. Sulfur Soil Amendment quantity was calculated multiplying the AC quantity by .5.Armoring1. Armoring which includes concrete slope pavement, HPTRM and Articulate Concrete Blocks (ACB) will need to be removed and replaced each time a lift is placed.2. Cost Engineering has the abstract or bid schedule for all armoring jobs that will be used in this project. 3. Removal and Disposal of HPTRM price was taken from LPV ARM 02 and escalated to FY 19. Markup and contractor designation already included; therefore, it was not included in the estimate.4. Removal of concrete slope pavement quantity was not quantified. A quantity was calculated through looking at the old drawings of the designated project. The replacement of concrete slope pavement will be taken from another project with markup and contract designation.5. Removal of ACBs or concrete pavements could not be found in the armoring abstract; therefore, a cost to remove was calculated.6. Install Armoring: The cost was taken from the abstracts for the designated armoring project and escalated as needed. Some items needed to be deleted in order to not cost out items twice. Fertilizing, Seeding and Mulching and Surface prep were deleted. The reason these items were deleted is because the quantity given by civil already included these quantities. In MII estimate, 1 Armoring contract would cover 2 or more jobs. The 2 or more jobs were combined into 1 contract, therefore, 1 armoring folder was used for that contract. See quantities and MII estimate. Foreshore Protection1. Cost was taken from LPV 20.2 and escalated. The markup and contracting designation is included.Transitions 1. The transition quantity was give per EA. A transition cost was taken from abstract LPV ARM 06, escalated and used for all transitions. The markup and contracting designation is included.Floodwall 1. Quantities were given by structures per LF.

Currency in US dollars

Description	Quantity	UOM	ContractCost	Contingency	Escalation	ProjectCost
bid schedule summary			**649,205,395.85**	**0.00**	**19,156,037.30**	**668,361,433.16**
			649,205,395.85			*668,361,433.16*
11 Levees and Floodwalls	**1.0000**	**JOB**	**649,205,395.85**	**0.00**	**19,156,037.30**	**668,361,433.16**
			434,860,053.26			*454,016,090.56*
1101 Levees	**1.0000**	**JOB**	**434,860,053.26**	**0.00**	**19,156,037.30**	**454,016,090.56**
			29,984,842.63			*31,969,960.95*
LPV-00.2	**1.0000**	**JOB**	**29,984,842.63**	**0.00**	**1,985,118.31**	**31,969,960.95**
			53,835,434.36			*57,802,334.65*
LPV-01.1 & 02.2	**1.0000**	**JOB**	**53,835,434.36**	**0.00**	**3,966,900.29**	**57,802,334.65**
			6,802,233.14			*7,397,686.11*
LPV-03d.2	**1.0000**	**JOB**	**6,802,233.14**	**0.00**	**595,452.97**	**7,397,686.11**
			37,027,895.84			*38,734,648.04*
LPV-04.2	**1.0000**	**JOB**	**37,027,895.84**	**0.00**	**1,706,752.21**	**38,734,648.04**
			56,033,907.15			*59,647,394.20*
LPV-05.2	**1.0000**	**JOB**	**56,033,907.15**	**0.00**	**3,613,487.05**	**59,647,394.20**
			51,213,911.85			*54,771,977.13*
LPV-19.2 & 20.1	**1.0000**	**JOB**	**51,213,911.85**	**0.00**	**3,558,065.28**	**54,771,977.13**
			36,255,118.56			*38,765,643.46*
LPV-108	**1.0000**	**JOB**	**36,255,118.56**	**0.00**	**2,510,524.89**	**38,765,643.46**
			15,995,098.85			*16,607,800.01*
LPV-109.02a	**1.0000**	**JOB**	**15,995,098.85**	**0.00**	**612,701.16**	**16,607,800.01**
			20,062,187.37			*20,669,222.52*
LPV-111.01	**1.0000**	**JOB**	**20,062,187.37**	**0.00**	**607,035.14**	**20,669,222.52**
			127,649,423.51			*127,649,423.51*
LPV-MRL-1	**1.0000**	**JOB**	**127,649,423.51**	**0.00**	**0.00**	**127,649,423.51**
			214,345,342.59			*214,345,342.59*
1102 Floodwalls	**1.0000**	**JOB**	**214,345,342.59**	**0.00**	**0.00**	**214,345,342.59**
			12,548.66			*12,548.66*
SC01-A1	**702.0000**	**LF**	**8,809,159.25**	**0.00**	**0.00**	**8,809,159.25**
			12,553.34			*12,553.34*
SC04	**378.0000**	**LF**	**4,745,161.21**	**0.00**	**0.00**	**4,745,161.21**
			12,553.69			*12,553.69*
SC04	**394.0000**	**LF**	**4,946,154.28**	**0.00**	**0.00**	**4,946,154.28**
			12,665.28			*12,665.28*
SC04-G	**101.0000**	**LF**	**1,279,193.59**	**0.00**	**0.00**	**1,279,193.59**

Currency in US dollars

Description	Quantity	UOM	ContractCost	Contingency	Escalation	ProjectCost
			12,572.60			*12,572.60*
SC05-FW	**153.0000**	**LF**	**1,923,608.06**	**0.00**	**0.00**	**1,923,608.06**
			12,565.75			*12,565.75*
SC05-FW	**180.0000**	**LF**	**2,261,835.31**	**0.00**	**0.00**	**2,261,835.31**
			12,623.65			*12,623.65*
SC05-G	**42.0000**	**LF**	**530,193.33**	**0.00**	**0.00**	**530,193.33**
			12,552.16			*12,552.16*
SC06	**404.0000**	**LF**	**5,071,071.20**	**0.00**	**0.00**	**5,071,071.20**
			12,567.22			*12,567.22*
SC12-FW1	**122.0000**	**LF**	**1,533,201.19**	**0.00**	**0.00**	**1,533,201.19**
			12,545.55			*12,545.55*
90E-LF	**2,465.0000**	**LF**	**30,924,776.03**	**0.00**	**0.00**	**30,924,776.03**
			13,131.12			*13,131.12*
LPV-MRL-1	**11,600.0000**	**LF**	**152,320,989.13**	**0.00**	**0.00**	**152,320,989.13**

Labor ID: NOLA2021 EQ ID: EP18R03 Currency in US dollars TRACES MII Version 4.4

**** TOTAL PROJECT COST SUMMARY ****

PROJECT: **LPV GRR INTERM**
PROJECT NO: 452002
LOCATION: Lake Pontchartrain Vicinity

DISTRICT: MVN District
POC: CHIEF, COST ENGINEERING, xxx

PREPARED: 7/6/2021

This Estimate reflects the scope and schedule in report; 2021 General Re-Evaluation Report

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)						TOTAL PROJECT COST (FULLY FUNDED)			
						Program Year (Budget EC): 2021 Effective Price Level Date: 1 OCT 20									
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	**TOTAL ($K)**	Spent Thru: **1-Oct-20** ($K)	**TOTAL FIRST COST** ($K)	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*		*K*	*L*	*M*	*N*	*O*
06	FISH & WILDLIFE FACILITIES	$2,230	$736	33.0%	$2,966	0.0%	$2,230	$736	$2,966	$0	$2,966	6.0%	$2,362	$780	$3,142
11	LEVEES & FLOODWALLS	$203,271	$67,080	33.0%	$270,351	0.0%	$203,271	$67,080	$270,351	$0	$270,351	133.4%	$474,367	$156,541	$630,908
11	LEVEES & FLOODWALLS	$128,157	$42,292	33.0%	$170,449	0.0%	$128,157	$42,292	$170,449	$0	$170,449	109.1%	$267,994	$88,438	$356,432
11	LEVEES & FLOODWALLS	$122,587	$40,454	33.0%	$163,041	0.0%	$122,587	$40,454	$163,041	$0	$163,041	208.6%	$378,350	$124,856	$503,206
11	LEVEES & FLOODWALLS	$214,345	$70,734	33.0%	$285,079	0.0%	$214,345	$70,734	$285,079	$0	$285,079	68.2%	$360,579	$118,991	$479,570
08	ROADS, RAILROADS & BRIDGES	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
09	CHANNELS & CANALS	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
10	BREAKWATER & SEAWALLS	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	CONSTRUCTION ESTIMATE TOTALS:	$670,591	$221,295		$891,886	0.0%	$670,591	$221,295	$891,886	$0	$891,886	121.2%	$1,483,652	$489,605	$1,973,258
01	LANDS AND DAMAGES	$6,858	$1,715	25.0%	$8,573	0.0%	$6,858	$1,715	$8,573	$0	$8,573	100.2%	$13,729	$3,432	$17,162
30	PLANNING, ENGINEERING & DESIGN	$93,883	$30,981	33.0%	$124,864	0.0%	$93,883	$30,981	$124,864	$0	$124,864	183.0%	$265,725	$87,689	$353,414
31	CONSTRUCTION MANAGEMENT	$60,353	$19,917	33.0%	$80,270	0.0%	$60,353	$19,917	$80,270	$0	$80,270	193.6%	$177,216	$58,481	$235,698
	PROJECT COST TOTALS:	$831,685	$273,908	32.9%	$1,105,593		$831,685	$273,908	**$1,105,593**	$0	**$1,105,593**	133.3%	$1,940,323	$639,208	$2,579,531

ESTIMATED TOTAL PROJECT COST: $2,579,531

________________________ **CHIEF, COST ENGINEERING, xxx**

________________________ **PROJECT MANAGER, xxx**

________________________ **CHIEF, REAL ESTATE, xxx**

________________________ **CHIEF, PLANNING, xxx**

________________________ **CHIEF, ENGINEERING, xxx**

________________________ **CHIEF, OPERATIONS, xxx**

________________________ **CHIEF, CONSTRUCTION, xxx**

________________________ **CHIEF, CONTRACTING,xxx**

________________________ **CHIEF, PM-PB, xxxx**

________________________ **CHIEF, DPM, xxx**

100 YEAR LEVEL OF RISK REDUCTION

LPV GRR SCHEDULE	Line Item Cost from Cost Input Sheet	Total with Cont. & Esc.	Total (Check)	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070
LEEVES AND ARMORING																																																				
LPV-03d.2																																																				
LPV-04.2																																																				
LPV-05.2																																																				
LPV-00.2																																																				
LPV-01.2 & 02.2																																																				
LPV-19.2 & 20.1																																																				
LPV-MRL-1																																																				
LPV-108																																																				
LPV-109.02a																																																				
LPV111.01																																																				
Floodwall																																																				
SC01-A1																																																				
90E-LF																																																				
SC04-G																																																				
SC05-FW																																																				
SC05-FW																																																				
SC04																																																				
SC04																																																				
SC05-G																																																				
SC12-FW1																																																				
SC06																																																				
LPV103																																																				
LPV MRL - 1																																																				

US Army Corps
of Engineers®

LPV GRR
100 Year Protection Plan
(1% Annual Chance Surge Risk Reduction Plan)
Feasibility Level
Cost and Schedule Risk Analysis Report

Prepared for:

U.S. Army Corps of Engineers
Mississippi Valley Division
New Orleans District

Prepared by:

New Orleans District

Date: 17-February-2021

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APPENDIX

EXECUTIVE SUMMARY

This General Re-Evaluation Report (GRR) with integrated Environmental Impact Statement presents the results of a U.S. Army Corps of Engineers (USACE) coastal storm risk management study for the Lake Pontchartrain and Vicinity (LPV) project located in New Orleans, Louisiana. This study is authorized by Section 3017 of the Water Resources Reform and Development Act of 2014. USACE is undertaking the study in partnership with the Coastal Protection and Restoration Authority Board of Louisiana, the study's non-federal sponsor. This report provides documentation of the plan formulation process to identify a recommended coastal storm risk management plan, along with environmental, engineering, and cost details of the Recommended Plan.

The existing LPV project includes features in four parishes (St. Charles, Jefferson, Orleans, and St. Bernard) located in the greater New Orleans area on the east bank of the Mississippi River. This is a high-density residential and commercial area. Currently, the LPV project includes a total of approximately 126.5 miles of levees and 56 miles of floodwalls, floodgates, water control structures, and other risk reduction features. This includes primary perimeter storm surge risk reduction features, and detention basin features along the IHNC and GIWW, and the three outfall canals. The existing project reduces the risk of flooding associated with a coastal storm surge and wave event with a 1% chance of being exceeded in any given year.

Southeast Louisiana, including the greater New Orleans area, is generally characterized by weak soils, general subsidence, and the global incidence of sea level rise that will cause levees to require future lifts (raises) to sustain the current performance of the project. This GRR reevaluates the performance of the LPV system given the combined effects of consolidation, settlement, subsidence, and sea level rise over time and the availability of new elevation data (vertical datums), and determines if additional actions are recommended to address the economic and life safety risks associated with overtopping of the levee system due to hurricanes and tropical storms.

The study utilized a 50-year period of analysis and estimated future conditions at the end of that period if no action is taken to address the identified problems. These projections include over $246 million in expected annual economic damages. The future estimated average annual incremental life loss related to overtopping of the system is 3E-02 (0.032) lives per year. Additionally, for the climate change analysis, the study considered potential relative sea level change impacts on system performance and adaptability during a 100-year performance horizon.

USACE identified several structural and non-structural measures to reduce coastal storm risk in the study area. An initial array of five action alternatives was formulated, evaluated, and compared primarily (but not exclusively) based on cost, economic damage reduction, life safety risk reduction related to overtopping of the system, and environmental and cultural resources impacts.

The National Economic Development (NED) Plan is the alternative that reasonably maximizes net economic benefits while remaining consistent with the federal objective of protecting the environment. Alternative 2 was identified as the NED Plan and the Recommended Plan.

The Recommended Plan includes system-wide levee lifts and raising floodwalls to address the projected 1% annual exceedance probability (AEP) flooding event through the year 2078. The general features included in the Recommended Plan can be seen in Figure ES-1. The plan consists of 50 miles of levee lifts to be constructed before the combined effects of consolidation, settlement, subsidence, and sea level rise reduce the levee elevations in each levee reach below the required design elevation. Additionally, the Recommended Plan includes 1 mile of floodwall replacements and 2.2 miles of new floodwall to be constructed prior to the combined effects causing the design requirements to be exceeded for each structure. Existing foreshore protection along Lake Pontchartrain will be restored following levee or floodwall modifications. Mitigation is anticipated to be required to address potential impacts to habitat along the Mississippi River. The Recommended Plan has a total project first cost of approximately $1.1 billion and a Benefit-to-Cost Ratio (BCR) of 7.3. It reduces the estimated annual economic damages to approximately $53 million and reduces life loss related to overtopping risk.

The Recommended Plan has many other benefits (both positive and negative) in addition to NED benefits. Regional Economic Development (RED) benefits support a total of 292 average annual, full-time equivalent jobs, $1.1 billion in labor income, $1.3 billion in gross regional product, and $2.1 billion in economic output in the local impact area. Other Social Effects (OSE) benefits include a reduction of life safety risk associated with overtopping of the levee system to tolerable levels, a reduction in the risk of overtopping that could result in contamination of farmland and drinking water and could negatively impact community cohesion, and reduced overtopping flood risk to three National Register Historic Districts and an archaeological site. The plan has negative Environmental Quality (EQ) effects including impacts to bottomland hardwoods along the Mississippi River and lake bottom habitat in Lake Pontchartrain, as well as soil and wildlife impacts in borrow sites.

Implementation of the Recommended Plan would result in potential impacts to Bottomland Hardwood-Wet (BLH-Wet) habitat. These impacts would be avoided to the maximum extent practicable but would be unavoidable in some locations due to existing infrastructure on the protected side of the levees. The proposed mitigation plan assumes these 12.1 Average Annual Habitat Units (AAHUs) of BLH-Wet impacted (approximately 20 acres) by the Recommended Plan would be offset through the purchases of equivalent mitigation bank credits.

The public had the opportunity to review and comment on the draft report during the 55-day public review period which began in December 2019. Public meetings were held in January 2020 to present the tentatively selected plan and allow the public to respond and ask questions prior to finalizing the recommendation. Comments received and responses can be found in Appendix L. Numerous environmental commitments are listed within the EIS to ensure environmental compliance, including development of a Programmatic Agreement with State Historic Preservation Officers, Tribes, and the Advisory Council on Historic Preservation. Additional NEPA documentation and associated public review would be conducted, as necessary, to address any changes not evaluated within the scope of the impact assessment.

The CSRA process for this project includes an analysis on the Structures, Levees and all other tasks. The results of the analyses are determined by qualifying and quantifying all potential cost risks and running a Monte Carlo simulation to produce the frequency spectrum and probability range for the applied risk costs. The cost contingency is obtained from the 80-percent contingency as determined by this analysis.

Initial Risk Register considered over 51 risk items. A total of 16 potential risk items for the Structures and Levees / All Other tasks were developed by the CSRA team and applied to a risk registry for analysis. Assumptions were made for each risk item before running the Monte Carlo simulation. The result of the simulation gave a 33% percent (rounded) contingency respectively at the 80-percent confidence level.

The contingency cost for this project was utilized for a Micro Computer Aided Cost Estimating System (MCACES) estimation of the costs associated with the 100 Year Protection Plan (1% Annual Chance Surge Risk Reduction Plan). The potential cost risks developed during this analysis also serve as an indicator of how to avoid unforeseen escalation of project costs throughout project implementation and therefore, may be used as a valuable tool in all future aspect of the project study, design, and construction planning and estimation.

The major contributors to the resulting total project cost contingency for the Structural and Levee/All other remaining Features were:

- (CA-1) Acquisition Strategy – defined as small business 8a
- (TR-2) Confidence in the scope and design and critical quantities– 50-year market condition could change – other walls may need to be demolished and constructed.
- (EX-2) Market Condition – 50-year market condition could change
- (EX-4) Fuel prices– Used historical fuel prices and used average of several months of highest prices.

The major contributor to the resulting total project contingency for the Schedule feature was:

- (EX-1) High River MRL Levees – risk of additional impacts which will cause delays.

The corresponding Total Cost including contingency (cost & schedule) for the Structural and Levee/All other Features is presented on table 1.

Table 1. Structures and Levee/All other Features Contingency Analysis Table

INITIAL CONSTRUCTION

Contingency Analysis

Base Case Estimate (Excluding 01)	$670,591,133	
Confidence Level	**Contingency Value**	**Contingency**
0%	**53,647,291**	**8%**
10%	**134,118,227**	**20%**
20%	**147,530,049**	**22%**
30%	**160,941,872**	**24%**
40%	**174,353,695**	**26%**
50%	**181,059,606**	**27%**
60%	**194,471,429**	**29%**
70%	**207,883,251**	**31%**
80%	**221,295,074**	**33%**
90%	**241,412,808**	**36%**
100%	**335,295,567**	**50%**

The rounded contingency percentage for **Structural Features** and for the **Levees/All Other Features (33.0%)** were transferred to the TPCS for final calculation of total contingency and cost. Lands and Damages cost and contingency are not included in the above. (NOTE: The rounding of the contingencies causes the totals on the TPCS to be slightly higher than and not add up to exactly the costs above.)

1. PURPOSE

The general purpose of this study with integrated Environmental Impact Statement (EIS) is to analyze alternatives to reduce hurricane and storm risk within the LPV study area. The study will evaluate and compare the benefits, costs, and impacts (positive or negative) of alternatives including the No Action Alternative. The study will identify whether an economically justified plan exists to reduce economic damages and life risk due to the combined effects of subsidence, consolidation, settlement, sea level rise, and datum changes on the LPV system. This report also satisfies the requirement of the National Environmental Policy Act (NEPA) to evaluate the proposed federal action.

Risks to human life are a fundamental component of all facets of flood and coastal storm risk management and must receive explicit consideration throughout the study process. As described in Section 3.4 of the main report, a risk assessment was performed to identify the magnitude of the risk associated with levee system overtopping. This assessment, including an evaluation of tolerable risk guidelines informed the formulation and evaluation of alternatives for the study.

2. BACKGROUND

The LPV project includes features in four parishes (St. Charles, Jefferson, Orleans, and St. Bernard) located in the greater New Orleans area on the east bank of the Mississippi River. Currently, LPV contains approximately 126.5 miles of levees and 56 miles of floodwalls, floodgates, water control structures, and other risk reduction features. This includes primary perimeter storm surge risk reduction features along the IHNC and GIWW, and the three outfall canals. The project is in a high-density residential and commercial area.

The Mississippi River and Tributaries' levee (MR&T levees or MRL) along with the Lower Bonnet Carré Guide Levee provides risk reduction from riverine flow flood risks. The LPV project connects to the MRL at both the west and east of the system.

The levees and floodwalls along the Inner Harbor Navigation Canal (IHNC) and Orleans Parish outfall canals were removed from frontline or perimeter risk reduction features and became interior risk reduction features by construction of the Seabrook Gate Closure and the IHNC - Lake Borgne Surge Barrier and Permanent Canal Closures and Pumps. Although these interior levees and floodwalls are not part of the hurricane perimeter defenses, they are an integral part of the LPV hurricane and storm damage reduction system required for reducing the risk of flooding caused by precipitation during a hurricane or tropical storm and over topping of the Lake Borgne Closure Surge Barrier.

Typical operations, maintenance, repair, replacement, and rehabilitation (OMRR&R) activities include mowing levees and ensuring sufficient turf growth, maintaining High Performance Turf Reinforcement Mats (armoring), maintaining and repairing spalls in floodwalls and concrete levee transition armoring, maintaining and operating floodgates, and operating and maintaining the complex structures such as IHNC surge barrier, Seabrook Complex, and Permanent Canal Closures and Pumps.

3. REPORT SCOPE

The scope of the risk analysis report is to calculate and present the cost and schedule contingencies at the 80 percent confidence level using the risk analysis processes as mandated by U.S. Army Corps of Engineers (USACE) Engineer Regulation (ER) 1110-2-1150, Engineering and Design for Civil Works, ER 1110-2-1302, Civil Works Cost Engineering, and Engineer Technical Letter 1110-2-573, Construction Cost Estimating Guide for Civil Works. The report presents the contingency results for both cost and schedule risks for all project features.

3.1. Project Scope

Engineering Circular Bulletin (ECB) 2007-17, Application of Cost Risk Analysis Methods to Develop Contingencies for Civil Works Total Project Costs (Sept. 10, 2007) requires that a formal risk analysis be prepared for all decision documents requiring Congressional authorization whose total costs are in excess of forty million dollars. In addition, to broadly defined risk analysis standards and recommended practices, a risk analysis is to be performed to meet the requirements and recommendations of the following documents and sources:

- Cost and Schedule Risk Analysis Process guidance prepared by the USACE Cost Engineering Directory of Expertise for Civil Works (Cost Engineering Dx), dated May 17, 2009.
- Engineer Regulation (ER) 1110-2-1302 Civil Works Cost Engineering, dated Sept. 15, 2008.
- Engineer Technical Letter (ETL) 1110-2-573 Construction Cost Estimating Guide for Civil Works, dated Sept. 30, 2008.

Specific study objectives were developed to identify measures and alternatives which can address the study area’s problems while taking advantage of the identified opportunities and avoiding the constraints. The following study objectives were developed based on the study area problems, opportunities, and goals, as well as the federal objective and regulations. Per the study’s authorizing language, the following objectives will include, at a minimum, consideration of an alternative to restore the authorized level of risk reduction (the 1% AEP flood event).

Objectives:

1. Reduce the risk of life loss due to hurricane and storm damage in LPV over the 50-year period of analysis associated with consolidation, settlement, subsidence, sea level rise, and new datum. This includes identifying at least one alternative which reduces life safety risk associated with system overtopping below tolerable levels (see Section 3.4.1). This will be primarily measured by life safety risk reduction estimates.

2. Reduce economic damages due to hurricane and storm damage in LPV over the 50-year period of analysis associated with consolidation, settlement, subsidence, sea level rise, and new datum. This will be primarily measured by economic benefits estimates.

The report includes the project technical scope, estimates, and schedules as developed and presented by USACE New Orleans District. Consequently, these documents serve as the basis for the risk analysis. In general terms, the construction scope consists of the following:

Lands and Damages
Fish and Wildlife Facilities
Levees and Floodwalls
Planning, Engineering and Design
Construction Management

3.2. USACE Risk Analysis Process

The risk analysis process follows the USACE Headquarters requirements as well as the guidance provided by the Cost Engineering Directory of Expertise for Civil Works (Cost Engineering DX). The risk analysis process reflected within the risk analysis report uses probabilistic cost and schedule risk analysis methods within the framework of the Crystal Ball software. The risk analysis results are intended to serve several functions, one being the establishment of reasonable contingencies reflective of an 80 percent confidence level to successfully accomplish the project work within that established contingency amount. Furthermore, the scope of the report includes the identification and communication of important steps, logic, key assumptions, limitations, and decisions to help ensure that risk analysis results can be appropriately interpreted.

Risk analysis results are also intended to provide project leadership with contingency information for scheduling, budgeting, and project control purposes, as well as provide tools to support decision making and risk management as the project progresses through planning and implementation. To fully recognize its benefits, cost and schedule risk analyses should be considered as an ongoing process conducted concurrent to, and iteratively with, other important project processes such as scope and execution plan development, resource planning, procurement planning, cost estimating, budgeting, and scheduling.

In addition to broadly defined risk analysis standards and recommended practices, the risk analysis is performed to meet the requirements and recommendations of the following documents and sources:

ER 1110-2-1150, Engineering and Design for Civil Works Projects.
ER 1110-2-1302, Civil Works Cost Engineering.
ETL 1110-2-573, Construction Cost Estimating Guide for Civil Works.
Cost and Schedule Risk Analysis Process guidance prepared by the USACE Cost Engineering DX.
Memorandum from Major General Don T. Riley (U.S. Army Director of Civil Works), dated July 3, 2007.
Engineering and Construction Bulletin issued by James C. Dalton, P.E. (Chief, Engineering and Construction, Directorate of Civil Works), dated September 10,

2007.

4. METHODOLOGY/PROCESS

The Project Delivery Team is composed of various USACE New Orleans District branches including Project Management, Real Estate, Planning, Contracting, Structures and Levee Design, Hydrologic and Geotechnical and Cost Engineering Offices.

This CSRA outcome is pending approval by Agency Technical Review (ATR).

The risk analysis process for this study is intended to determine the probability of various cost outcomes and quantify the required contingency needed in the cost estimate to achieve any desired level of cost confidence. A parallel process is also used to determine the probability of various project schedule duration outcomes and quantify the required schedule contingency (float) needed in the schedule to achieve any desired level of schedule confidence.

In simple terms, contingency is an amount added to an estimate (cost or schedule) to allow for items, conditions, or events for which the occurrence or impact is uncertain and that experience suggests will likely result in additional costs being incurred or additional time being required. The amount of contingency included in project control plans depends, at least in part, on the project leadership's willingness to accept risk of project overruns. The less risk that project leadership is willing to accept the more contingency should be applied in the project control plans. The risk of overrun is expressed, in a probabilistic context, using confidence levels.

The Cost Engineering DX guidance for cost and schedule risk analysis generally focuses on the 80-percent level of confidence (P80) for cost contingency calculation. It should be noted that use of P80 as a decision criteria is a risk adverse approach (whereas the use of P50 would be a risk neutral approach, and use of levels less than 50 percent would be risk seeking). Thus, a P80 confidence level results in greater contingency as compared to a P50 confidence level.

The risk analysis process uses *Monte Carlo* techniques to determine probabilities and contingency. The *Monte Carlo* techniques are facilitated computationally by a commercially available risk analysis software package (Crystal Ball) that is an add-in to Microsoft Excel. Cost estimates are packaged into an Excel format and used directly for cost risk analysis purposes. Because Crystal Ball is an Excel add-in, the schedules for each option are recreated in an Excel format from their native format. The level of detail recreated in the Excel-format schedule is sufficient for risk analysis purposes that reflect the established risk register, but generally less than that of the native format.

The primary steps, in functional terms, of the risk analysis process are described in the following subsections. Risk analysis results would be provided in section 6.

4.1. Identify and Assess Risk Factors

Identifying the risk factors via the PDT are considered a qualitative process that results in establishing a risk register that serves as the document for the further study using the Crystal Ball risk software. Risk factors are events and conditions that may influence or drive uncertainty in project performance. They may be inherent characteristics or conditions of the project or external influences, events, or conditions such as weather or economic conditions. Risk factors may have either favorable or unfavorable impacts on project cost and schedule.

Checklists or historical databases of common risk factors are sometimes used to facilitate risk factor identification. However, key risk factors are often unique to a project and not readily derivable from historical information. Therefore, input from the entire PDT is obtained using creative processes such as brainstorming or other facilitated risk assessment meetings. In practice, a combination of professional judgment from the PDT and empirical data from similar projects is desirable and is considered.

A formal PDT meeting was held in USACE New Orleans HQ for the purposes of identifying and assessing risk factors. The meeting held on 10/28/2020 - 11/4/2020 included representatives from multiple project team disciplines and functions including:

Project/program managers.
Economist.
Contracting/acquisition.
Real Estate.
Environmental.
Civil, structural, geotechnical, and hydraulic design.
Cost and schedule engineers.
Construction.

This meeting focused primarily on risk factor identification using brainstorming techniques, but also facilitated discussions based on risk factors common to projects of similar scope and geographic location. Individual meetings were realized with each disciplines branch primarily for risk factor assessment and quantification.

4.2. Quantify Risk Factor Impacts

The quantitative impacts of risk factors on project plans are analyzed using a combination of professional judgment, empirical data, and analytical techniques. Risk factor impacts are quantified using probability distributions (density functions), because risk factors are entered into the Crystal Ball software in the form of probability density functions.

Similar to the identification and assessment process, risk factor quantification involves multiple project team disciplines and functions. However, the quantification process relies more extensively on collaboration between cost engineering, designers, and risk analysis team members with lesser inputs from other functions and disciplines.

The probabilistic distribution functions are used to describe the characteristic population (tendencies) of the risk factor inputs. The following elements of each risk factor were addressed in the risk factor quantification process:

Maximum possible value for the risk factor.
Minimum possible value for the risk factor.
Most likely value (the statistical mode), if applicable.
Nature of the probability density function used to approximate risk factor uncertainty.
Mathematical correlations between risk factors.
Affected cost estimate and schedule elements.

In this example, the risk discussions focused on the various project features as presented within the USACE Civil Works Work Breakdown Structure for cost accounting purposes. It was recognized that the various features carry differing degrees of risk as related to cost, schedule, design complexity, and design progress. The example features under study are presented in table 2:

Table 2. Work Breakdown Structure by Feature

01	LANDS AND DAMAGES
11	LEVEES & FLOODWALLS
30	PLANNING, ENGINEERING & DESIGN
31	CONSTRUCTION MANAGEMENT

The resulting product from the PDT discussions is captured within a risk register as presented in section 6 for both cost and schedule risk concerns. Note that the risk register records the PDT's risk concerns, discussions related to those concerns, and potential impacts to the current cost and schedule estimates. The concerns and discussions are meant to support the team's decisions related to event likelihood, impact, and the resulting risk levels for each risk event.

4.3. Analyze Cost Estimate and Schedule Contingency

Contingency is analyzed using the Crystal Ball software, an add-in to the Microsoft Excel format of the cost estimate and schedule. *Monte Carlo* simulations are performed by applying the risk factors (quantified as probability density functions) to the appropriate estimated cost and schedule elements identified by the PDT. Contingencies are calculated by applying only the moderate and high level risks identified for each option (i.e., low-level risks are typically not considered, but remain within the risk register to serve historical purposes as well as support follow-on risk studies as the project and risks evolve).

For the cost estimate, the contingency is calculated as the difference between the P80 cost forecast and the base cost estimate. Each option-specific contingency is then allocated on a civil works feature level based on the dollar-weighted relative risk of each feature as quantified by *Monte Carlo* simulation. Standard deviation is used as the feature-specific measure of risk for contingency allocation purposes. This approach results in a relatively larger portion of all the project feature cost contingency being allocated to features with relatively higher estimated cost uncertainty.

For schedule contingency analysis, the option schedule contingency is calculated as the difference between the P80 option duration forecast and the base schedule duration. These contingencies are then used to calculate the time value of money impact of project delays that are included in the presentation of total cost contingency in section 6. The resulting time value of money, or added risk escalation, is then added into the contingency amount to reflect the USACE standard for presenting the "total project cost" for the fully funded project amount.

Schedule contingency is analyzed only on the basis of each option and not allocated to specific tasks. Based on Cost Engineering DX guidance, only critical path and near critical path tasks are considered to be uncertain for the purposes of contingency analysis.

5. KEY ASSUMPTIONS

Key assumptions are those that are most likely to significantly affect the determinations and/or estimates of risk presented in the risk analysis. The key assumptions are important to help ensure that project leadership and other decision makers understand the steps, logic, limitations, and decisions made in the risk analysis, as well as any resultant limitations on the use of outcomes and results.

The following are examples of key assumptions for the risk analysis that could be identified by the PDT and risk analyst.

Level of Design: The cost comparisons and risk analyses performed and reflected within this report are based upon design scope and estimates that are considered to be well developed and designed.
Design Scope: The prescribed scope satisfies the requirements of this acquisition given that it is an economic update.
Operation and Maintenance: Operation and maintenance activities were not included in the cost estimate or schedules
Contract Acquisition Strategy: Consistent with cost estimate and schedule assumptions, it is assumed that the contract acquisition strategy is predominately firm fixed price.
Confidence Levels: The Walla Walla Cost Engineering Dx guidance generally focuses on the eighty-percent level of confidence (80%) for cost contingency calculation. For this risk analysis, the eighty-percent level of confidence (80%) was used. It should be noted that the use of 80% as a decision criteria is a moderate risk aversion approach, generally resulting in higher cost contingencies. However, the 80% level of confidence also assumes a small degree of risk that the recommended contingencies may be inadequate to completely capture actual project costs.
Only moderate and high risk levels were applied for the purposes of the CSRA analysis.

The following list identifies the key risk analysis assumptions and limitations within the context of the WBV GRR PAC CSRA. For each item, the context is first provided and then followed by the key assumption or limitation.

- *Unknown Decisions or Decision Makers:* The CSRA was prepared using a framework to generate contingency information that is appropriate for use by State of Louisiana and USACE decision makers for scheduling, budgeting, and project control purposes. The framework may generate results that are appropriate for use by a wide variety of decision makers or stakeholders; however, the assumed use of CSRA results is limited to scheduling, budgeting, and project control. Other uses by unknown decision makers may not be appropriate.

- *Dynamic Risks:* Risk events are dynamic, not static, and should be evaluated regularly through all phases of design, construction and O&M (if required). The CSRA is based on the identification and assessment of risks as of the date of this document. Reduced utility of current CSRA results should be assumed if the likelihood and impact of risks change over time.
- *Causal Relationships:* With the exception of risk events identified as correlated in the risk register, it is assumed that the impacts of risks are independent and that the realization of one risk does not cause the realization of another. Significant variance of the risk model results from actual project costs and schedules may be experienced if significant causal relationships exist between risks assumed to be independent.
- *Conservation of Market Pricing Risk:* The CSRA assumes that market pricing risks are not created or destroyed but can only be transferred or shared *at a price* as a result of various contract acquisition strategies. As an example, it is assumed that a contractor will add a level of contingency to a fixed price bid, relative to a cost reimbursable bid, that is reflective of the risk transferred contractually from the Government to the contractor. Other aspects of contract acquisition strategies not related to market pricing, such as the management cost of modifications or claims, are not included in this assumption. Any contract acquisition strategy that actually transfers market pricing risk to a contractor *at no cost* to the Government is not reflected in the CSRA.
- *Unknown Unknown* and *Unknowable Risks*: The Cynefin Framework describes decision-making contexts, in part, by characteristic types of uncertainty. Simple, complicated, complex and chaotic contexts within the framework are respectively associated with *known known*, *known unknown*, *unknown unknown* and *unknowable* uncertainties. The CSRA process focuses on *known known* and *known unknown* risks and is not intended to quantify the impacts of *unknown unknown* or *unknowable* risks. Significant variance of the risk model results from actual project costs and schedules may be experienced if *unknown unknowable* risks, as defined in the Cynefin Framework, are realized.

6. RISK ANALYSIS RESULTS

The following sections discuss the risk register, cost risk analysis results, schedule risk analysis results, and the combined cost and schedule risk analysis results.

6.1. Risk Register

A risk register is a tool commonly used in project planning and risk analysis and serves as the basis for the risk studies and Crystal Ball risk models. A summary risk register that includes typical risk events studied (high and moderate levels) is presented in a table in this section. The risk register reflects the results of risk factor identification and assessment, risk factor quantification, and contingency analysis. The complete detailed risk register is attached as Appendix A. The detailed risk registers in Appendix A include low level and unrated risks, as well as additional information regarding the specific nature and impacts of each risk. A condensed version of the Risk Register of modeled risk items can be seen on Table 3.

It is important to note that a risk register can be an effective tool for managing identified risks throughout the project life cycle. As such, it is generally recommended that risk registers be updated as the designs, cost estimates, and schedule are further refined, especially on large projects with extended schedules. Recommended uses of the risk register going forward include:

Documenting risk mitigation strategies being pursued in response to the identified risks and their assessment in terms of probability and impact.
Providing project sponsors, stakeholders, and leadership/management with a documented framework from which risk status can be reported in the context of project controls.
Communicating risk management issues.
Providing a mechanism for eliciting risk analysis feedback and project control input.
Identifying risk transfer, elimination, or mitigation actions required for implementation of risk management plans.

Table 3. Risk Register – Modeled Items

CREF	Risk/Opportunity Event	Risk Event Description	PDT Discussions on Impact and Likelihood	Risk Level ©	Risk Level (S)
Organizational and Project Management Risks (PM)					
PM1	Project competing with other projects, funding and resources	Demands on resources	Normal demand on resources within the district.	Low	Low
PM2	Unplanned work that must be accommodated	Hurricane Effects	There always a risk that hurricanes could cause damage causing scope increases. This item will be taken into account under the category construction risk item mods and claims.	Low	Low
PM3	Local agency/regulator issues	Sponsor Request for changed work	Sponsors may request modification post contract award. Taken into account in construction category item modification.	Low	Low
PM4	Staff Turnover	Staff turnover over the next 50years plus is guaranteed.	Turnover is likely to cause inefficiencies and result in lost institutional knowledge. Marginal cost growth over the next 50 years is likely due to that inefficiency, re-learning of lessons and lost knowledge. Effect PED. Drive up cost 1 to 2 percent.	Medium	Low
PM5	Established Project	All of the LPV GRR projects that are add ons from existing projects done within the last 20 years.	Project is well developed and pitfalls are known and work arounds developed. Overall project cycle is well understood as long as wholesale staff turnover is not experienced.	Low	Low
Contract Acquisition Risks (CA)					
CA1	Small Business and 8(a) Contracting	The project is assumed to be done using an acquisition strategy of small business and 8(a) contracting.	Estimate has taken small business into account by assuming certain items will be subcontracted. Is it possible for these contract go out as a different acquistion strategy? Probably not. Only if contract goes over bond capacity, Project is to high cost or to large scope wise. Low risk because better price with big business contractors will have better competition. SO low risk. Cost could be higher due to not enough subcontracting and other issues (Procurement Strategy) or bids could come in lower due to competition other issues (Procurement Strategy).	Medium	Low
CA2	Acquistion planning	Strategy and funding stream	A strategy is in place. The strategy is that projects and funding will be spread work out over 50 years. Assume funding stream will not be a problem.	Low	Low
CA3	Design Build	Levee and Floodwall work is not typically Design Build.	Design Build is not likely to provide benefits for this type of project. Design Build is unlikely.	Low	Low
General Technical Risks (TR)					
TR1	Design Criteria	All designs incorporate current design requirements.	Currently no pending design criteria changes are known. Most work being done will occur on existing levees or existing floodwalls. Work is typical at the MVN district.	Low	Low

TR2	Floodwall confidence in design	confidence in the scope and design and critical quantites	Pre-Katrina perimeter T-wall was checked against the post-Katrina HSDRRS Design Guidelines for the 2057 design life. GRR considers a longer design life (e.g. 2073) with higher associated SWLs (sea water levels). The higher SWLs (sea water level) associated with the longer design life will cause the factors of safety for most, if not all, of the post-Katrina T-walls to fall below the required HSDRRS Design Guidelines. In order to have a accurate risk for this item, new fragility curves would be needed to be done. Since new fragility curves can not be done due to the amount of work vs time available to comple, an assumption base on historical data and engineering experience will be used to access this risk. Therefore, this risk to the scope of the project is high.	High	Low
TR3	Floodwall confidence in design	confidence in the scope and design and critical quantites	The typical section used for the floodwall quantities were assume to be an average of total LF of the floodwall to be replaced. It Is assumed that the quantities could be -5% to +5 of the current quantities used.	Medium	Low
TR4	Level of Design - Floodwalls	Floodwall design is highly conceptual.	New Orleans will replace deficient floodwall with new higher floodwall. HESCO basket/stockpile flood figting material temporary protection will be deployed as needed during construction.	Medium	Low
TR5	Floodwall confidence in design	confidence in the scope and design and critical quantites	Ran a profile surveys before study started. The profile was used to predict straddle lifts and the slopes from the previous lift were used. Low Risk	Low	Low
TR6	Confidence in scope, investigations, design, critical quantities	Used previous lift schedule to predict settlement on all the reaches.	Used representative previous lift schedules to predict settlement on all the reaches. The settlement could increase or decrease causing quantities to increase or decrease. A conservative lift schedule was used; therefore, the quantity should be on the conservative side.	Low	Low
TR7	Floodside Shifts	Possible floodside shift may occur but technical assume all straddle levees	MRL- Some of the MRL Reaches would probably need floodside shift but due to time contraints straddle lifts were assumed for quantities. A small analysis was done that showed that quantities take offs for a straddle levee in place of a possible floodside shift is convservative.	Low	Low

TR8	Sufficiency / availability of as-built data / base map data	As builts have been provided.	Used typical section to arrive at quantity. Heights of floodwall can vary in elevation but do not forsee major changes. TR3 already takes possible quantity change into account.	Low	Low
TR9	Right-of-way analysis in question	Change from straddle to flood side shift	The MRL levees in some areas could have floodside stability issues that would need to be analyzed during PED phase. Affect to quantities is negligible. Increase to right of way is possible. Assume there could be up to 25' of ROW for 7000LF of Levee needed to be acquired.	Medium	Low
Civil/Site Design (CV)					
CV1	Borrow Material	Haul locations have been assumed (15 mile haul distances).	Suitability of borrow material may be in question requiring either additional acreage and mitigation.	Low	Low
Lands and Damages (LD)					
LD1	New Orleans	Some 76 sites have been identified for Lands, Easements, Rights-of-way, Relocations and Disposal (LERRD) needed to acquire. right of way and borrow site locations with approximately 75 ownerships	MVN opinion is current footprint is worst case. Increase in acreage is unlikely.	Low	Low
LD2	Environmental Mitigation	Availbility of mitigation bank credits (area)	Mitigation cost may be low due to demand of mitigation bank credits. The cost could potential go up by 100%. Assumption made by Kip.	Medium	Low
LD3	Property Acquisitions	Several landowners with land fronting canal (waterfront) voiced their opposition to losing their water access - floodwall acres acquisition could be problematic.	Opinion is to give them options for water access. Costs in REP includes damages for their loss of waterfront.	Low	Low
Regulatory Environmental Risks (RG)					
RG1	Programmatic Agreement	An overall literature search is being conducted for the entire areas. A programmatic agreement will lay out how surveys will be conducted and what to do if resources are encountered.	Programmatic agreement should allow for more efficient coordination between USACE, SHPO and Tribes.	Low	Low

RG2	Cultural Resources	Most of the construction will be in the existing footprint, borrow areas will be more likely to encounter resources.	Cultural surveys will be conducted once borrow areas are identified. Programmatic agreement will lay out the process if resources are discovered. Primarily risk would be to schedule to allow time for surveys and proper documentation (if required). Efforts will be made to avoid cultural impacts.	Low	Low
RG3	Archeological Sites and Standing Structures	Most Standing Structures are known within the LPV/WBV. Archeological sites are likely known with the exception of the portion MRL levee lifts.	LPV/WBV levee and flood are low risk. MRL has higher potential of risk but will be address in PA (Programmatic agreement) Historic sites previously "capped" by existing levee are likely to be encountered with this MRL. If eligible sites are encountered additional cost and schedule for site documentation and mitigation. Flexibility in MRL schedule would individual sites to be shuffled to allow time for individual site surveys to be completed. Indirect (visual) impacts to urban would need to be consider. Surveys could be minimal from $100k. Site Mitigation would range from $250k to $500k for site mitigations (full archeological survey and documentation). Cultural survey costs have been included in the baseline estimate. Site mitigation has not been included. If encountered construction would work around the site until addition consultation is completed and resolved.	Low	Low
RG4	Burial Locations	Unknown burial sites are unlikely to be encountered	It is not likely burial sites will be located during construction. If encountered, burial location will be avoid until location is resolved. With the exception of the MRL levee shifts, all other projects have been previously disturbed; therefore, low risk.	Low	Low
RG5	Threatened and Endangered Species	Several endangered species in the project area.	Through coordination with Fish and Wildlife services and NMFS and through use of best management practices impacts are unlikely. If this would occur, it would effect the schedule which would gives a moderate impact.	Low	Low
RG6	Clean Water Act Compliance and Mitigation Impacts	Mitigation has been developed based on projected Impacts.	There will be times when assumptions have not been meet and actual mitigation requirements will be increased.	Low	Low
RG7	HTRW in Borrow Areas	Borrow areas have not been identified HTRW survery's will be conducted.	If HTRW is found, another borrow will be need be found. According to Kip Runyon and Joe Musso, the likelihood o finding HTRW at borrrow pits is low. The cost impact could be because of haul distance. (See CO5) Schedule could be delayed due to finding a borrow area but since the project is 50 year program if the project is delayed it would not affect the overall program.	Low	Low
RG8	Environmental Justice	High or high adverse disproportionate impacts must be encountered before mitigation will be required per EO 12898.	Cost and Schedule impacts are not likely.	Low	Low
RG9	Environmental and Water quality issues	Potential Submerged Aquatic Vegetation (SAV) in Foreshore protection areas. Construction Dredging Access may not be able to avoid SAV. (only LPV)	If SAV is can't be avoided then will have to mitigate. This would cause construction of a new mitigation area cause cost and schedule growth.	Low	Low
Construction Risks (CO)					
CO1	Site Access and Site Constraints - Floodwalls		Site have been access in past. Jobs are mostly add ons.	Low	Low

CO2	Weather	Contracts will include weather days.	New Orleans historically experiences significant time growth due to weather delays, especially for large clay construction contracts and moisture control. Will impact costs (see CO4), but little overall impact to larger project timeline	Low	Low
CO3	Weather	Contracts will include weather days.	New Orleans historically experiences significant time growth due to weather delays, Floodwall, from historical data, has a certain percentage of servere weather increase. Will impact costs (see CO4), but little overall impact to larger project timeline	Low	Low
CO4	Poor Performing Contractor	Poor performing contractors can significantly delay individual contracts.	Individual contracts will be impacted by poor performing contractors. Overall program schedule is not likely to be impacted. Contracts are independent. Program Risk is low and not modeled.	Low	Low
CO5	Mods and Claims	Every project experiences cost growth after award.	LPV projects have typically tracked best case 5%, most likely 8% and 12% worst case after award cost growth. Schedule growth on individual contracts is likely, but overall program is unlikely to be affected.	Medium	Low
CO6	Material availability and delivery	Haul Distance and material availability	Availability in location in future may be an issue but will happen before award. Material located in relation to the project. It was assumed that 15 mile haul will used. Medium risk because assuming borrow pit will be an average of 15 mile for work site. Haul can be over 15 miles or under. Assume a low of 10 mile haul and high of 20 mile haul.	Medium	Low
Estimate and Schedule Risks (ES)					
ES1	New Orleans Estimates	T-Wall replacement based on recent Floodwall cross section with crews and adjusted localized production rates. Floodwall estimate includes designer provided quantities. Site specific crews and production rates. Earthwork based on government furnished material and assumed 15mile haul.	Levee estimates are likley cost neutral. Floodwalls are typical work, Typical production rates and production were used. Cost risk is Low.	Low	Low
ES2	LABOR AVAILABILITY/PRICING	Labor shortages and increase rates	Assume economy will have low unemployment. Assuming labor cost could increase.	Medium	Low
ES3	MATERIAL AVAILABILITY/PRICING	material shortages and increased cost	Projects are using standard materials, quotes for all major materials. Material Prices could increase will improving economy and tariffs.	Medium	Low
ES4	Government vs Contractor	Possibility of the some borrow area switching to contractor furnished.	Possible that some borrow areas could change to contractor furnished borrow area. Assume 20% of the material could change to contractor furnished material.	Medium	Low
ES5	Material Pricing Uncertainty	Floodwall and Material Pricing could fluctuation over the project life (50 to 100years)	Assume moderate cost risk with ENR commodity computations. Assume taken into account in ES3.	Low	Low
ES6	Differing Site conditions	Differing Site conditions	Production Rates are from historical data but unforeseen site condition could lower production rate causing cost impacts.	Medium	Low

External Risks (EX)					
EX1	High Water- MRL Colocated sections	Mississippi in recent years has remained at above average stages for significant portions of the year impacting project access, design and construction.	Continued high water events would result in schedule delays and associated cost impacts. Since the high river only effect MRL, a high risk is implemente only the schedule for MRL jobs. Assume that those project will be high risk. Usually, high water comes in the winter or (historically) spring and ends by June. 6-8 months could be affect in any given year. -(Construction) Government labor S&A cost. Personnel (inspector other construction personnel) will be on the job for longer period of time. S&A for MRL projects was separated from other LPV contracts in the Cost and Schedule Summary. The S&A used is from historical data including High water.	Low	High
EX2	Market Conditions	Construction Market and bidding competition	To project market conditions 50 years into the future is difficult. Competition of levee and floodwall work has been robust in recent years. Do not foresee an issue in the future but since changes could happen a medium risk was assumed. Low 0% High 5%.	Medium	Low
EX3	Federal Funding	MRL and LPV/WBV Separate Funding	MRL is separate funding. From history, it doesn't seem like funding was be a issue. It is assumed that it will continue to be so. LPV/WBV - If intial funding is appropriated by Congress, it is expect that ongoing appropriation will occur for the life of the project.	Low	Low
EX4	Unexpected escalation on key materials	Fuel prices and key materials	The inflation of fuel and key materials is always a possibility and fuel is a cost driver for the mob/demob and other construction items. Fuel cost has flucuated and is low at the moment. It will increase in near future.	Medium	Low
EX5	Political and Sponsor Support	Political and Sponsor Support remains committed to the project and public safety.	Natural disasters could draw additional attention to the project potentially increasing funding (opportunity).	Low	Low
EX6	Hurricane Risk	Hurricane Effects	Hurricane often occur and a process is already in place. Cost and Schedule changes will be taken into account under the construction risk category item mods.	Low	Low
EX7	Sponsor Funding	Sponsor is responsible for LERRDS and cost share.	Sponsor funding should not be an issue. Project is a typical cost sharing, sponsor is responsible for LERRDS.	Low	Low
EX8	Stakeholders	late changes, new changes	Assume any changes that occur will be Included in construction risk category under item called modifications.	Low	Low
EX9	Environmental Community	Lawsuits have been filed previously over project impacts.	USACE has successfully defended lawsuits in the past through full disclosure of impacts in the EIS. Future litigation will likely also not result in changes to the project. Project work continued during previous litigation and would likely be able to continue during any future litigations. Overall Lawsuit Risk is considered Low.	Low	Low

6.2. Cost Risk Analysis - Cost Contingency Results

A cost risk models was run for the Structural Features and for the Levees/All Other Features of construction work. As shown in Table 3, there were a total of 16 risks used in the modeling for the risk analyses which had a cost impact of moderate or high.

Some risks applied only to one feature set and some applied to both. The risk was analyzed using the low, most likely, and high estimates for each risk item and the items associated variance distribution. The analysis produced a sensitivity chart of the risk items and confidence levels from 0 to 100% and the associated contingency amount.

The cost sensitivity chart for the Structural Features and Levees/All Other is shown in Figure 1. The sensitivity chart shows the influence of each risk items on the resulting cost contingency. The risk items are ranked according to their importance to the cost contingency. As shown in the Cost Sensitivity Charts, Acquisition Strategy, market conditions, Confidence in the scope and design and critical quantities and Fuel prices had the most influence on the cost contingency for the Structural, Levee/others Features.

Figure 1. Structures and **Levees/All Other Cost Sensitivity Chart**

The cost risk analysis also produced a confidence table in ten percent increments of project confidence associated with contingency dollars. The confidence levels are shown in Table 4. As seen in the table, all but one of the associated contingency dollar amounts are positive. The contingency dollar amounts range from over $53 million to $336 million. The recommended cost contingency amount for the Structural Features and Levees/All Other is $221,295,074.

Table 4. Structures and Levees/All Other Cost Confidence Table

INITIAL CONSTRUCTION

Contingency Analysis

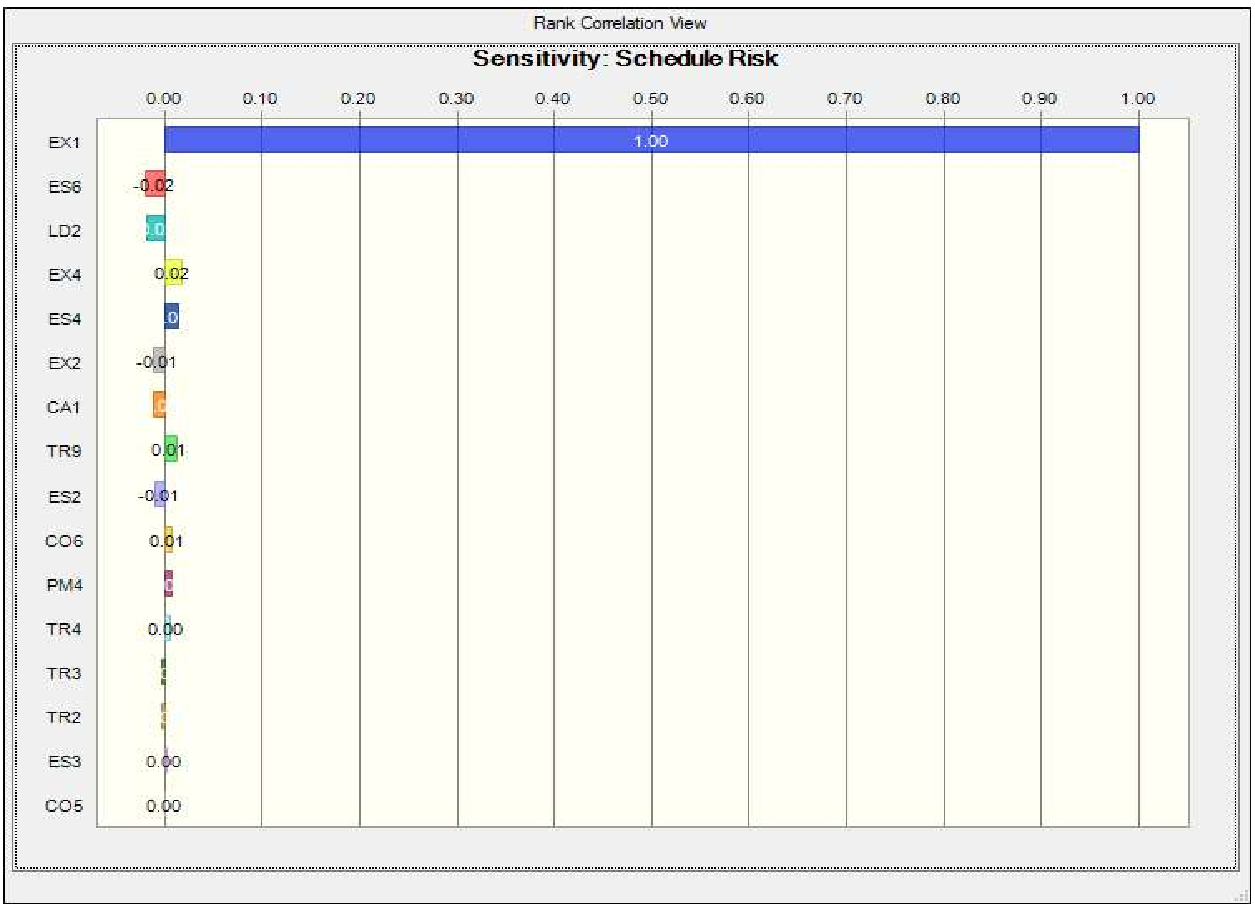
Base Case Estimate (Excluding 01)	$670,591,133	
Confidence Level	**Contingency Value**	**Contingency**
0%	53,647,291	8%
10%	134,118,227	20%
20%	147,530,049	22%
30%	160,941,872	24%
40%	174,353,695	26%
50%	181,059,606	27%
60%	194,471,429	29%
70%	207,883,251	31%
80%	221,295,074	33%
90%	241,412,808	36%
100%	335,295,567	50%

6.3. Schedule Risk Analysis - Schedule Contingency Results

A schedule risk analysis was conducted on 1 risk of the risk register, shown in Appendix A, which had a schedule impact of moderate or high. The project Risk Register originally considered over 51 risk items but only 1 risk was determined to have an impact on the overall program schedule. The risk was analyzed using the low, most likely, and high estimates for each risk item and the items associated variance distribution. The analysis produced a sensitivity chart of the risk items and confidence levels from 0 to 100% and the associated contingency amount.

The schedule sensitivity chart is shown in Figure 2 below. The sensitivity chart shows the influence of each risk items on the resulting schedule contingency. The risk items are ranked according to their importance to the schedule contingency. As shown in the Schedule Sensitivity Chart, High Water item had the most influence on the schedule contingency. It is important to note again that the schedule is for a Program rather than a Single Project and therefore very few items were considered to be a High risk to the program and did not significantly affect the overall schedule.

Figure 2



Schedule Sensitivity Chart

The schedule risk analysis also produced a confidence table in ten percent increments of project confidence associated with contingency months. The confidence table is shown in Table 5 below. As seen in the table, all the associated contingency month amounts are positive. The contingency month amounts range from 6 months to 17 months. The recommended schedule contingency amount is 11 months. Note that these results reflect only those contingencies established from the schedule risk analysis.

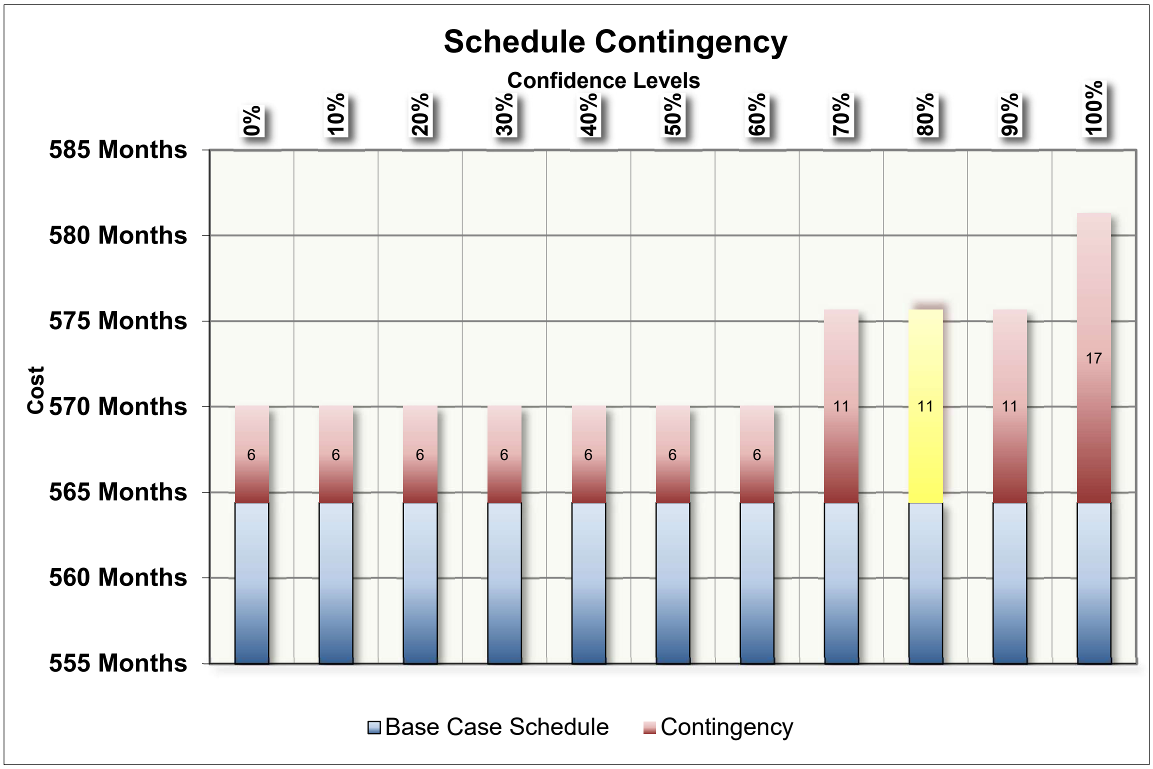
Table 5. Schedule Confidence Table

Contingency Analysis

Base Case Schedule	**564.4 Months**	
Confidence Level	**Contingency Value**	**Contingency**
0%	**6 Months**	**1%**
10%	**6 Months**	**1%**
20%	**6 Months**	**1%**
30%	**6 Months**	**1%**
40%	**6 Months**	**1%**
50%	**6 Months**	**1%**
60%	**6 Months**	**1%**
70%	**11 Months**	**2%**
80%	**11 Months**	**2%**
90%	**11 Months**	**2%**
100%	**17 Months**	**3%**

From the table, a confidence bar chart was also established that shows the relationship of percent confidence with contingencies in months. That bar chart is shown in Figure 3. Due to not many risk modeled, all confidence levels show a steady increase in the contingency amount.

Figure 3. Schedule Confidence Curve



7. MAJOR FINDINGS/OBSERVATIONS

The cost and schedule risk analysis resulted in a recommended combined cost contingency of $221,295,074 and a schedule recommended contingency of 11 months. The project construction costs for confidence levels 0 to 100% are shown below. Table 6 presents construction costs, which include base cost plus cost and schedule contingencies. Lands and Damages cost and contingency are not included. Figure 4 illustrates the construction cost risk analysis confidence bar chart. The recommended contingency is 33% Structural Features and the Levees/All Other Features, based on the 80% confidence level. These contingencies were applied to the detailed estimate for the tentatively selected plan for the LPV GRR project. The rounded contingency percentages for Structural Features and the Levees/All Other Features (33.0%) where transferred to the TPCS for final calculation of Total Contingency and Total Cost. Lands and Damages cost and contingency are not included in the above numbers.

Contingency Summary Table - Cost

PROJECT CONTINGENCY (BASELINE ESTIMATE)	Percentile	Baseline w/ Contingency	Contingency %
	0%	**$724,238,424**	**8%**
	10%	**$804,709,360**	**20%**
	20%	**$818,121,182**	**22%**
	30%	**$831,533,005**	**24%**
	40%	**$844,944,828**	**26%**
	50%	**$851,650,739**	**27%**
	60%	**$865,062,562**	**29%**
	70%	**$878,474,384**	**31%**
	80%	**$891,886,207**	**33%**
	90%	**$912,003,941**	**36%**
	100%	**$1,005,886,700**	**50%**

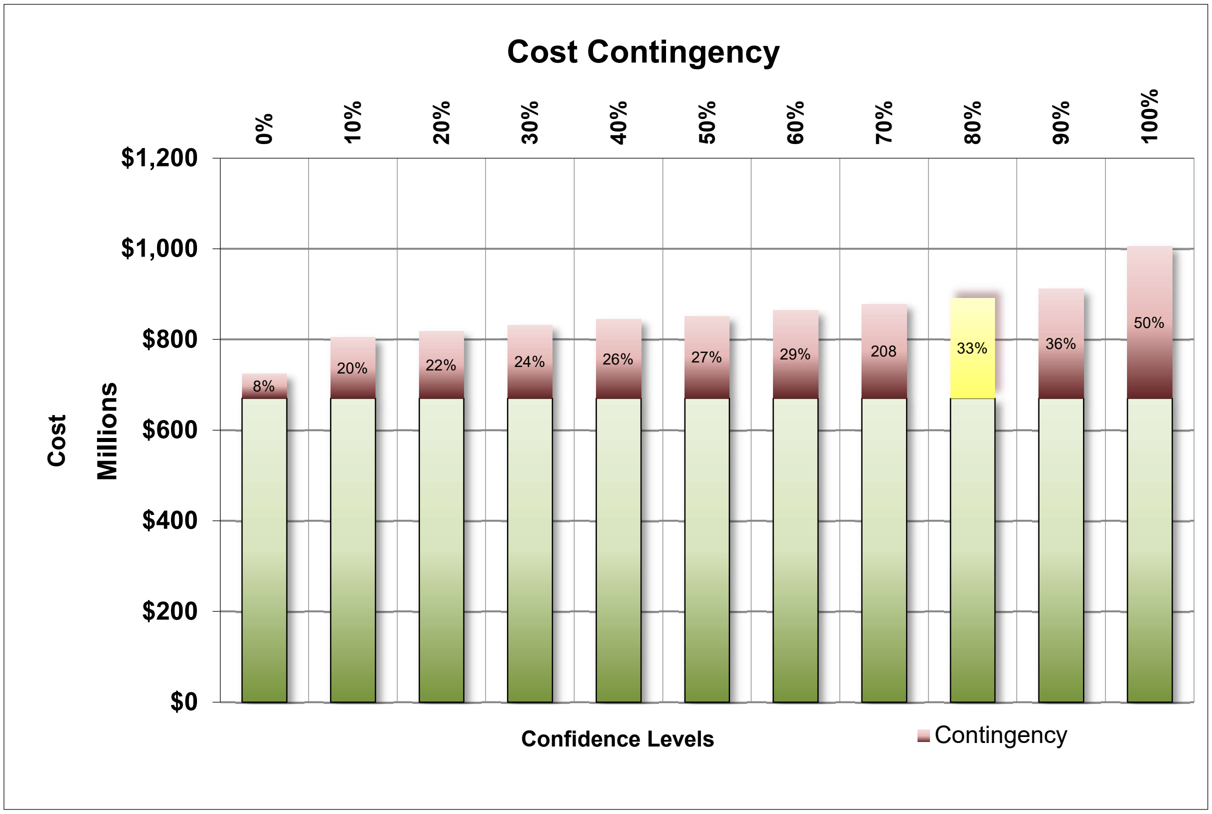
Contingency Summary Table - Schedule

PROJECT CONTINGENCY (BASELINE SCHEDULE)	Percentile	Baseline w/ Contingency	Contingency %
	0%	**570.0 Months**	**1%**
	10%	**570.0 Months**	**1%**
	20%	**570.0 Months**	**1%**
	30%	**570.0 Months**	**1%**
	40%	**570.0 Months**	**1%**
	50%	**570.0 Months**	**1%**
	60%	**570.0 Months**	**1%**
	70%	**575.7 Months**	**2%**
	80%	**575.7 Months**	**2%**
	90%	**575.7 Months**	**2%**
	100%	**581.3 Months**	**3%**

Table 6. Project Contingencies (Base Cost plus Contingency)

The above costs do not include 01 Lands and Damages and rounding of the contingency used when transferred to the TPCS and therefore will not match the TPCS exactly.

Figure 4. Project Confidence Curve



The major contributors to the resulting total project cost contingency for the Structural and Levee/All other remaining Features were:

- (CA-1) Acquisition Strategy – defined as small business 8a
- (TR-2) Confidence in the scope and design and critical quantities– 50-year market condition could change – other walls may need to be demolished and constructed.
- (EX-2) Market Condition – 50-year market condition could change
- (EX-4) Fuel prices– Used historical fuel prices and used average of several months of highest prices.

The major contributor to the resulting total project contingency for the Schedule feature was:

- (EX-1) High River MRL Levees – risk of additional impacts which will cause delays.

These items are discussed in more detail in the Mitigation Recommendations section.

Lands and Damages are not included in the CSRA because it was not considered to be an overall program risk by the PDT. Lands and Damages is a very small project cost and any schedule delay in a specific location would not significantly affect the midpoint of the overall program. The Local Sponsor is responsible for LERRDs and in order to serve as the Non-Federal sponsor must have the authority to appropriate (take) property.

The above risk analysis results are intended to provide project leadership with contingency information for scheduling, budgeting, and project control purposes, as well as to provide tools to support decision making and risk management as projects progress through planning and implementation. These conclusions were reached by identifying and assessing risk items for use in the risk analysis. These quantitative impacts of these risk items are then analyzed using a combination of professional judgment, empirical data, and analytical techniques. The total project cost contingency is then analyzed using the Crystal Ball software. *Monte Carlo* simulations are performed by applying the risk factors (quantified as probability density functions) to the appropriate estimated cost and schedule elements identified by the PDT.

8. MITIGATION RECOMMENDATIONS

An important outcome of the cost and schedule risk analysis is the communication of high risk areas which have a high potential to affect the project cost and/or schedule. For the LPV GRR, the high cost risk items are the Acquisition Strategy, market conditions, Confidence in the scope and design and critical quantities and Fuel prices had the most influence on the cost contingency for the Structural, Levee/others Features.

Mitigation measures for Acquisition Strategy, if competition is high and it usually is for the type of projects being constructed than the cost can decrease.

Market Condition may not fluctuate as much as risk model predicts

Fuel prices have reached high values but there is a possibility that the Fuel prices will not fluctuate the value estimated in risk register.

2021

Lake Pontchartrain & Vicinity GRR
Appendix J – Economics

US Army Corps
of Engineers
New Orleans District

U.S. Army Corps of Engineers, New Orleans District

Non-Federal Sponsor: Coastal Protection and Restoration Authority

February 2021

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LAKE PONTCHARTRAIN & VICINITY GRR
APPENDIX J – ECONOMICS

1 STUDY AREA DESCRIPTION

1.1 INTRODUCTION

This appendix presents an economic evaluation of the Recommended Plan for the Lake Pontchartrain and Vicinity Feasibility Study. It was prepared in accordance with Engineering Regulation (ER) 1105-2-100, Planning Guidance Notebook, and ER 1105-2-101, Planning Guidance, Risk Analysis for Flood Damage Reduction Studies. The National Economic Development Procedures Manual for Flood Risk Management, prepared by the Water Resources Support Center, Institute for Water Resources, was also used as a reference, along with the User's Manual for the Hydrologic Engineering Center Flood Damage Analysis Model (HEC-FDA). The Life Safety analysis will be addressed in its own appendix.

1.2 STUDY AREA

The Lake Pontchartrain and Vicinity study area comprises much of the greater New Orleans area. The delineated sub-basins are St. Charles, Jefferson East Bank, Orleans East Bank, New Orleans East, and the Chalmette Loop. In Figure 1, the sub-basins within the LPV study area are outlined in red. The LPV project includes features in four parishes (St. Charles, Jefferson, Orleans, and St. Bernard) located in the greater New Orleans area on the east bank of the Mississippi River. Currently, LPV contains approximately a total of 126.5 miles of levees and floodwalls (Figure 1-3). There are approximately 83 miles of armored perimeter levees and floodwalls and approximately 43.5 miles of interior levees and floodwalls. The project is in a high-density residential and commercial area. The LPV system is shown in Figure 2.

The Mississippi River and Tributaries' levee (MR&T levees or MRL) along with the Lower Bonnet Carré Guide Levee provides risk reduction from riverine flow flood risks. The LPV project connects to the MRL at both the west and east of the system.

The levees and floodwalls along the Inner Harbor Navigation Canal (IHNC) and Orleans Parish outfall canals were removed from frontline or perimeter risk reduction features and became interior risk reduction features by construction of the Seabrook Gate Closure and the IHNC - Lake Borgne Surge Barrier and Permanent Canal Closures and Pumps. Although these interior levees and floodwalls are not part of the hurricane perimeter defenses, they are an integral part of the LPV hurricane and storm damage reduction system required for reducing the risk of flooding caused by precipitation during a hurricane or tropical storm and over topping of the Lake Borgne Closure Surge Barrier.

Typical operations, maintenance, repair, replacement, and rehabilitation (OMRR&R) activities include mowing levees and ensuring sufficient turf growth, maintaining High Performance Turf Reinforcement mats (armoring), maintaining and repairing spalls in floodwalls and concrete levee transition armoring, maintaining and operating floodgates, and operating and maintaining the complex structures such as IHNC surge barrier, Seabrook Complex, and Permanent Canal Closures and Pumps.

1.3 PROJECT DESCRIPTION

The Recommended Plan includes system levee lifts to the projected 1% AEP event at 2077. Construction of the TSP would generally occur in the same footprint as the existing LPV project and existing MRL levees. Project features consist of 50 miles of levee lifts along the existing levee alignment to be constructed as-needed before the combined effects of consolidation, settlement, subsidence and sea level rise reduce the levee elevations in each levee reach below the required design elevation. In some reaches, levee lifts may need to occur more than once during the period of analysis. Additionally, the plan includes 3 miles of floodwall modifications and replacements along the existing alignment to be constructed as-needed prior to the combined effects causing the design requirements to be exceeded for each structure.

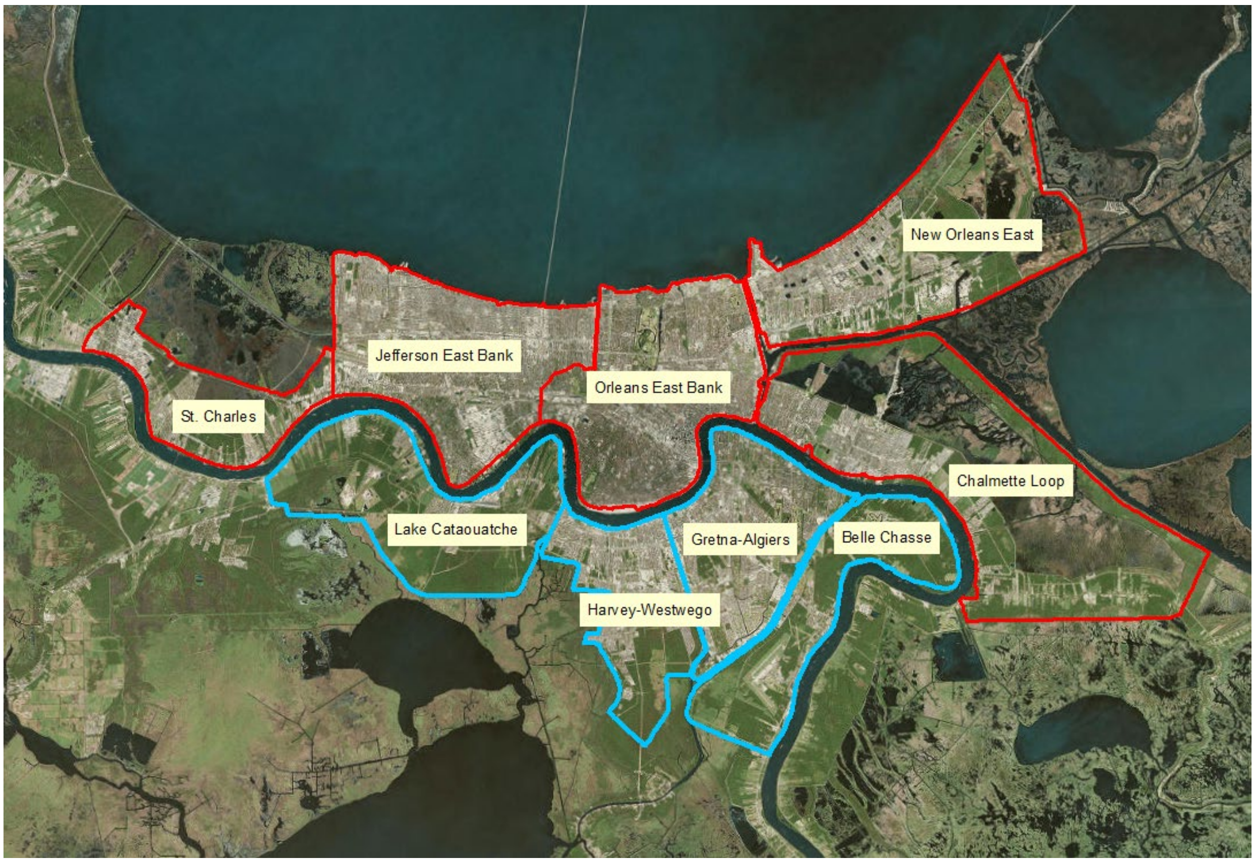

Figure 1. Lake Pontchartrain and Vicinity Sub-Basins (outlined in red)

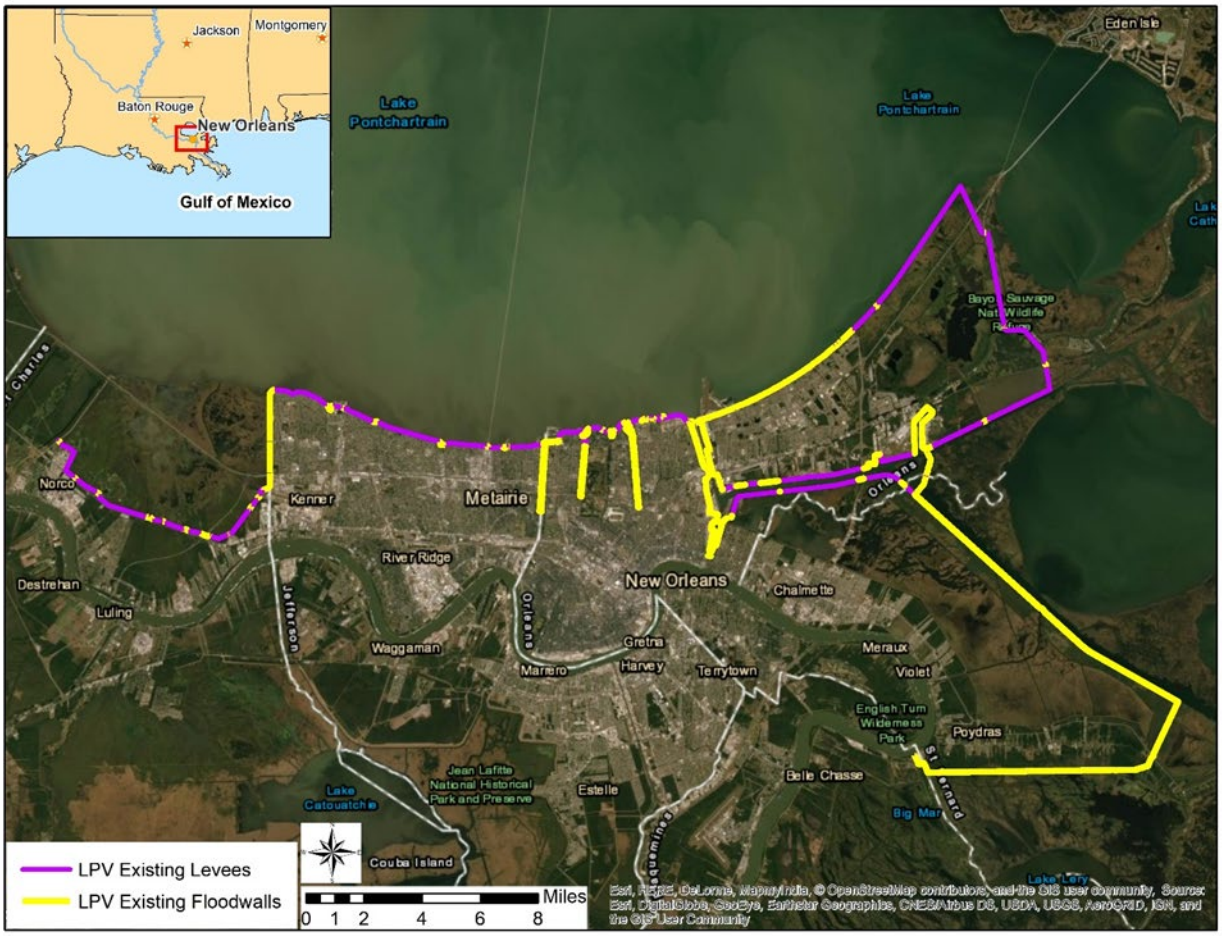

Figure 2. Lake Pontchartrain and Vicinity Existing Levees and Floodwalls

1.4 LAND USE

The total number of acres by sub-basin and type are shown in Table 1-1. Nearly 60 percent of the land in the study area is developed. Most the remaining acres in the study area are comprised of wetlands. Figure 3 shows the distribution across the study area.

Table 1-1. Study Area Historical and Projected Population by Parish

Land Use	St. Charles	Jefferson	Orleans East Bank	New Orleans East	Chalmette Loop	Study Area Total
Open Water	64	72	241	4,375	5,319	10,071 (6.6%)
Developed, Open Space	699	711	1,256	1,318	1,295	5,279 (3.5%)
Developed, Low Intensity	4,397	16,210	13,584	7,459	6,344	47,994 (31.3%)
Developed, Medium Intensity	1,184	6,574	8,110	3,023	2,760	21,651 (14.1%)

Developed, High Intensity	1,258	4,829	4,528	1,926	1,251	13,792 (9.0%)
Barren Land	107	37	0	744	554	1,442 (0.9%)
Deciduous Forest	50	30	23	24	120	247 (0.2%)
Evergreen Forest	22	0	1	0	69	92 (0.1%)
Mixed Forest	20	1	2	0	438	461 (0.3%)
Shrub/Scrub	48	8	6	29	195	286 (0.2%)
Herbaceous	35	9	0	144	99	287 (0.2%)
Hay/Pasture	79	10	3	43	360	495 (0.3%)
Cultivated Crops	123	0	0	116	544	783 (0.5%)
Woody Wetlands	4,358	13	3	6,342	9,594	20,310 (13.3%)
Emergent Herbaceous Wetlands	601	20	0	9,105	20,255	29,981 (19.6%)

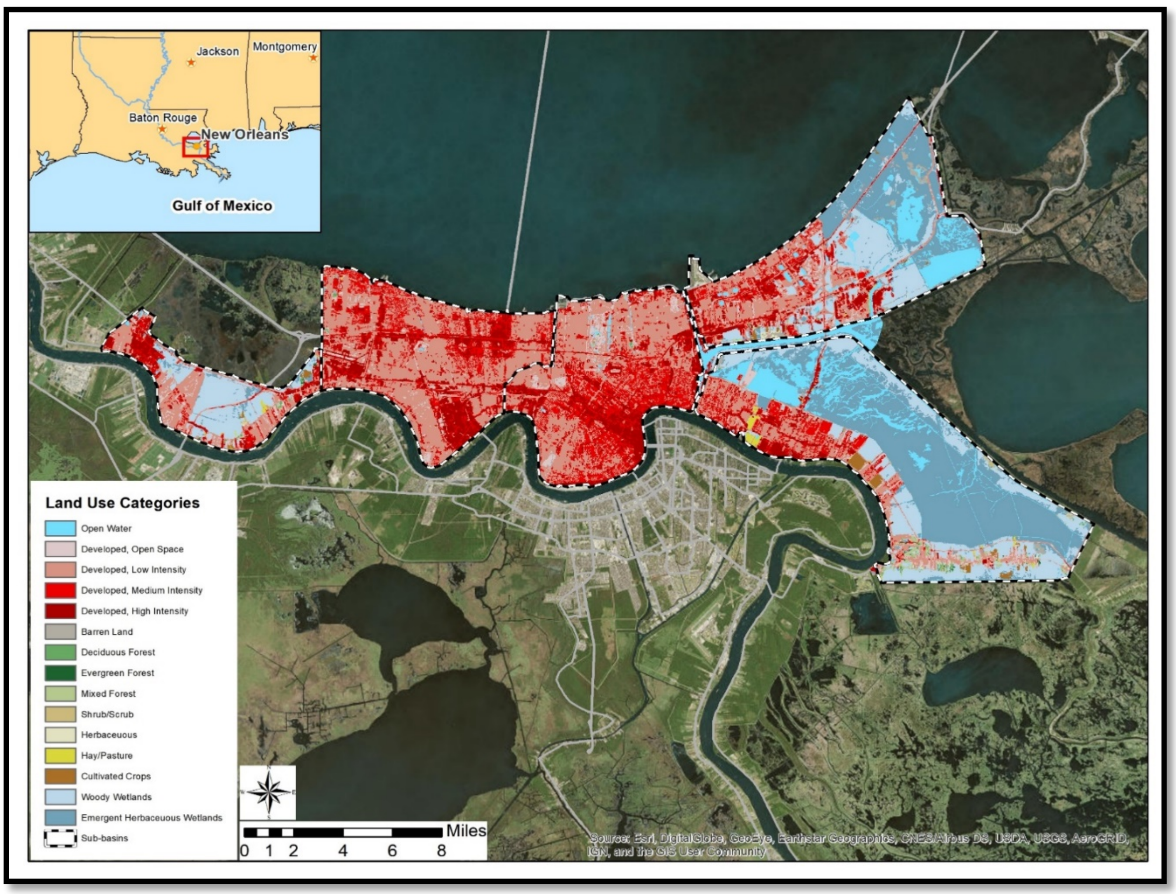

Figure 3. Land Use Distribution

2 SOCIO-ECONOMICS SETTING

2.1 POPULATION, NUMBER OF HOUSEHOLDS, AND EMPLOYMENT

Tables 2-1, 2-2, and 2-3 display the population, number of households, and the employment (number of jobs) for each of the four parishes for the years 2000, 2010, and 2019, as well as projections for the years 2030 and 2045. The 2000, 2010, and 2019 estimates for population and number of households are from the U.S. Census Bureau. The 2001, 2010, and 2019 estimates for employment are from the U.S Bureau of Economic Analysis. All projections were developed by Moody's Analytics, which has projections to the year 2045.

Table 2-1. Study Area Historical and Projected Population by Parish

Parish	2000	2010	2019	2030	2045
Jefferson	454,940	432,552	432,493	466,710	479,970
Orleans	485,610	343,829	390,144	416,800	428,640
St. Bernard	67,280	35,897	47,244	48,580	49,960
St. Charles	48,118	52,845	53,100	55,339	58,101
Sources: 2000, 2010, 2019 from U.S. Census Bureau; 2030, 2045 from Moody's Analytics Forecast					

Table 2-2. Existing Condition and Projected Households by Parish

Parish	2000	2010	2019	2030	2045
Jefferson	176,410	169,180	168,895	185,170	217,450
Orleans	189,020	143,980	154,036	188,680	203,320
St. Bernard	25,200	13,570	15,029	19,790	21,440
St. Charles	16,473	18,598	18,762	22,080	23,960
Sources: 2000, 2010, 2019 from U.S. Census Bureau; 2025, 2045 from Moody's Analytics Forecast					

Table 2-3. Existing Condition and Projected Employment by Parish

Parish	2001	2010	2019	2030	2045
Jefferson	226,620	207,568	207,150	227,260	251,560
Orleans	288,387	194,416	223,475	223,530	247,440
St. Bernard	17,232	11,753	11,351	12,360	13,690
St. Charles	19,629	23,100	23,615	30,330	34,670
Sources: 2001, 2010, 2019 from U.S. Bureau of Labor Statistics; 2025, 2045 from Moody's Analytics Forecast					

2.2 INCOME

Table 2-4 shows the actual and projected per capita personal income levels for the four parishes from 2000 to 2045. The 2000, 2010, and 2019 estimates are from the U.S Bureau of Economic Analysis and the projections for 2030 and 2045 are from the Moody's Analytics Forecast.

Table 2-4. Per Capita Income ($) by Parish

Parish	2000	2010	2019	2030	2045
Jefferson	28,638	42,411	52,274	75,450	136,868
Orleans	26,726	42,347	53,923	76,038	137,373
St. Bernard	22,504	30,650	33,556	41,710	72,640
St. Charles	24,634	39,557	49,353	49,660	146,912
Sources: 2000, 2010, 2019 from U.S. Bureau of Economic Analysis; 2030 and 2045 from Moody's Analytics (ECCA) Forecast					

2.3 COMPLIANCE WITH POLICY GUIDANCE LETTER (PGL) 25 AND EO 11988.

Given continued growth in population, it is expected that development will continue to occur in the study area with or without the enhanced flood risk reduction measures in place, and will not conflict with PGL 25 and EO 11988, which state that the primary objective of a flood risk reduction project is to protect existing development, rather than to make undeveloped land available for more valuable uses. However, the overall growth rate is anticipated to be the same with or without the project in place. Thus, the project would not induce development, but would rather reduce the risk of the population being displaced after a major storm event.

3 FLOOD HISTORY

3.1 MAJOR TROPICAL EVENTS

While the planning area has periodically experienced localized flooding from excessive rainfall events and has experienced two major floods from the Mississippi River in 1927 and 1973the primary cause of the flood events that have taken place in South Louisiana has been the tidal surges from hurricanes and tropical storms.

Hurricane Juan caused extensive flooding throughout southern Louisiana due to its prolonged 5-day movement back and forth along the Louisiana coast in October 1985. The majority of the flood damage occurred in the Lincolnshire and Westminster subdivisions located on the west bank of Jefferson Parish. Rainfall totals in the area ranged from five inches to almost 17 inches. The storm was responsible for storm surges of five to eight feet and tides of three to six above normal. According to FEMA officials, the estimated value of the residential and commercial damage and public assistance totaled $112.5 million.

The most significant storm event to affect the Metropolitan New Orleans Area since Hurricane Betsy in 1965 was Hurricane Katrina. Hurricane Katrina made landfall on August 29, 2005, near the town of Buras in Plaquemines Parish as a 0.25% AEP storm with winds in excess of 120 miles per hour and a storm surge of approximately 30 feet. After tracking across the southeastern Louisiana coastline, it made a second landfall near the town of Waveland on the Mississippi Gulf Coast. The surge from Lake Pontchartrain pushed water into the three major outflow canals (London Avenue, Orleans, and 17th Street) of the city of New Orleans, which overwhelmed their adjacent floodwalls. The surge from Lake Borgne overwhelmed the levees protecting St. Bernard Parish, New Orleans East, and the Lower Ninth Ward. Many portions of the metropolitan area were submerged in more than 6 feet of water for more than 3 weeks. Area pump stations were left inoperable or inaccessible, which caused the dewatering process to take approximately 53 days. According to the Department of Health and Hospitals (DHH), approximately 1,400 deaths were reported following Hurricane Katrina. Approximately 1.3 million residents were displaced immediately following the storm. The storm caused more than $40.6 billion of insured losses to the homes, businesses, and vehicles in six states. Approximately two thirds of these losses, or $25.3 billion, occurred in Louisiana based on data obtained from the Insurance Information Institute. According to the LRA, approximately 150,000 housing units were damaged, and according to the Department of Environmental Quality (DEQ), 350,000 vehicles, and 60,000 fishing and recreational vessels were damaged.

3.2 FEMA FLOOD CLAIMS

As of the 2019 season, the most recent named storms to affect the study area include, Hurricane Ike in 2008, Tropical Storm Lee in 2011, and Hurricane Gustav in 2008. Of the three, Hurricane Gustav brought the most damage to the study area. Table 3-1 lists the FEMS flood claims, by parish, from January 1878 through September 2018.

Table 3-1. FEMA Flood Claims by Parish for January 1878-September 2018

Parish	Total Number of Claims	Total Payments (millions)
Jefferson	129,140	$3,410
Orleans	124,030	$7,246
St. Bernard	23,626	$2,238
St. Charles	5,963	$101
Total	282,759	$12,995

3.3 FEMA Severe Repetitive Loss Properties

A Repetitive Loss (RL) property is any insurable building for which two or more claims of more than $1,000 were paid by the National Flood Insurance Program (NFIP) within any rolling 10-year period, since 1978. A RL property may or may not be currently insured by the NFIP. Table 3-2 shows the repetitive loss property by parish.

Table 3-2. FEMA Severe Repetitive Loss Properties by Parish (January 1978-December 2018)

Parish	Number of Structures
Jefferson	8,844
Orleans	6,544
St. Bernard	1,207
St. Charles	643
Total	17,238
Source: Federal Emergency Management Agency (FEMA)	

4 ANALYSIS OVERVIEW

4.1 STRUCTURE INVENTORY

The structure inventory used for this study is the National Structure Inventory (NSI) version 2. This updated version of the inventory uses open-source building footprints from Microsoft data, ESRI map layer data, and CoreLogic data to improve structure placement over the previous version of the NSI. RS Means was used to calculate the depreciated replacement value of structures. An extensive survey was conducted to estimate foundation heights for different sectors within the Metro New Orleans area. Furthermore, the foundation heights of the inventory were updated using data from a traffic zone survey that was conducted for the Metro New Orleans data. This structure inventory does not include future development. Structure counts by reach along with the total structure and content value are shown in Table 4-1. Structure counts by occupancy types are shown in Table 4-2.

Table 4-1. Structure Counts and Value by Reach (2021 price level)

Reach	Structure Count	Total Value
CL	19,598	7,802,961,000
JEB	86,639	48,018,373,000
NOE	23,959	11,612,588,000
OEB	93,052	63,381,560,000
SC	10,104	4,704,841,000
Total	233,352	135,520,323,000

Table 4-2. Residential and Non-Residential Structure Inventory Counts

Residential	Number
One-Story Slab	73,761
One-Story Pier	67,339
Two-Story Slab	26,600
Two-Story Pier	23,478
Mobile Home	3,420
Total	**194,598**
Non-Residential	**Number**
Eating and Recreation	3,718
Professional	12,065
Public and Semi-Public	3,293
Repair and Home Use	4,211
Retail and Personal Services	7,666
Warehouse	5,016
Multi-Family Occupancy	2,795
Total	**38,764**

4.2 STRUCTURE VALUE UNCERTAINTY

The uncertainty surrounding the residential structure values was based on the depreciation percentage applied to the average replacement cost per square foot calculated from the four exterior wall types. A triangular probability distribution was used to represent the uncertainty surrounding the residential structure values in each occupancy category. The most-likely depreciated value was based on the average construction class and a 20 percent depreciation rate (consistent with an observed age of a 20-year old structure in average condition), the minimum value was based on the economy construction class and a 45 percent depreciation rate (consistent with an observed age of a 30-year old structure in poor condition), and the maximum value was based on the luxury construction class and a 7 percent depreciation rate (consistent with an observed age of a 10-year old structure in good condition). These values were then converted to a percentage of the most-likely value with the most-likely value equal to 100 percent of the average value for each occupancy category and the economy and luxury class values equal to a percentage of these values. The triangular probability distributions were entered into the HEC-FDA model to represent the uncertainty surrounding the structure values in each residential occupancy category.

The uncertainty surrounding the non-residential structure values was based on the depreciation percentage applied to the average replacement cost per square foot calculated from the six exterior wall types. A triangular probability distribution based on the depreciation percentage associated with an observed age (determined using the professional judgment of personnel familiar with the study area) and the type of frame structure was used to represent the uncertainty surrounding the non-residential structure values in each occupancy category. The most-likely depreciated value was based on the depreciation percentage (25 percent) assigned to structures with an observed age of 20 years for masonry and wood construction, the minimum depreciated value was based on the depreciation percentage (40 percent) assigned to structures with an observed age of 30 years for framed construction, and the maximum depreciated value was based on the on the depreciation percentage (8 percent) assigned to structures with an observed age of 10 years for masonry on masonry or steel construction. These values were then converted to a percentage of the most-likely value with the most-likely value being equal to 100 percent and the minimum and maximum values equal to percentages of the most-likely value. The triangular probability distributions were entered into the HEC-FDA model to represent the uncertainty surrounding the structure values for each non-residential occupancy category.

4.3 DEPTH-DAMAGE RELATIONSHIPS AND CONTENT-TO-STRUCTURE VALUE RATIO (CSVR)

Depth-damage relationships define the relationship between the depth of flooding and the percent of damage at varying depths that occurs to structures and contents. These mathematical functions are used to quantify the flood damages to a given structure. The content-to-structure value ratio (CSVR) is expressed as a ratio of two values: the depreciated replacement cost of contents and the depreciated replacement cost of the structure. One method to derive these relationships is the "Expert Opinion" method described in the Handbook of Forecasting Techniques, IWR Contract Report 75-7, December 1975 and Handbook of Forecasting Techniques, Part II, Description of 31 Techniques, Supplement to IWR Contract Report 75-7, August 1977. A panel of experts was convened to develop site-specific depth-damage relationships and CSVRS for feasibility studies associated with Jefferson and Orleans Parishes. Professionals in the fields of residential and non-residential construction, general contractors, insurance claims adjusters with experience in flood damage, and a certified restoration expert were selected to sit on the panel. The panel was tasked with developing an array of residential and non-residential structure and content types. Residential structure types were divided into one-story on pier, one-story on slab, two-story on pier, two-story on slab and mobile homes. Non-residential structure types were categorized as metal-frame walls, masonry bearing walls, and wood or steel frame walls. Residential contents were evaluated as one-story, two-story, or mobile home. Non-residential content categories included the following types: eating and recreation, groceries and gas stations, multi-family residences, repair and home use, retail and personal services, professional businesses, public and semi-public, and warehouse and contractor services. The results of this panel were published in the report Depth-Damage Relationships for Structures, Contents, and Vehicles and Content-To-Structure Value Ratios (CSVRS) In Support Of the Jefferson and Orleans Flood Control Feasibility Studies, June 1996 Final Report. Table 4-3 displays the content-to-structure value ratios and their respective standard deviations used for LPV.

Table 4-3. Content-to-Structure Value Ratios and Standard Deviations

Structure Category		(CSVR,SD)
Residential	One-story	(0.69, 0.37)
	Two-story	(0.67, 0.35)
	Mobile home	(1.14, 0.79)
Non-Residential	Eating and Recreation	(1.70, 2.93)
	Groceries and Gas Stations	(1.34, 0.78)
	Professional Buildings	(0.54, 0.54)
	Public and Semi-Public Buildings	(0.55, 0.80)

Structure Category		(CSVR,SD)
	Multi-Family Buildings	(0.28, 0.17)
	Repair and Home Use	(2.36, 2.95)
	Retail and Personal Services	(1.19, 1.05)
	Warehouses and Contractor Services	(2.07. 3.25)

4.4 VEHICLE INVENTORY AND VALUES

Based on 2010 Census information for the New Orleans Metropolitan area, there are an average of 2.0 vehicles associated with each household (owner occupied housing or rental unit). According to the Southeast Louisiana Evacuation Behavioral Report published in 2006 following Hurricanes Katrina and Rita, approximately 70 percent of privately owned vehicles are used for evacuation during storm events. The remaining 30 percent of the privately owned vehicles remain parked at the residences and are subject to flood damages. According to Edmunds.Com, the average value of a used car was $18,800 as of 2nd quarter 2015. The Manheim Used Vehicle Value Index was used to adjust the average value to reflect FY 2019 price levels. According to the Manheim index, the average value of a used car increase 8.0 percent to $20,000 between the years 2015 and 2020. Since only those vehicles not used for evacuation can be included in the damage calculations, an adjusted average vehicle value of $12,000 ($20,000 x 2.0 x 0.30) was assigned to each individual residential automobile structure record in the HEC-FDA model. If an individual structure contained more than one housing unit, then the adjusted vehicle value was assigned to each housing unit in a residential or multi-family structure category. Only vehicles associated with residential structures were included in the analysis. Vehicles associated with non-residential properties were not included in the evaluation. Finally, every apartment building was assumed to contain 30 units so every apartment building has $360,000 as the average value for vehicles (30 units x $12 thousand).

4.5 VEHICLE VALUE UNCERTAINTY

The uncertainty surrounding the values assigned to the vehicles in the inventory was determined using a triangular probability distribution function. The average value of a used car, $18,800, was used as the most-likely value. The average value of a new vehicle, $34,000, before taxes, license, and shipping charges was used as the maximum value, while the average 10-year depreciation value of a vehicle, $3,000 was used as the minimum value. The percentages were developed for the most-likely, minimum, and the maximum values with the most-likely equal to 100 percent, and the minimum and the maximum values as percentages of the most-likely value (minimum=25%, most-likely=100%, maximum=183%). These percentages were entered into the HEC-FDA model as a triangular probability distribution to represent the uncertainty surrounding the vehicle value for both residential and non-residential vehicles.

4.6 FIRST FLOOR ELEVATIONS

Topographical data based on NAVD 88 vertical datum was used to assign ground elevations to structures and vehicles in the study area. The assignment of ground elevations and the placement of structures were based on a digital elevation model (DEM) with a fifteen foot by fifteen foot grid resolution developed by the United States Geological Survey (USGS). The ground elevation was added to the height of the foundation of the structure above the ground in order to obtain the first floor elevation of each structure in the study area. Vehicles were assigned to the ground elevation of the adjacent residential structures.

4.7 UNCERTAINTY SURROUNDING ELEVATIONS

There are two sources of uncertainty surrounding the first floor elevations: the use of the LiDAR data for the ground elevations, and the methodology used to determine the structure foundation heights above ground elevation. The error surrounding the LiDAR data was determined to be plus or minus 0.5895 feet at the 95 percent level of confidence. This uncertainty was normally distributed with a mean of zero and a standard deviation of 0.3 feet.

The uncertainty surrounding the foundation heights for the residential structure categories and commercial structures was estimated by calculating the standard deviations surrounding the sampled mean values. An overall weighted average standard deviation for all of the sampled structures was computed for each residential and non-residential structure category and for all of the residential and non-residential structures, regardless of structure category.

Uncertainty can only be applied to structure occupancies in the HEC-FDA model. In order to develop a standard deviation for each structure occupancy, first, the structures in each residential category had to be grouped into the structure occupancies; second, a mean foundation height value was the structures within the structure occupancy; third, the standard deviation as a percentage of the mean foundation height value for all the sampled residential structures was calculated and that percentage was applied to the mean foundation value of the residential and non-residential occupancies; fourth, the calculated standard deviation for each structure occupancy was entered into the HEC-FDA model.

5 DAMAGES AND BENEFITS ESTIMATION

5.1 ECONOMIC MODEL

The Hydrologic Engineering Center Flood Damage Analysis (HEC-FDA) program version 1.4.2 was utilized to evaluate flood damages using risk-based methods. This program is used to quantify the uncertainty in discharge-exceedance probability, stage-discharge, and stage-damage functions and assimilates it into the economic and engineering performance analyses of alternatives. Monte Carlo simulation is used to compute the expected value of damage while explicitly accounting for the uncertainty in economic and hydraulic parameters used to determine flood inundation damages. The analysis considers a range of possible values for each economic variable used to calculate the elevation- or stage-damage curves, and for each hydrologic/hydraulic variable used to calculate the stage-frequency curves. It also considers a probability distribution for the likely occurrence of any given outcome within the specified range. The key economic inputs for the analysis are the structure inventory, depth-damage functions, content-to-structure value ratios, and the associated quantified risk and uncertainty parameters associated with these inputs.

5.2 STAGE-DAMAGE RELATIONSHIPS WITH UNCERTAINTY

The HEC-FDA model used the economic and engineering inputs to generate a stage-damage relationship for each structure category in each study area reach under 2028 and 2077 conditions. The possible occurrences of each economic variable were derived through the use of Monte Carlo simulation. A total of 1,000 iterations were executed by the model for the LPV evaluation. The sum of all sampled values was divided by the number of samples to yield the expected value for a specific simulation. A mean and standard deviation was automatically calculated for the damages at each stage.

5.3 STAGE-PROBABILITY RELATIONSHIPS WITH UNCERTAINTY

The HEC-FDA model used an equivalent record length of 50 years for each study area reach to generate a stage-probability relationship with uncertainty through the use of graphical analysis. Order statistics are used to define the uncertainty about a graphical frequency function defined by Weibull plotting positions for a specified equivalent record length. A normal distribution is used to define the errors. The model used the eight stage-probability events (1, 0.1, .04, .02, .01, .005, .002, .001) representing water surface elevations from coastal storm surge together with the equivalent record length to define the full range of the stage-probability or stage-probability functions by interpolating between the data points. The model used the eight stage-probability events together with the equivalent record length to define the full range of the stage-probability or stage-probability functions by interpolating between the data points. Confidence bands surrounding the stages for each of the probability events were also provided. False levees were used to control for damages occurring below the stages where inundation begins. Table 5-1 shows the damages by probability event in both 2028 and 2077. The stage probability relationships that were developed for this study reflect inundation resulting from overtopping of the existing system. Levee fragility was not modeled for this study. Although it is common to include levee fragility as part of the estimation of without-project damages for existing local levees, the existing levee system in this study is a FEMA certified Federal levee system that was constructed in accordance with the USACE HSDRRS criteria.

Table 5-1. Study Area Damages by Year and Probability Event ($1,000s)

AEP	Damages 2028	Damages 2077
0.1	0	0
0.05	0	0
0.02	0	75,000
0.01	18,000	1,525,000
0.005	929,000	32,505,000
0.002	18,651,000	89,972,000
0.001	38,383,000	111,914,000

5.4 EXPECTED ANNUAL DAMAGES

The model used Monte Carlo simulation to sample from the stage-probability curve with uncertainty. For each of the iterations within the simulation, stages were simultaneously selected for the entire range of probability events. The sum of all damage values divided by the number of iterations run by the model yielded the expected value, or mean damage value, with confidence bands for each probability event. The probability-damage relationships are integrated by weighting the damages corresponding to each magnitude of flooding (stage) by the percentage chance of exceedance (probability). From these weighted damages, the model determined the expected annual damages (EAD) with confidence bands (uncertainty). For the without-project condition, the expected annual damages (EAD) were totaled for each study area reach to obtain the total without-project EAD under 2028 and 2077 conditions. Table 5-2 shows the without-project damages by damage category for 2028 and 2077. Tables 5-3 and 5-4 show the without-project damages by reach for 2028 and 2077 respectively. The increase in damages from 2028 to 2077 is due to increasing sea-level rise along with increasing subsidence of the existing levee system. No future development was included in this analysis. This process is repeated for the Recommended Plan.

Table 5-2. Study Area Damage by Damage Category ($1,000s)

Year	Auto	Commercial	Mobile Homes	Residential	Total
2028	3,417	51,974	1,259	40,720	97,370
2077	14,533	258,248	7,097	200,127	480,005

Table 5-3. Study Area Expected Annual Damages Without-Project (2028; $1,000s)

Reach	EAD
Chalmette Loop	6,353
Jefferson East Bank	68,820
New Orleans East	7,177
Orleans East Bank	7,640
Saint Charles	7,380
Total	97,370

Table 5-4. Study Area Expected Annual Damages Without-Project (2077; $1,000s)

Reach	EAD
Chalmette Loop	12,150
Jefferson East Bank	249,553
New Orleans East	36,300
Orleans East Bank	160,211
Saint Charles	21,791
Total	480,005

5.5 EQUIVALENT ANNUAL DAMAGES

The model uses the discount rate to discount the future damages and benefits occurring in 2077 back to the base year of 2028. Table 5-5 shows the equivalent annual damages by reach for the without-project condition and the damages reduced for the Recommended Plan. Table 5-6 shows the equivalent annual damages and benefits by category and the percentage that each category contributes to the total.

Table 5-5. Study Area Equivalent Annual Damages and Benefits by Reach (FY 21 Price Level; FY 21 Discount Rate; $1,000s)

Reach	Without Project Damages	Residual Damages	Damages Reduced
Chalmette Loop	8,612	1,909	6,703
Jefferson East Bank	139,247	17,690	121,558
New Orleans East	18,526	1,964	16,561
Orleans East Bank	67,094	31,171	35,923
Saint Charles	12,995	136	12,860
Total	246,474	52,869	193,605

Table 5-6. Study Area Equivalent Annual Damages and Benefits by Damage Category (FY 21 Price Level; FY 21 Discount Rate; $1,000s)

Without Project Damages				
Auto	**Commercial**	**Mobile Homes**	**Residential**	**Total**
7,749	132,354	3,534	102,837	246,474
3%	54%	1%	42%	100%
Damages Reduced				
5,833	107,241	2,789	77,741	193,605
3%	55%	1%	40%	100%

6 PROJECT COSTS

6.1 AVERAGE ANNUAL COSTS

The schedule of initial construction cost, which make up the cost of addressing the existing deficiencies in the system, were used to determine the interest during construction and gross investment cost at the end of the installation period (2028). The FY 2021 Federal discount rate of 2.5 percent was used to discount the costs to the base year and then amortize the costs over the 50-year period of analysis. The incremental operations, maintenance, relocations, rehabilitation, and repair (OMRR&R) costs for the recommended plan was discounted to present value and annualized using the Federal discount rate of 2.5 percent for 50 years. This estimate assumes an average yearly cost of $1000 per linear foot for minor repairs to concrete, joints, and slope paving, as well as minor mowing. It also assumes an average yearly cost of $2700 per acre of levee surface for mowing. This estimate of OMRR&R represents the incremental costs associated with the new or improved project features. The total OMRR&R represents approximately 3% of the total project cost. Table 6-1 provides the life cycle costs for each of the project components, the average annual construction costs, the annual operation and maintenance costs, and the total average annual costs for the Recommended Plan.

Table 6-1. Recommended Plan (2021 Price Level; FY 21 Discount Rate)

Year	Years from Base Year	Expenditures	Present Value Factor	Present Value of Expenditures
2025	3	$36,551,557	1.0637	38,879,041
2026	2	$36,551,557	1.0377	37,930,772
2027	1	$36,551,557	1.0124	37,005,631
2028	0	$0	0.9877	0
2029	-1	$0	0.9636	0
2030	-2	$0	0.9401	0
2031	-3	$0	0.9172	0
2032	-4	$20,712,363	0.8948	18,534,132
2033	-5	$20,712,363	0.8730	18,082,080
2034	-6	$0	0.8517	0
2035	-7	$32,470,399	0.8309	26,981,037
2036	-8	$108,572,238	0.8107	88,016,872
2037	-9	$108,572,238	0.7909	85,870,119
2038	-10	$18,396,386	0.7716	14,194,886
2039	-11	$49,300	0.7528	37,113
2040	-12	$27,476,235	0.7344	20,179,431
2041	-13	$28,194,235	0.7165	20,201,710
2042	-14	$43,832,390	0.6990	30,640,730
2043	-15	$767,300	0.6820	523,293

Year	Years from Base Year	Expenditures	Present Value Factor	Present Value of Expenditures
2044	-16	$35,092,677	0.6654	23,349,238
2045	-17	$76,251,961	0.6491	49,497,512
2046	-18	$72,394,457	0.6333	45,847,304
2047	-19	$19,163,686	0.6179	11,840,326
2048	-20	$19,163,686	0.6028	11,551,538
2049	-21	$19,163,686	0.5881	11,269,793
2050	-22	$767,300	0.5737	440,229
2051	-23	$767,300	0.5597	429,491
2052	-24	$20,836,369	0.5461	11,378,561
2053	-25	$50,016,020	0.5328	26,647,138
2054	-26	$29,946,951	0.5198	15,565,755
2055	-27	$29,946,951	0.5071	15,186,102
2056	-28	$767,300	0.4947	379,608
2057	-29	$767,300	0.4827	370,349
2058	-30	$767,300	0.4709	361,316
2059	-31	$767,300	0.4594	352,504
2060	-32	$767,300	0.4482	343,906
2061	-33	$767,300	0.4373	335,518
2062	-34	$35,568,039	0.4266	15,173,528
2063	-35	$39,898,537	0.4162	16,605,798
2064	-36	$39,898,537	0.4060	16,200,779
2065	-37	$39,898,537	0.3961	15,805,638
2066	-38	$767,300	0.3865	296,549
2067	-39	$767,300	0.3771	289,316
2068	-40	$767,300	0.3679	282,260
2069	-41	$24,795,796	0.3589	8,898,927
2070	-42	$24,795,796	0.3501	8,681,880
2071	-43	$24,795,796	0.3416	8,470,127
2072	-44	$767,300	0.3333	255,713
2073	-45	$767,300	0.3251	249,476
2074	-46	$767,300	0.3172	243,392
2075	-47	$767,300	0.3095	237,455
2076	-48	$767,300	0.3019	231,664

Year	Years from Base Year	Expenditures	Present Value Factor	Present Value of Expenditures
2077	-49	$767,300	0.2946	226,013
		$1,134,081,700		$754,371,549
Interest Rate (%)	2.5			
Amortization Factor	0.03526			
Average Annual Costs	$26,119,100			
Average Annual O&M Costs	$478,600			
Total Average Annual Costs	$26,597,700			

7 RESULTS

7.1 NET BENEFITS

The net benefits for the Recommended Plan were calculated by subtracting the average annual costs from the equivalent annual benefits. The net benefits were used to determine the economic justification of the Recommended Plan. Table 7-1 displays the equivalent annual damages and benefits, total first costs, average annual cost, benefit-to-cost ratio, and equivalent annual net benefits for the Recommended Plan. The Recommended Plan is economically justified, meaning its benefit-to-cost ratio is a least 1.

Table 7-1. Net Benefits Summary for the Recommended Plan (FY 2021 Price Level; FY 2021 Discount Rate; $1,000s)

Alternative	Recommended Plan
Project First Cost	$1,105,593
Interest During Construction	$4,160
Total Investment Cost	$1,109,753
AA Investment Costs	$26,119
AA O&M Costs	$479
Total AA Costs	$26,598
Without Project EAD	$246,474
EAD Reduced Benefits	$193,605
Net Benefits	$167,007
B/C Ratio	7.3

7.2 BENEFIT EXCEEDANCE PROBABILITY RELATIONSHIP

The HEC-FDA model used the uncertainty surrounding the economic and engineering inputs to generate results that can be used to assess the performance of the recommended plan. Table 7-2 shows the expected annual benefits at the 75, 50, and 25 percentiles. These percentiles reflect the percentage chance that the benefits will be greater than or equal to the indicated values. The benefit exceedance probability relationship for the Recommended Plan can be compared to the point estimate of its average annual cost. The table indicates the percent chance that the expected annual benefits will exceed the expected annual costs therefore the benefit cost ratio is greater than one and the net benefits are positive. The net benefits and B/C ratios are also displayed at each of the percentiles.

Table 7-2. Risk Analysis Probability that Expected Annual Benefits Exceed Annual Costs (FY 2021 Price Level; FY 2021 Discount Rate; $1,000s)

		Probability that Damages Reduced exceed indicated values				
Plan Name	**Equivalent Annual Damages Reduced**	**0.75**	**0.5**	**0.25**	**Average Annual Costs**	**Probability Benefits Exceed Costs**
Recommended Plan	$193,605	27,243	73,715	298,131	$26,598	Greater Than 75%
Net Benefits		645	47,117	271,533		
B/C Ratio		1.0	2.8	11.2		

7.3 RELATIVE SEA LEVEL RISE SCENARIOS

The prior analysis incorporated H&H data that was developed from the intermediate relative sea-level rise scenario, which was determined to be the most likely scenario to occur. H&H data was also developed for low and high relative sea-level rise scenarios. The project benefits, net benefits, and b/c ratios were recalculated under both alternate relative sea-level rise scenarios. These results are displayed in Table 7-3.

Table 7-3. Relative Sea Level Rise Scenarios (FY 2021 Price Level; FY 2021 Discount Rate; $1,000s)

Scenario	Low RSLR	High RSLR
Total AA Costs	26,598	26,598
Without Project EAD	215,437	394,109
EAD Reduced Benefits	170,066	234,498
Net Benefits	143,468	207,900
B/C Ratio	6.4	8.8

7.4 PROJECT PERFORMANCE

The results from the HEC-FDA model were also used to calculate the long-term annual exceedance probability (AEP) and the conditional non-exceedance probability, or assurance, for various probability storm events. The model provided a target stage to assess project performance for each study area reach for the base year, 2028, and the last year in the 50-year period of analysis under both without-project and with-project conditions. For study area reaches without proposed levees or berms, the target stage was set by default at the elevation where the model calculated five percent residual damages for the 1% AEP (100-year) event.

The HEC-FDA model calculated a target stage AEP with a median and expected value that reflected the likelihood that the target stages will be exceeded in a given year. The median value was calculated using point estimates, while the expected value was calculated using Monte Carlo simulation. The results also show the long-term risk or the probability of a target stage being exceeded over 10-year, 30-year, and 50-year periods. Finally, the model results show the conditional non-exceedance probability or the likelihood that a target stage will not be exceeded by the 10% AEP (10 year), the 4% AEP (25-year), the 2% AEP (50-year), the 1% AEP (100-year), the 0.4% AEP (250-year), and the 0.2% AEP (500-year). Tables 7-4 through B:7-7 display the project performance results for each study area reach for the base year, 2028, and the last year in the 50-year period of analysis, 2077, under without-project and with-project conditions.

Table 7-4. Project Performance by Reach, Without Project 2028

					Long Term Risk (years)			Conditional Non-Exceedance Probability by Events					
Reach	Target Stage	Geo Tech	Median	Expected	10	30	50	0.1	0.04	0.02	0.01	0.004	0.002
CL	-3	L	0.01	0.015	0.1403	0.3645	0.5303	0.9998	0.9797	0.777	0.4499	0	0
JEB	-8	L	0.02	0.037	0.314	0.6772	0.8481	0.9997	0.8068	0.0973	0.0256	0.0117	0.0049
NOE	-6	L	0.01	0.0157	0.1466	0.3784	0.5472	0.9996	0.9784	0.7771	0.4272	0	0
OEB	0.84	L	0.01	0.0151	0.1415	0.3672	0.5336	0.9996	0.9781	0.7738	0.4428	0	0
SC	1.17	L	0.0101	0.0098	0.0938	0.2558	0.3888	0.9998	0.9998	0.8779	0.4975	0.3875	0.3285

Table 7-5. Project Performance by Reach, Without Project 2077

					Long Term Risk (years)			Conditional Non-Exceedance Probability by Events					
Reach	Target Stage	Geo Tech	Median	Expected	10	30	50	0.1	0.04	0.02	0.01	0.004	0.002
CL	-3	L	0.02	0.0352	0.301	0.6584	0.8331	0.9997	0.8068	0.1086	0.0285	0.012	0.0066
JEB	-7	L	0.02	0.0368	0.3124	0.6749	0.8463	0.9997	0.8065	0.049	0.0129	0.009	0.0074
NOE	-5.58	L	0.0198	0.0245	0.2197	0.525	0.7108	0.9997	0.9997	0.1629	0.0423	0.0132	0.0084
OEB	0.85	L	0.0199	0.026	0.2317	0.5465	0.7323	0.9998	0.9993	0.1249	0.0327	0.0162	0.0105
SC	1.17	L	0.0194	0.0216	0.1958	0.48	0.6637	0.9997	0.9997	0.2556	0.0674	0.0463	0.0357

Table 7-6. Project Performance by Reach, Recommended Plan 2028

					Long Term Risk (years)			Conditional Non-Exceedance Probability by Events					
Reach	Target Stage	Geo Tech	Median	Expected	10	30	50	0.1	0.04	0.02	0.01	0.004	0.002
CL	-3	L	0.02	0.0262	0.2336	0.5498	0.7355	0.9995	0.8057	0.4989	0.0521	0	0
JEB	-8	L	0.999	0.999	1	1	1	0	0	0	0	0	0
NOE	-6	L	0.999	0.999	1	1	1	0	0	0	0	0	0
OEB	0.84	L	0.1	0.1237	0.7329	0.9809	0.9986	0.2015	0	0	0	0	0
SC	1.03	L	0.5	0.5921	0.9999	1	1	0	0	0	0	0	0

Table 7-7. Project Performance by Reach, Recommended Plan 2077

					Long Term Risk (years)			Conditional Non-Exceedance Probability by Events					
Reach	**Target Stage**	**Geo Tech**	**Median**	**Expected**	**10**	**30**	**50**	**0.1**	**0.04**	**0.02**	**0.01**	**0.004**	**0.002**
CL	-3	L	0.02	0.0266	0.236	0.5541	0.7398	0.9996	0.8053	0.4967	0.3016	0	0
JEB	-6.97	L	0.01	0.0145	0.1362	0.3555	0.5191	0.9996	0.9996	0.9887	0.4931	0	0
NOE	-5.58	L	0.0099	0.0144	0.1349	0.3525	0.5154	0.9995	0.9995	0.9884	0.5189	0	0
OEB	0.85	L	0.0199	0.0268	0.2382	0.558	0.7435	0.9998	0.9994	0.1118	0.0294	0.016	0.0112
SC	1.17	L	0.008	0.0082	0.0789	0.2186	0.3371	0.9997	0.9997	0.9997	0.9121	0	0

8 REGIONAL ECONOMIC DEVELOPMENT (RED)

8.1 GENERAL

The Regional Economic Development (RED) account addresses the impacts that the USACE expenditures associated with the construction of a coastal storm risk management system will have on the levels of income, output and employment throughout the region. These impacts are not included in the NED analysis, but can still be used by decision makers as part of their investment decision process.

This Regional Economic Development (RED) analysis employs input-output economic analysis, which measures the interdependence among industries and workers in an economy. This analysis uses a matrix representation of a regional economy to predict the effect that changes in one industry will have on other industries. The greater the interdependence among industry sectors, the larger the multiplier effect on the economy. Changes to government spending drive the input-output model to project new levels of sales (output), value added Gross Regional Product (GRP), employment, and income for each industry.

RECONS Version 2 was the specific input-output model used to estimate the regional economic development impacts of the Recommended Plan. The U.S. Army Corps of Engineers (USACE) Institute for Water Resources, Louis Berger, and Michigan State University developed the regional economic impact modeling tool, RECONS (Regional Economic System), that provides estimates of jobs and other economic measures such as labor income, value added, and sales that are supported by USACE programs, projects, and activities. This modeling tool automates calculations and generates estimates of jobs, labor income, value added, and sales through the use of IMPLAN®'s multipliers and ratios, customized impact areas for USACE project locations, and customized spending profiles for USACE projects, business lines, and work activities. RECONS allows the USACE to evaluate the regional economic impact and contribution associated with USACE expenditures, activities, and infrastructure.

8.2 DESCRIPTION OF METRICS

"Output" is the sum total of transactions that take place as a result of the construction project, including both value added and intermediate goods purchased in the economy. "Labor Income" includes all forms of employment income, including employee compensation (wages and benefits) and proprietor income. "Value Added" or "Gross Regional Product" represents the value-added output of the study regions. This metric captures all final goods and services produced in the study areas because of the existence of the project. It is different from output in the sense that one dollar of a final good or service may have multiple transactions associated with it. "Jobs" is the estimated worker-years of labor required to build the project.

8.3 ASSUMPTIONS

Input-output analysis rests on the following assumptions. The production functions of industries have constant returns to scale, so if output is to increase, inputs will increase in the same proportion. Industries face no supply constraints; they have access to all the materials they can use. Industries have a fixed commodity input structure; they will not substitute any commodities or services used in the production of output in response to price changes. Industries produce their commodities in fixed proportions, so an industry will not increase production of a commodity without increasing production in every other commodity it produces. Furthermore, it is assumed that industries use the same technology to produce all of their commodities. For this analysis, the Long-Term Impacts and Contributions module was used to account for expenditures occurring throughout the period of analysis. The economic impacts results are presented for the entire period of analysis, aggregated for all 50 years for output, labor income, and value added. The number of jobs is presented as an average across all years included in the period of analysis.

8.4 RESULTS

The construction expenditures associated with the Recommended Plan are estimated to be $1,105,593,000. Of this total expenditure, $1,070,309,718 will be captured within the local impact area. The remainder of the expenditures will be captured within the state impact area and the nation. These direct expenditures generate additional economic activity, often called secondary or multiplier effects. The direct and secondary impacts are measured in output, jobs, labor income, and gross regional product (value added) as summarized in the following tables. The regional economic effects are shown for the local, state, and national impact areas. In summary, the expenditures of $1,105,593,000 support a total of 292 average annual, full-time equivalent jobs, $1,122,511,177 in labor income, $1,296,667,786 in gross regional product, and $2,088,615,000 in economic output in the local impact area. More broadly, these expenditures support 379 average annual, full-time equivalent jobs, $1,506,297,652 in labor income, $1,867,910,659 in gross regional product, and $3,096,587,178 in economic output in the nation. Table 8-1 summarizes these results.

Table 8-1. Regional Economic Development (RED) Summary

Area	Output	Jobs*	Labor Income	Value Added
Local				
Direct Impact	$1,070,309,718	197	$788,868,080	$709,867,871
Secondary Impact	$1,018,305,281	95	$333,643,097	$586,799,915
Total Impact	$2,088,615,000	292	$1,122,511,177	$1,296,667,786
State				
Direct Impact	$1,074,870,917	203	$831,590,902	$717,952,264
Secondary Impact	$1,059,505,971	101	$340,238,148	$601,215,694
Total Impact	$2,134,376,888	303	$1,171,829,050	$1,319,167,958
US				
Direct Impact	$1,098,810,292	220	$865,325,430	$774,817,200
Secondary Impact	$1,997,776,886	159	$640,972,222	$1,093,093,459
Total Impact	$3,096,587,178	379	$1,506,297,652	$1,867,910,659

* Jobs are presented in average annual, full-time equivalence (FTE)

It should be noted that in addition to the regional benefits that would accrue to the study area from the expenditures associated with the construction of the levee lifts, there are additional regional benefits in the form of the avoidance of business losses. Given that the study area is highly developed with a large number of commercial structures, a significant storm event that would overtop the existing system would cause major disruptions in regional commerce. Maintaining the target level of risk reduction with the levee lifts would reduce the likelihood that the system would overtop, and, in the event that overtopping did occur, would likely result in lower levels of flooding inside of the levee system, mitigating the potential disruption.

2021

Lake Pontchartrain & Vicinity GRR
Appendix K – Mitigation Plan

US Army Corps of Engineers
New Orleans District

U.S. Army Corps of Engineers, New Orleans District

Non-Federal Sponsor: Coastal Protection and Restoration Authority

July 2021

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LAKE PONTCHARTRAIN & VICINITY GRR
APPENDIX K – MITIGATION PLAN

1. INTRODUCTION

1.1 PROPOSED ACTION

The U.S. Army Corps of Engineers (USACE), Mississippi Valley Division, New Orleans District (CEMVN), prepared an Environmental Impact Statement (EIS) and General Re-Evaluation Report (GRR) to evaluate the impacts associated with the proposed construction of the Lake Pontchartrain and Vicinity (LPV) project. See Section 1.3 and 1.6 of the LPV GRR/EIS for study authority and study description, respectively.

The flood side shifts would impact approximately 20.3 acres of bottomland hardwood-wet habitat along the co-located LPV and Mississippi River Levees (MRL). It is anticipated that LPV levees or floodwalls would need to be placed on top of the Mississippi River and Tributaries (MR&T) levees (raising elevation 2-2.5 feet) between river miles 81 and 90 (Figure 1). River mile 90.5 has been identified as the design grade crossover point with an intermediate relative sea level rise scenario (1.8 feet).

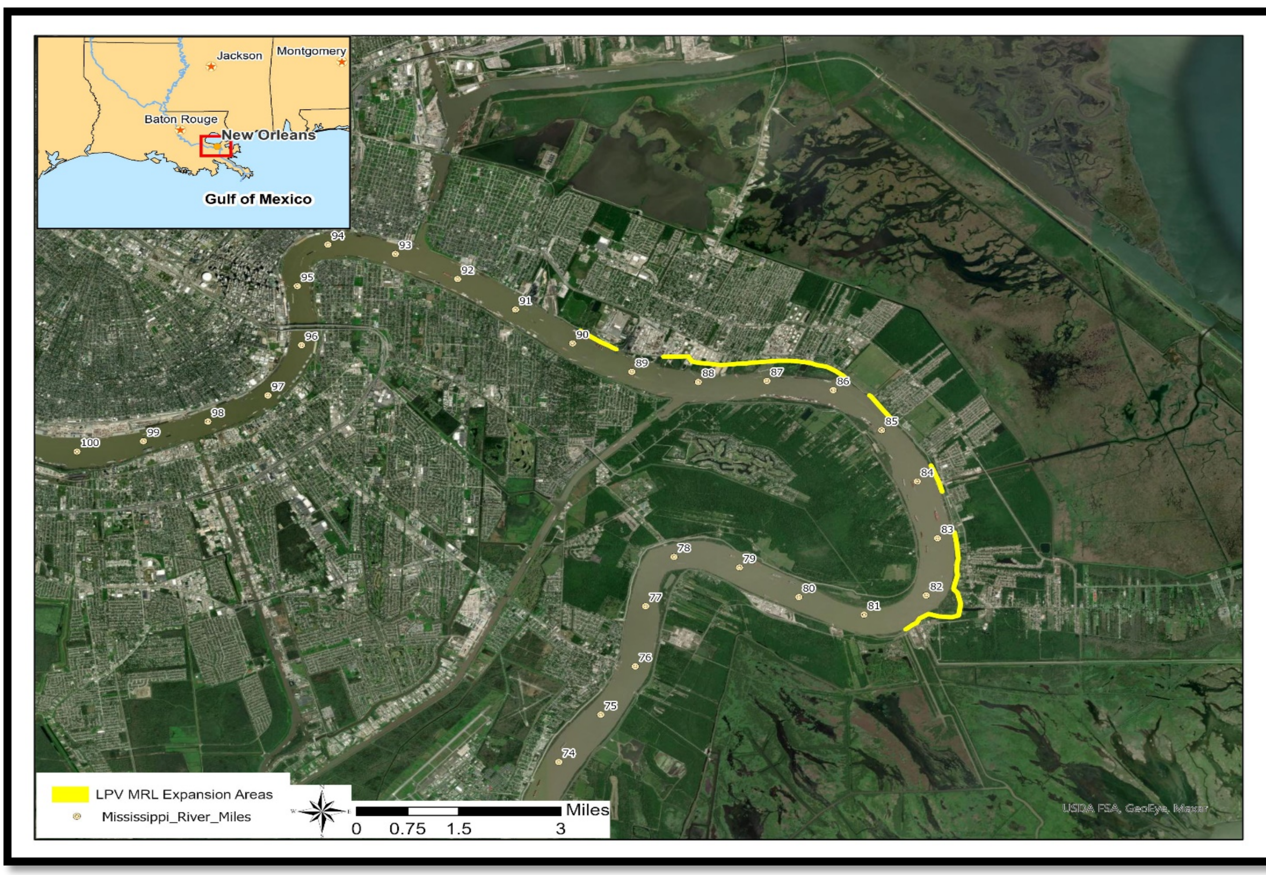


Figure 1. Location of potential impacts

1.2 PRIOR REPORTS

Numerous studies and reports regarding mitigation for water resources development projects in the study area have been prepared by CEMVN, other federal, state, and local agencies, research institutes, and individuals. The CEMVN HSDRRS website provides additional information on studies and construction:

https://www.mvn.usace.army.mil/Missions/Environmental/NEPA-Compliance-Documents/HSDRRS-Projects/ [accessed 2 June 2021].

Previous mitigation plans have identified and modified mitigation projects for various habitat types impacted. The original mitigation projects associated with HSDRRS are discussed in:

Programmatic Individual Environmental Report #36 Lake Pontchartrain and Vicinity (LPV) Hurricane and Storm Damage Risk Reduction System (HSDRRS) Mitigation, PIER #36[1], signed Decision Record 22 November 2013.

PIER #36 described and evaluated its proposed mitigation plan to compensate for unavoidable habitat losses caused by the construction of the LPV HSDRRS. The mitigation plan set forth in the PIER was comprised of both constructible and programmatic features. In the Decision Record, the constructible feature of the selected plan was recommended for implementation, which included purchase of BLH-Wet and swamp mitigation bank credits with no particular mitigation bank identified, while the programmatic features were recommended for further evaluation and design.

Supplemental to PIER #36, Bayou Sauvage, Turtle Bayou & New Zydeco Ridge Restoration Project, Saint Tammany & Orleans Parishes, Louisiana, SIER 1[2], signed Decision Record 20 October 2015.

SIER 1 described and evaluated proposed changes to the recommended mitigation plan described in PIER #36.

Final Supplemental Environmental Assessment – West Bank and Vicinity Hurricane and Storm Damage Risk Reduction System Flood Side BLH-Wet and Swamp Mitigation, Lafourche Parish, Louisiana SEA #572[3] (Signed FONSI 24 July 2019).

SEA #572 was needed since many of the earlier identified mitigation projects were determined not to be implementable. SEA #572 evaluated 5 additional projects and carried two forward for further analysis (Hwy 307 and Mitigation Banks), the remaining considered projects were not moved forward due to cost, additional impacts that would require mitigation, or unacceptable schedule delays related to obtaining right of entry (ROE). Appendix E of SEA #572 is hereby incorporated by reference for a monitoring plan and success criteria. Appendix H of SEA #572 is hereby incorporated by reference for mitigation planting guidelines.

[1] Available online at https://www.mvn.usace.army.mil/Missions/Environmental/NEPA-Compliance-Documents/HSDRRS-Projects/PIER-36-Bayou-Sauvage-Turtle-Bayou-and-New-Zydeco-Ridge-Restoration/; accessed on 3 June 2021
[2] Available online at https://www.mvn.usace.army.mil/Missions/Environmental/NEPA-Compliance-Documents/HSDRRS-Projects/PIER-36-Bayou-Sauvage-Turtle-Bayou-and-New-Zydeco-Ridge-Restoration/; accessed on 3 June 2021
[3] Available online at: https://www.mvn.usace.army.mil/Portals/56/Users/194/42/2242/Draft%20SEA%20572%20Document.pdf; accessed on 3 November 2020

Supplemental Project Description Document No. 4. West Bank and Vicinity (WBV), Highway 307 Mitigation Hurricane and Storm Damage Risk Reduction System. February 2020. (Approved 17 April 2020).

The purpose of the supplemental project description document was to provide a brief and concise summary of the current plan for the mitigating WBV HSDRRS General Flood Side (FS) Bottomland Hardwood-Wet impacts and General FS Swamp impacts as presented in the Supplemental Environmental Assessment #572, and as revised from those plans originally described in the 2014 WBV HSDRRS Mitigation for mitigating the cited impacts.

2. MITIGATION PROCEDURES

The mitigation procedures follow Appendix C of the Planning Guidance Notebook dated 01 April 2019.

2.1 INVENTORY AND CATEGORIZE ECOLOGICAL RESOURCES

An ecological resources inventory within the study area is documented in Chapter 4 of the LPV GRR/EIS.

2.2 DETERMINE SIGNIFICANT NET LOSSES

This section describes the methods used to evaluate the quality of BLH-Wet habitat and to determine the quantity of like-quality, in-kind mitigation habitat required.

2.2.1 WVA MODEL ANALYSES

The WVA Bottomland Hardwood Community Model used for the LPV Mitigation was certified in accordance with EC 1105-2-412 and was re-approved for regional use on December 6, 2018.

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

- Wetland Value Assessment Bottomland Hardwoods Community Model for Civil Works (Version 1.2)

The WVA models assess the suitability of each habitat type for providing resting, foraging, breeding, and nursery habitat to a diverse assemblage of fish and wildlife species. The standardized, multi-species, habitat-based methodology facilitates the assessment of project-induced impacts on fish and wildlife resources. The Bottomland Hardwood Community Model, which was used for BLH-Wet features, consists of 7 variables: 1) tree species composition; 2) stand maturity; 3) understory/midstory; 4) hydrology; 5) size of contiguous forested area; 6) suitability and traversability of surrounding land uses; and 7) disturbance.

Values for variables used in the model are derived for existing conditions and are estimated for conditions projected into the future if no mitigation efforts are applied (i.e., future without project) and for conditions projected into the future if the proposed mitigation project is implemented (i.e., future with project), providing an index of habitat quality, or habitat suitability, for the period of analysis. The HSI is combined with the acres of habitat to generate a number that is referred to as “habitat units”. Expected project impacts/benefits are estimated as the difference in habitat units between the future with project scenario and the future-without-project scenario. To allow comparison of WVA benefits to costs for overall project evaluation, total benefits are averaged over a 50-year period, with the result reported as Average Annualized Habitat Units (AAHUs). WVA assumptions used and full calculations for the LPV GRR/EIS Mitigation Plan are provided in Enclosure 1 below. Table 1 summarizes the calculation of mitigation requirements for LPV GRR/EIS. Detailed HSI calculations are available upon request.

Table 1. Summary of Impacted BLH-Wet Habitat and Mitigation Requirement

	Existing Conditions of BLH-Wet Impacted		Mitigation Requirement
Location	Acres	AAHUs Impacted	AAHUs
River Mile 81-90	20.27	12.12	12.12

The Planning Guidance Notebook (ER 1105-2-100) requires that “Mitigation plans shall ensure that adverse impacts to bottomland hardwood forests are mitigated in-kind, to the extent possible.”

2.3 DEFINE MITIGATION PLANNING OBJECTIVES

The mitigation project area consists of the LPV study area in St. Charles, Jefferson, Orleans and St. Bernard Parishes and the Mississippi River Levee on the east bank in St. Bernard Parish and associated right-of-way. The goal is to mitigate for impacts to approximately 20.3 acres of bottomland hardwood forest Section 404 jurisdictional wetlands (BLH-Wet). The required mitigation would offset the unavoidable loss of this habitat type, which is already limited in the vicinity of the study area.

The objective of the proposed mitigation is to compensate for habitat losses, as measured by AAHUs, that are expected to occur during the construction of the proposed actions for flood side (FS) BLH-Wet. This is the only habitat type expected to be impacted by the FS shift of the MRL levees. All other features of the recommended plan for LPV are not expected to require compensatory mitigation since those actions are proposed within the existing, previously-disturbed ROWs. The proposed compensatory mitigation would replace the lost functions and services of the impacted FS BLH-Wet habitat.

2.4 DETERMINE UNIT OF MEASUREMENT

The output of the mitigation plan increments would be measured by AAHUs.

2.5 IDENTIFY AND ASSESSS THE POTENTIAL MITIGATION STRATEGIES

2.5.1 MITIGATION PLAN FORMULATION STRATEGIES

LPV HSDRRS Mitigation plan formulation efforts (e.g., PIER #36, SIER 1) are herein incorporated by reference into this mitigation plan. Lessons learned from these efforts were considered for this mitigation planning effort. The project delivery teams collaborated with the sponsor and resource agencies to develop the strategies for delivering the mitigation requirements. The strategies entailed in-basin and in-kind habitat restoration work to be performed at mitigation banks or in appropriate sites for work by the government.

Details of the previous screening process are not repeated here. Further details of specific alternatives are provided below.

2.5.2 MITIGATION PROJECT CONSIDERATIONS

The following factors were considered during the mitigation project development:

1) In accordance with the Planning Guidance Notebook, compensatory mitigation was formulated to occur within the same watershed or hydrologic basin as the impacts and to replace the functions and services of each impacted habitat type with functions and services of the same habitat type. The LPV GRR/EIS Mitigation Basin boundaries coincide with the Lake Pontchartrain watershed boundaries except for the southern boundary. The southern boundary for planning purposes was limited to the intermediate/brackish marsh interface at 6 parts per thousand (ppt) because the LPV GRR/EIS work only impacts freshwater BLH-Wet habitat and the functions and services of freshwater wetland could not be replaced in areas with salinities greater than those found in intermediate wetland systems.
2) Because the impacts would occur within the Louisiana Coastal Zone (CZ), bank credits would need to be approved by the Louisiana Department of Natural Resources, Office of Coastal Management (OCM) to offset impacts within the CZ.

2.5.3 CONSIDERED MITIGATION ALTERNATIVES

<u>No Action Alternative:</u> NEPA requires that in analyzing alternatives to proposed action, a Federal agency consider an alternative of “No Action”. The No Action alternative evaluates not implementing the LPV GRR/EIS proposed action and associated mitigation, and represents the future-without-project (FWOP) scenario by which alternatives considered in detail are compared. The FWOP provides a baseline essential for impact assessment and alternative analysis. This section presents the No Action Alternative as not implementing mitigation for LPV GRR/EIS construction impacts. Compensatory mitigation for unavoidable habitat losses due to the construction of the proposed LPV GRR/EIS is required by law (e.g., Clean Water Act, WRDAs of 1986, 2007, and 2016), and the CEMVN does not consider the No Action Alternative to be a reasonable or legally viable alternative that could be chosen.

The analysis for the No Action Alternative considers previous, current, and reasonably foreseeable future projects, which could impact the resources evaluated in the GRR/EIS. For the purpose of this analysis, a project is considered “reasonably foreseeable” if it meets one of the following criteria:

- USACE authorized ecosystem restoration, hurricane and storm damage risk reduction, flood risk reduction, and/or navigation project with an anticipated Tentatively Selected Plan;
- CWPPRA project authorized at a Phase 2 – construction status;
- Coastal Impact Assistance Program ecosystem restoration or hurricane and storm damage risk reduction or flood risk reduction project which is funded for construction;
- State of Louisiana Surplus-funded ecosystem restoration or hurricane and storm damage risk reduction or flood risk reduction project funded for construction; or
- Louisiana Levee District permitted hurricane and storm damage risk reduction or flood risk reduction project.

Wetland or ecosystem restoration activities considered part of the No Action Alternative could counter, to a degree, the current land loss trends throughout the basin and progressions of wetlands to open water. In addition to these ecosystem restoration projects, a number of hurricane and storm damage risk reduction projects, flood risk reduction projects, and navigation projects would continue to influence the hydrodynamics within the basin.

Alternative 1: Purchase of Mitigation Bank Credits. 12.12 Average Annual Habitat Units (AAHUs) of flood side BLH-Wet impacts would be mitigated through the purchase of mitigation bank BLH credits approved by OCM and USACE to offset coastal zone impacts from a bank with perpetual conservation servitude. The purchase would occur prior to or concurrent with construction impacts.

No particular bank is proposed for use at this time. The bank(s) from which credits would be purchased would be selected through a solicitation process, through which any mitigation bank meeting eligibility requirements and having the appropriate resource type of credits could submit a proposal to sell credits. If appropriate and cost-effective, the Corps may choose to purchase mitigation bank credits from more than one bank to fulfill the compensatory mitigation requirements for BLH-Wet habitat type. The solicitation for mitigation bank bids will include requirements that the banks are OCM-approved, and within the same or adjacent Coastal Wetlands Planning, Protection, and Restoration Act defined hydrologic basin as the impacts.

The purchase of credits is dependent on receipt of acceptable, cost-effective proposals from eligible banks. Currently, there are insufficient in-kind mitigation bank credits in the watershed to implement this alternative; however, CEMVN anticipates future banks and/or future credit releases may be approved prior to construction of the proposed action for the LPV GRR/EIS. No new cumulative impacts to any resource would be incurred from the purchase of credits from a previously approved mitigation bank for the LPV GRR/EIS mitigation under the proposed mitigation plan. The purchase of mitigation bank credits would occur at existing approved banks, which perform in accordance with schedules contained in their respective mitigation banking instruments. No physical impacts at a bank would occur with the purchase of credits. Depending on the amount of mitigation bank credits available in the basin at the time of credit purchase for the LPV mitigation, LPV use of mitigation credits may reduce the number of credits available to permittees to compensate for BLH impacts authorized by Department of Army Section 10/404 permits. Following the LPV purchase, in the event sufficient credits are not available to offset impacts associated with a proposed permit, the District Engineer would determine appropriate compensatory mitigation based on the factors described in 33 CFR Part 332.3(b).

If purchase of mitigation bank credits were approved as the GRR/EIS Mitigation Plan and if an acceptable, cost-effective bid to sell credits is received, then all BLH-Wet impacts would be mitigated through the purchase of BLH-Wet credits equaling 12.12 AAHUs. The same version of the WVA model that was used to assess the impacts of constructing the proposed action would be run on the mitigation banks to ensure that the assessment of the functions and services provided by the mitigation bank match the assessment of the lost functions and services as the impacted site.

Alternative 2: Corps-Constructed. Construction of a new or expansion of an existing Corps-constructed mitigation project within LPV watershed.

Alternative 3: Combination. Combination of Corps-constructed mitigation project and mitigation bank credits.

2.6 DEFINE AND ESTIMATE COSTS OF MITIGATION PLAN INCREMENTS

An average cost estimate for BLH-Wet mitigation is based on previous estimates for BLH-Wet mitigation in the area. The cost of mitigation was estimated per AAHU and applied in the project cost estimates in the main report.

2.7 DISPLAY INCREMENTAL COSTS

Cost effectiveness and incremental cost analysis (CE/ICA) can provide decision-makers with relative output-cost relationships of various mitigation alternatives and help decision-makers identify a recommended mitigation plan to pursue in more detail. The Institute for Water Resources Planning Suite II was used to complete the CE/ICA of the mitigation alternatives to evaluate and compare the monetary cost estimates and non-monetary outputs. Cost-effective alternatives are plans that have the greatest output of all alternatives for that cost. A secondary analysis on the subset of cost-effective alternatives identifies superior financial investments, called “Best Buys”, through an incremental cost analysis. Best Buy alternatives provide the greatest increase in output for the least increase in cost.

The mitigation cost estimates are provided per AAHU and are based on costs from recent CEMVN projects. An average cost of $256,625 per AAHU based on multiple recent BLH-Wet mitigation projects was used for Corps-constructed mitigation. For the purchase of BLH-Wet mitigation bank credits, an average cost of $99,663 per AAHU was used based on multiple recent mitigation bank credit purchases. For the combination alternative of using bank credits and constructed, a 50/50 split per AAHU and associated costs was used. All alternatives had the same output of 12.12 AAHUs.

Table 3 displays the incremental costs for each mitigation plan. The No Action and mitigation bank alternative were Best Buys, while the other alternatives were non-cost effective.

Table 3. Incremental Cost Comparison for Considered Mitigation Alternatives

Alternative	Cost*	Output (AAHUs)	Cost Effective
No Action	$0	0	Best Buy
Mitigation Bank	$1,207,916	12.12	Best Buy
Constructed	$3,110,295	12.12	Non-Cost Effective
Bank + Constructed	$2,159,105	12.12	Non-Cost effective

* Estimates based on range of recent projects in the area.

Due to the relatively few AAHUs of BLH habitat that would be lost and the time and resources that would be required to design and implement a Corps-constructed mitigation project, purchase of mitigation bank credits is the most timely, efficient, and cost-effective alternative. From this analysis, purchase of mitigation bank credits was selected as the recommended mitigation plan.

2.8 ELEMENTS OF THE RECOMMENDED MITIGATION PLAN

CEMVN has assessed the impacts of the no action alternative and the proposed mitigation credit purchase on relevant resources in the study area, including air quality, water quality, terrestrial habitat, aquatic habitat, fish and wildlife, wetlands, threatened and endangered species, recreational resources, aesthetic resources, cultural resources, farmland, and socioeconomic resources through the LPV GRR/EIS. Chapter 4 of the LPV GRR/EIS provides the details of the existing conditions within the study area and are not repeated here. Chapter 7 of the LPV GRR/EIS describes the environmental impacts, including direct, indirect, and cumulative effects of the proposed action including mitigation on relevant resources and are not repeated here.

The proposed action in this mitigation plan consists of purchasing mitigation bank credits to mitigate 12.12 AAHUs of BLH-Wet impacts.

Since the proposed action recommended for implementation at this time consists of purchasing mitigation credits, CEMVN has concluded that there would be no new direct, indirect, or cumulative impacts to any relevant resources from that action. Any changes to the proposed mitigation plan would be fully evaluated in future NEPA documents. Future NEPA documents would further evaluate the impacts of Alternative 2 (Alternative Projects to Mitigation Bank).

a. Description of Physical Action – None. Purchase of mitigation credits does not involve any physical action. The mitigation bank that sells the credits will continue to operate in accordance with its mitigation banking instrument.

b. Type, amount, and characteristics of the habitat to be restored – Sufficient OCM-approved bottomland hardwood forest credits will be purchased from a mitigation bank in the Lake Pontchartrain watershed to offset impacts to 12.12 AAHUs of bottomland hardwood forests located on the floodside of the Mississippi River Levee in St. Bernard Parish within the Louisiana Coastal Zone. The same WVA model that was used to determine impacts will be used to determine the number of bank credits required to offset the bottomland hardwood forest losses.

c. Ecological Success Criteria –The selected mitigation bank must be in compliance with its Mitigation Banking Instrument, which sets forth the bank’s ecological success criteria and the timeline for the bank’s achievement of its ecological success milestones.

d. Monitoring Plan - The purchase of mitigation bank credits relieves the USACE and the NFS from monitoring to ensure ecological success.

e. Adaptive Management – The selected mitigation bank must be in compliance with its Mitigation Banking Instrument, including relevant success criteria. Purchase of credits relieves USACE and the NFS of the responsibility to ensure ecological success.

f. Real Estate Required – None.

3. DATA GAPS AND UNCERTAINTIES

Mitigation Bank Credit Availability. Whether in-basin mitigation banks within the CZ may be capable of supplying the credits needed to meet any of the mitigation requirements at the time of solicitation is uncertain. Banks currently able to meet the mitigation requirements may not be able to do so at the time of solicitation. If mitigation credits are not available in the future, then a Corps-constructed mitigation project would be needed. In addition, new banks able to meet the mitigation requirement may become approved by the time the solicitation is released. Accordingly, identification of particular banks that could be used to meet the mitigation requirement cannot occur with any degree of certainty and has not been done for the LPV GRR/EIS. Since the bank(s) that may ultimately be selected to provide the necessary mitigation credits is(are) unknown, the existing conditions present at the bank site(s) are similarly unknown. Existing bank habitat quality varies depending on the success criteria met, as specified in the bank's Mitigation Banking Instrument (MBI). Typically, as mitigation success criteria are met and the quality of the habitat increases within the bank, more credits are released for purchase.

If, based on credit availability or following evaluation of the mitigation bank proposals, it becomes apparent that purchasing bank credits is not cost effective or feasible (including due to lack of satisfactory bids), CEMVN will complete its evaluation of Mitigation Plan Alternative 2 which would evaluate Corps-constructed mitigation projects within the LPV watershed in the CZ, possibly in combination with a credit purchase. Construction of a mitigation project involves identification of a site, planning, design, acquisition of real estate, construction, monitoring, adaptive management, and ongoing operation and maintenance by the NFS. In that event, environmental compliance would be achieved through the following evaluation, coordination, and analysis:

1) Endangered Species Act Section 7 Consultation with the USFWS;
2) Coordination under the Louisiana Coastal Resources Program with Louisiana Department of Natural Resources;
3) Receipt of a Water Quality Certification from the State of Louisiana;
4) Public review of the Section 404(b)(1) Public Notice and signature of the Section 404(b)(1) Evaluation; Coordination with Louisiana Department of Environmental Quality (LDEQ) on the air quality impact analysis;
5) Coordination with National Marine Fisheries Service on Essential Fish Habitat recommendations;
6) Completion of the National Historic Preservation Act Section 106 consultation pursuant to the Programmatic Agreement; and
7) Preparation of and issuance of a supplemental NEPA document evaluating the proposed Corps-constructed project for 30-day public review and comment.

Tropical Storms. Tropical storm events can directly and indirectly contribute to coastal land loss through erosion from increased wave energies, removal and/or scouring of vegetation from storm surge, and saltwater intrusion into estuaries and interior wetlands. Wetland loss and degradation of large areas can occur over a short period of time as a result of storms. There is a risk that a single storm event, or multiple storms over a short period of time, could significantly reduce or eliminate anticipated benefits of mitigation plans in areas susceptible to storm surge and shearing. The extent of potential damage is dependent upon several unknown variables, including the track and intensity of the storm, the development stage of the project, changes in future conditions in the study area, and variability of project performance from forecast conditions due to other factors of risk and uncertainty.

Increased Sea Level Rise and Subsidence. Increased sea level rise coupled with subsidence could convert emergent wetlands to shallow open water and shallow open water to deep water habitat, reducing or eliminating the effectiveness of mitigation plans. Relative sea level rise is taken into account with the valuation of credits for approved mitigation banks and design of constructed mitigation projects.

Climate Change. Extreme changes in climate (temperature, rain, evaporation, wind) could result in conditions that cannot support the types of habitat restored, reducing the effectiveness of the mitigation plan. Extreme climate change could essentially eliminate the benefits of vegetative plantings, if the change resulted in plant mortality. The monitoring plan for all USACE constructed projects would monitor the success of any vegetative plantings and includes provisions for replanting if mortalities become such that meeting the required success criteria is in jeopardy.

Errors in Analysis. Future conditions are inherently uncertain. The forecast of future conditions is limited by existing science and technology. Future conditions described in the LPV GRR/EIS are based on an analysis of historic trends and the best available information. Some variation between forecast conditions and reality is certain. Mitigation features were developed in a risk-aware framework to minimize the degree to which these variations would affect planning decisions. However, error in analysis or discrepancies between forecast and actual conditions could affect plan effectiveness.

All of the models used in the LPV GRR/EIS are abstract mathematical representations of reality. Models simulate complex systems by simplifying real processes into expressions of their most basic variables. These tools assist with finding optimal solutions to problems, testing hypothetical situations, and forecasting future conditions based on observed data. No model can account for all relevant variables in a system. The interpretation of model outputs must consider the limitations, strengths, weaknesses, and assumptions inherent in model inputs and framework. Inaccurate assumptions or input errors could change benefits predicted by models used in the LPV GRR/EIS. The potential for significant changes due to errors has been reduced through technical review, sensitivity analyses, and quality assurance procedures. However, there is inherent risk in reducing complex natural systems into the results of mathematical expressions driven by the simplified interaction of key variables.

WVA Model Uncertainties. WVA models were run using site-specific data collected at project sites and through assumptions made based on aerial photography and field data from similar projects. There is reasonable confidence that these data are representative of actual site conditions and that the WVA has produced results representative of what would be found for the sites within LPV GRR/EIS. The final mitigation requirements will be included in the Final Fish and Wildlife Coordination Act Report.

Implementation. The timing for implementation is an uncertainty that must be considered. If the plan is not implemented in a timely fashion, the conditions in the study area could change. The impact of the uncertainties associated with the future condition of the study area could increase mitigation costs, decrease mitigation benefits, or both.

If the proposed mitigation project becomes infeasible due to difficulties in implementation or changed conditions, the CEMVN will take appropriate action to ensure satisfaction of its mitigation requirement. If a proposed mitigation project could not be implemented, the CEMVN would default to another alternative or to a combination of Corps-constructed project and credit purchase to meet the need.

Mitigation for Coastal Zone Impacts. Louisiana Department of Natural Resources (LDNR) administers the Federal Coastal Zone Management Act in Louisiana through its Louisiana Coastal Resources Program (LCRP). Depending on the projects implemented (i.e., depending on whether the mitigation bank or Corps-constructed project is located in the Coastal Zone), LDNR may determine that, in its view, such projects do not mitigate for coastal zone impacts. If deemed necessary, additional mitigation for coastal zone impacts may be required and would be assessed and coordinated in subsequent NEPA documents.

4. MITIGATION SUCCESS CRITERIA, MONITORING, REPORTING & ADPATIVE MANAGEMENT

4.1 BANK CREDITS (RECOMMENDED MITIGATION PLAN)

If credits are purchased from a mitigation bank, the mitigation bank must comply with the requirements of the USACE Regulatory Program and its MBI, which specifies the management, monitoring, and reporting required to be performed by the bank.

The proposed mitigation action solely includes the purchase of mitigation bank credits. Purchase of credits relieves the CEMVN and non-federal sponsor of the responsibility for monitoring and of demonstrating mitigation success. The required reporting of mitigation bank performance to resource agencies and USACE Regulatory will satisfy monitoring requirements.

4.2 CORPS-CONSTRUCTED (CONTINGENCY)

If appropriate mitigation bank credits are not available or are too costly, then consistent with WRDA 2007, Section 2036(a), a monitoring and adaptive management plan for proposed Corps-constructed mitigation projects would be developed with success criteria targets identified. The original general guidelines for plantings, success criteria, and monitoring were included as Appendix J in PIER #36 and are hereby incorporated by reference. If Corps-constructed mitigation is needed in the future, refined project specific monitoring, reporting and success criteria for the mitigation features would be required. See Appendix E of SEA #572 as an example of what would be required. For Corps-constructed mitigation projects, the CEMVN would monitor the complete mitigation site, on a cost-shared basis with the NFS, to determine whether additional construction, invasive species control and/or plantings would be necessary to achieve mitigation success. The CEMVN would undertake additional actions necessary to achieve mitigation success in accordance with cost-sharing applicable to the project and subject to the availability of funds.

5. COORDINATION AND CONSULTATION

5.1 PUBLIC INVOLVEMENT

A 55-day public comment and review period occurred to solicit additional public input on the proposed LPV Draft GRR/EIS and associated mitigation plan.

5.2 AGENCY COORDINATION

Preparation of the LPV GRR/EIS has been coordinated with appropriate Congressional, federal, state, and local interests, as well as environmental groups and other interested parties. The following agencies, as well as other interested parties, received copies of the LPV Draft GRR/EIS:

- U.S. Department of the Interior, Fish and Wildlife Service
- U.S. Department of the Interior, National Park Service
- U.S. Environmental Protection Agency, Region VI
- U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service
- Natural Resources Conservation Service
- Louisiana Advisory Council on Historic Preservation
- Governor's Executive Assistant for Coastal Activities
- Louisiana Department of Wildlife and Fisheries
- Louisiana Department of Natural Resources, Coastal Management Division
- Louisiana Department of Natural Resources, Coastal Restoration Division
- Louisiana Department of Environmental Quality
- Louisiana State Historic Preservation Officer
- Coastal Protection and Restoration Authority Board

6. COMPLIANCE WITH ENVIRONMENTAL LAWS AND REGULATIONS

Section 7.22 of the LPV GRR/EIS summarizes the status of compliance with environmental laws and regulations for the proposed action.

7. FUTURE MITIGATION NEEDS

Once final designs for all LPV GRR/EIS contracts are complete, the mitigation team, along with resource agencies, would revisit the impacts to all habitat types from the LPV GRR/EIS construction. Completion of this effort would result in a final computation of impacts and may necessitate an increase or decrease in the amount of LPV GRR/EIS mitigation to fully mitigate all impacts. A change in the amount of mitigation bank credits purchased would be the first option considered.

8. CONCLUSION

8.1 RECOMMENDED DECISION

Recommend approval of the LPV GRR/EIS Mitigation Plan, which fulfills the general BLH-Wet mitigation requirement for LPV GRR/EIS: purchase of mitigation bank credits.

8.2 PREPARED BY

The point of contact for this mitigation plan for the LPV GRR/EIS is Mr. Kip Runyon, USACE St. Paul District, CEMVP-PD-P.

9. ENCLOSURE 1: WETLAND VALUE ASSESSMENT MODEL ASSUMPTIONS AND CALCULATIONS

9.1 PROJECT SPECIFIC ASSUMPTIONS

- Aerial imagery used to delineate impacted area along the LPV-MRL
- 25 feet from existing right-of-way was used to calculate the area impacted by flood side levee shifts required.
- Acreage estimated via GIS
- WVA conducted with previously collected data (2010) and with newly collected data (2020)
- Approximately 20.3 acres impacted by proposed action

9.2 WETLAND VALUE ASSESSMENT FOR LPV

- Analysis was based on data collected in 2010 and on data collected in 2020. The existing BLH-Wet on the flood side of the existing levees is primarily black willow and of generally poor quality.
- <u>Future Without Project:</u> For the FWOP it was assumed that the area would remain in some form of BLH-Wet for the period-of-analysis (50 years, end year 2073), with gradual increases in tree maturity.
- <u>Future With Project:</u> For the FWP it was assumed all BLH-Wet habitat that is present today would be converted to a turfed levee by year 1 and was determined to not provide any bottomland hardwood habitat values.

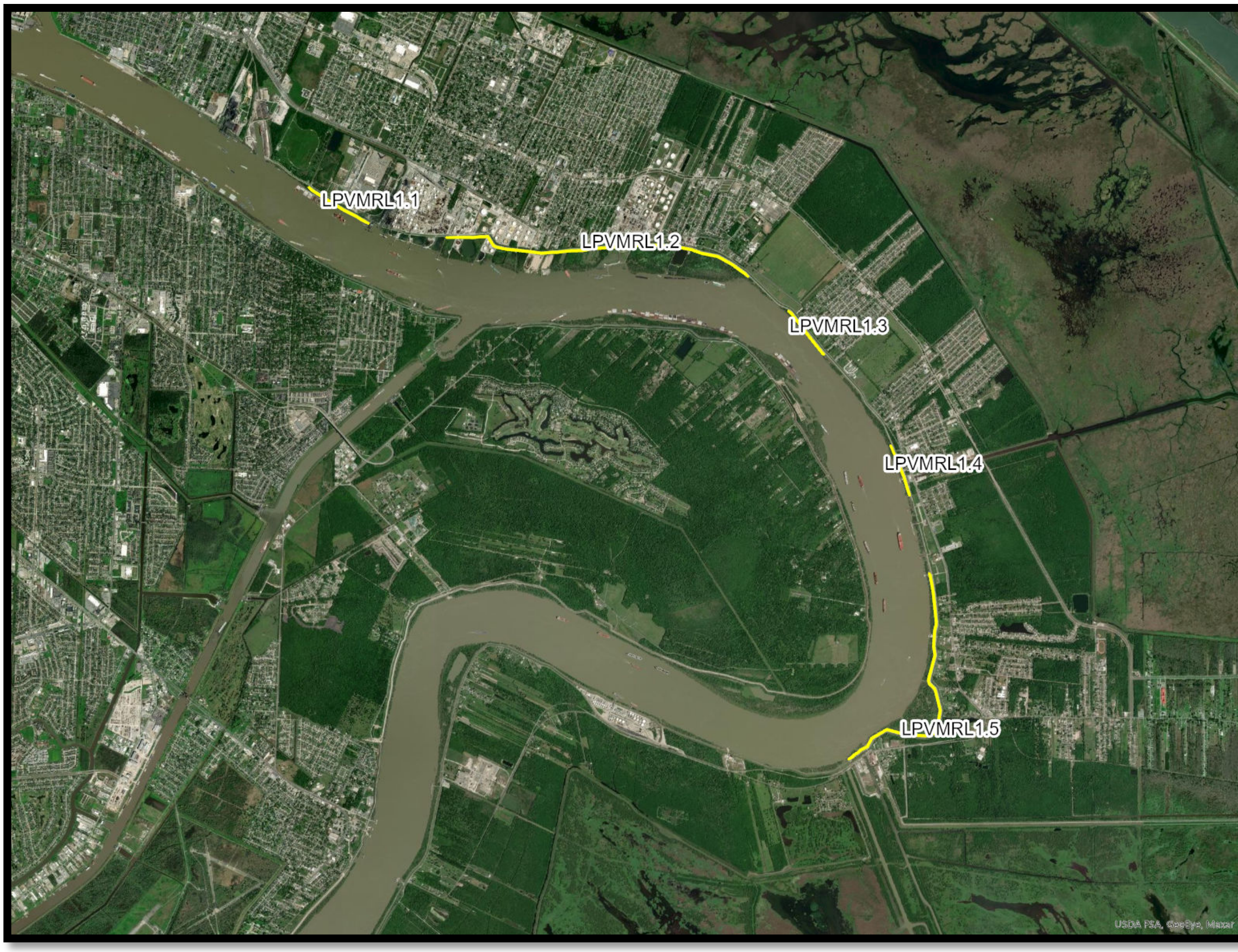


Figure 2. Locations of impact sites

Table 2. AAHUs by site

Site	Acres	AAHUs
LPVMRL 1.1	1.88	-0.95
LPVMRL 1.2	8.44	-4.68
LPVMRL 1.3	1.51	-0.77
LPVMRL 1.4	1.44	-0.81
LPVMRL 1.5	7.00	-4.91
Total	20.27	-12.12

9.3 WVA MODEL GENERAL ASSUMPTIONS AND RELATED GUIDANCE

PREFACE

Several of the assumptions set forth in this document are based on mitigation implementation schedules. Many sections include specified WVA model target years (TYs) and calendar years applicable to assumptions, and a few sections outline anticipated mitigation construction (*i.e.,* mitigation implementation) schedules. It is critical for the WVA analyst to understand that this document has not been revised to account for changes to the mitigation implementation/construction schedule for a particular mitigation project from CEMVN prior to running WVA models. The analyst may then need to modify some of the WVA model assumptions and guidelines presented herein to account for differences between the present mitigation implementation/construction schedule and the schedules(s) that were assumed in generating this document.

This document should be applied when conducting WVA analyses for the GRR/EIS and the Recommended Plan selected for meeting the LPV mitigation needs.

BOTTOMLAND HARDWOOD MODEL – GENERAL ASSUMPTIONS

V1 – Tree Species Associations/Composition (in canopy stratum – percentage of trees that are hardmast or other edible-seed producing trees and their percentage that are soft mast, non-mast/inedible seed producing trees)

Of the total trees initially planted, 60% will be hard-mast producing species and 40% will be soft-mast producing species. Assume this species composition ratio (*i.e.*, 60% of trees are hard mast-producing and 40% are soft mast-producing) will remain static over the entire period of analysis (*i.e.*, remains the same from time of planting throughout all subsequent model target years).

General Notes: Do not classify Chinese Tallow as a “mast or other edible-seed producing tree”. Consider it a non-mast producing tree. Although it is an invasive species, one must still include this species regarding its contribution to percent cover in the canopy, midstory, and ground cover strata when it is present on a site (applicable to FWP scenario and applicable to FWOP scenario)

V2 – Stand Maturity (average age or density breast height (dbh) of dominant and co-dominant canopy trees)

Guidance as to how factors like subsidence and sea level rise might affect this variable (especially if the mitigation sites becomes flooded for long durations, since the growth of the trees may be adversely affected and certain tree species could die): If the mitigation feature (polygon) is designed such that flooding at the end of the period of analysis will not impact tree survival, (*i.e.*, flooding is <12% of the growing season (33 days) and is no more than 20% to 30% of the non-growing season, then trees should not be adversely affected. However, if the site design does not achieve this goal, then adjust the tree growth spreadsheet such that typical growth is reduced by at least 10% once flooding exceeds 20-30% of the non-growing season or as 12% or more of the growing season.

General Notes: Include the dbh of Chinese tallow when working with this variable. The same guidance would apply to other invasive species in the canopy stratum. For planted trees, you can use the age of the trees in lieu of their dbh when running the model. Assume trees planted will be approximately 1 year old when they are first installed.

V3 – Understory/Midstory (percent cover)

Assumptions applicable to restoration features that do not require the deposition of fill to achieve target grades:

TY	Year (tentative)	Assumption
0	2022	Understory = 0%//Midstory = 0%
1	2023	Understory = 100%//Midstory = 0%
10	2033	Understory = 50%//Midstory = 50%
25	2048	Understory = 25% //Midstory = 60%
50	2073	Understory = 35% // Midstory = 30%

Values for cover in the understory and midstory strata must be based on site-specific conditions existing prior to the start of construction. The specified values are based on the assumptions that normal flooding conditions are present (*i.e.,* desirable depth and duration of inundation). These values will need to be adjusted if sea-level rise is anticipated to increase flooding of the particular mitigation polygon to a degree whereby growth and/or survival of plant species in the understory and/or midstory strata are adversely impacted.

General Notes: Cover accounted for by Chinese tallow and other invasive and nuisance plant species must be included in the percent cover data. Changes in hydrology could result from factors such as sea level rise and subsidence. An increase in the duration of flooding will typically decrease the understory cover and, to a lesser degree, decrease the midstory cover.

V4 – Hydrology (flooding duration and water flow/exchange)

Assumptions applicable for restoration features that do not require deposition or fill to achieve target grades and to the BLH-Wet enhancement features where hydrologic enhancements is a component of the mitigation design:

TY	Year (tentative)	Assumption
0	2023	Baseline conditions (score based on existing hydrology)
1	2024	Duration = temporary
10	2033	Duration = temporary
25	2048	Duration = temporary
50	2073	Duration = temporary

Scoring of water flow/exchange component of hydrology must be based on site-specific conditions anticipated. The specified value for flooding duration is based on the assumption that normal flooding conditions are present (*i.e.*, desirable depth and duration of inundation). This value will need to be adjusted if sea-level rise is anticipated to significantly increase the duration of flooding in the particular mitigation polygon. In many case, it is probably that the duration may shift from temporary to season. For BLH-Wet enhancement features that do not include measures to enhance existing hydrology as part of the mitigation design, the scoring of variable V4 must be based on site-specific conditions hence no general assumptions are applicable.

V5 – Size of Contiguous Forested Area

Do not consider the mitigation polygon to classify as "forested" until the planted trees are 20 years old. Remember that trees will be 1 year old when they are first installed, hence the mitigation polygon would classify as forested 19 years following the year of initial planting. Prior to this target year, the trees initially planted in the mitigation polygon will be considered as either understory or midstory cover. For the target year when the planted trees reach 20 years old and for all model target years thereafter, the planted trees will be considered large enough for the mitigation polygon to be considered a forest. Hence at the target year planted trees reach 20 years old and all target years thereafter, the mitigation polygon can be included in the calculation of forested acreages (along with contiguous forested areas outside the mitigation polygon).

For areas outside the mitigation polygons, assume the conditions present at TY0 will remain unchanged throughout the period of analysis of the mitigation project. As used here, the term "mitigation polygon" refers to all proposed mitigation polygons regardless of the target habitat proposed. Under the FWOP scenario, existing conditions would prevail in the mitigation polygon and areas outside the limits of these polygons throughout the period of analysis.

General Notes: When scoring this variable for the FWP scenario, the area within the mitigation polygon itself as well as the adjacent "non-mitigation" areas are combined to generate the total forested acreage. However, remember the assumption that planted trees in restoration features will not be considered large enough for the feature to classify as forest until the planted trees are 20 years old. When evaluating the size of contiguous forested areas, non-forested corridors <75 feet wide will not constitute a break in the forest area contiguity.

V6 – Suitability and Tranversability of Surrounding Land Uses (within 0.5 miles of site perimeter)

When scoring a given BLH-Wet mitigation polygon, include the nearby or adjacent mitigation polygons in your assessment of land use types by assuming their land use type is the habitat type proposed (*i.e.*, the target habitat type). However, one must consider the TY that the nearby/adjacent mitigation polygon will actually shift from its existing habitat type to the target habitat type.

When evaluating this variable, typically assume the land uses in lands outside the mitigation polygons will score the same under the FWP and FWOP scenario. In other words, typically assume that the existing conditions present in TY0 will remain unchanged over the period of analysis of the mitigation project. One would typically not consider potential future land development rates when scoring this variable due to the uncertainty of long-term development trends. Exceptions to this general approach would include: (1) situations where there is a high level of confidence that a particular area is slated for significant change in land use; or (2) situations where it is anticipated that the "land use" (habitat type) will significantly change over time due to the effects of sea level rise and land loss.

V7 – Disturbance (sources of disturbance vs. distance from site perimeter to disturbance source)

For consistency purposes, assume baseline conditions affecting the scoring of this variable will not change over time. In other words, typically assume that the existing conditions present in TY0 will remain unchanged over the period of analysis of the mitigation project.

General Notes: When scoring this variable, all distances are measured from the perimeter of the BLH-Wet mitigation polygon itself.

NOTES REGARDING CONSTRUCTION & PLANTING OF BLH-WET MITIGATION AREAS

The following is a typical estimated project construction timeline:

All projects: begin construction in Year X

For BLH-Wet restoration areas that do not require deposition of fill as part of the construction process:

- June Year X – Begin construction
- Nov. Year X – End construction (but could be as late as March or April of Year X+1 if much earthwork is required)
- Dec. Year X+1 – Install plants (earliest scenario for site requiring minimal earthwork)
- Sept. Year X+2 – Install plants (earliest scenario for site requiring substantial earthwork).

For BLH enhancement area:

- June Year X – Begin construction (includes start of invasive plant eradication)
- Oct. Year X – End construction
- Dec. Year X – Install Plants

All of these above timelines are preliminary and are subject to refinement as plans as refined for a particular mitigation site. Planting of canopy and midstory species in March should be avoided if possible since conditions could be adversely dry, thereby decreasing survival of plantings. Chemical eradication of invasive/nuisance hardwood species such as Chinese tallow should be done during the growing season. Greatest effectiveness may be realized if chemical treatment is applied from August through October when most energy is being used for root development.

Planting of BLH-Wet Restoration Areas:

Initial plantings should be:

- Canopy species: plant on 9-ft centers (538 trees/acre) , of total trees planted, 60% will be hard mast-producing species and 40% will be soft mast-producing species.
- Midstory species (shrubs and small trees): plant on 20-ft centers (109 seedlings/acre)
- Stock size (canopy and midstory species): 1 year old, 1.5 ft tall (minimum)

Planting of BLH-Wet Enhancement Areas:

Initial plantings should follow the same guidelines as for BLH-Wet restoration areas regarding the general density of installed plants and the stock used. Where initial enhancement activities include the eradication of invasive/nuisance plants, a significant number of native canopy and/or midstory species may remain, but in spatial distribution that leaves relatively large “gaps” in the canopy stratum and/or the midstory stratum. In such cases, areas measuring approximately 25 feet by 25 feet that are devoid of native canopy species should be planted and areas measuring approximately 45 feet by 45 feet that are devoid of native midstory species should be planted.

The typical guideline of having 60% of the canopy species planted be hard mast-producing and 40% of the canopy be soft mast-producing species may be altered in situations where several native trees remain after eradicating invasive/nuisance species. The objective would be to have the ultimate canopy composition (planted trees after reaching canopy strata plus existing trees) be close to 60%:40% ratio of hard mast to soft mast species.

BOTTOMLAND HARDWOOD-WET WVA MODEL – TARGET YEARS FOR MODELS FOR PROPOSED CORPS CONSTRUCTED MITIGATION PROJECTS (IF NEEDED)

Use the target years specified below when analyzing BLH-Wet restoration polygons:

TY	Year (tentative)	
0	2023	Baseline conditions, assumes construction starts
1	2024	Initial construction activities begin and are completed. Initial eradication of invasive and nuisance plants is started and completed
2	2025	Restoration feature settles to desired target grade Any associated perimeter containment dikes are degraded or gapped. Plants installed. Temporary flooding duration (target flooding duration/target hydroperiod) acheived
11	2034	Class 5 is achieved for V1.
20	2043	For V3, Understory = 25%//Midstory = 60%. Planted areas Class as Forested for V5
50	2073	End of period of analysis for a GRR-LPV mitigation feature

The user of these general guidelines is cautioned that the construction schedule for proposed mitigation features may not follow the construction schedule assumed in the preceding sections. If this is the case, the model target years and their associated model assumptions may have to be adjusted accordingly.

2021

Lake Pontchartrain & Vicinity GRR
Appendix L – Coordination

US Army Corps of Engineers
New Orleans District

U.S. Army Corps of Engineers, New Orleans District

Non-Federal Sponsor: Coastal Protection and Restoration Authority

February 2021

TABLE OF CONTENTS

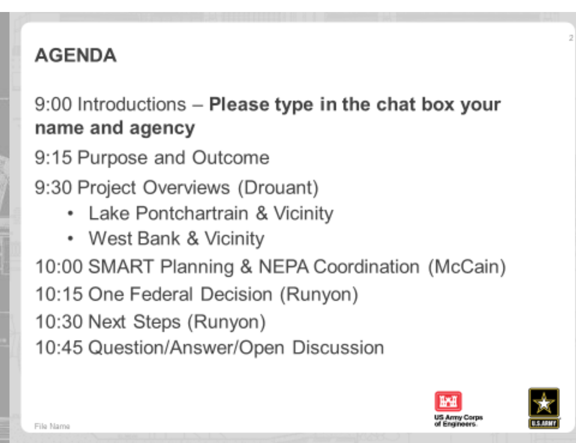
LAKE PONTCHARTRAIN & VICINITY GRR
APPENDIX L - COORDINATION

1 AGENCY MEETINGS

Below are a list of key meetings that were help with interagency partners and cooperating agencies. Full meeting minutes are documented in the project file and available upon request.

Date	Summary
24 October 2018	Webinar with Resource Partners Information gathering, identify additional resource needs, discuss One Federal Decision, Staff from CEMVN, CEMVS, Louisiana Department of Wildlife and Fish, USGS, CPRA, Louisiana Department of Culture, Recreation and Tourism, NOAA, USEPA. Slides from webinar provided below.
6 November 2018	Meeting with State Agencies. Notes provided below
7 November 2018	Meeting with Federal Agencies. Notes provided below.
31 July 2019	USACE and NOAA staff call to discuss how to work through the One Federal Decision Process
13 November 2019	Webinar with Resource Partners Inform the resource partners on the TSP and upcoming public review Staff from CEMVN, CEMVS, Louisiana Dept. of Wildlife of Fish, LDNR, NMFS, and USFWS attended. Slides from webinar provided below.

1.1 24 OCTOBER 2018 – RESOURCE PARTNER WEBINAR



INTRODUCTIONS

Lake Pontchartrain & Vicinity

Project Manager: Bradley Drouant
Environmental Lead: Kip Runyon

West Bank & Vicinity
Project Manager: Bradley Drouant
Environmental Lead: Kat McCain

PURPOSE & OUTCOME

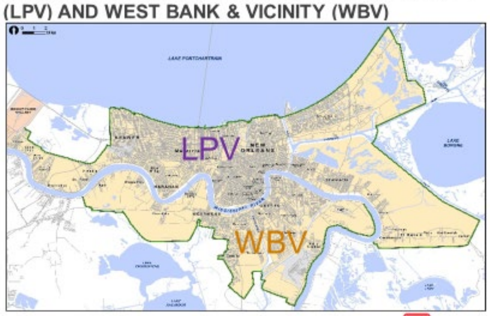
PURPOSE:

- To initiate data collection, identify partners, and discuss needs on supplemental studies for the USACE New Orleans District
- Discuss information needed to make a determination of level of investigation and need for EIS
- Discuss agency participation and expectations

EXPECTED OUTCOME:

- Inform agencies of the upcoming planning charette and needs for ongoing agency coordination moving forward

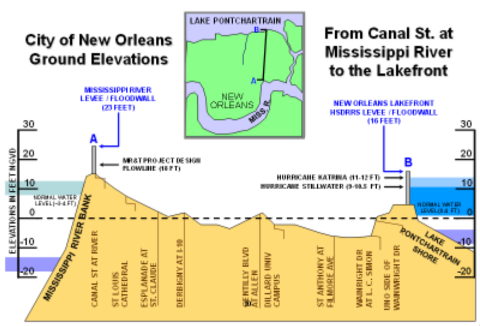
FUTURE LEVEE LIFTS GENERAL REEVALUATION REPORTS FOR LAKE PONTCHARTRAIN & VICINITY (LPV) AND WEST BANK & VICINITY (WBV)



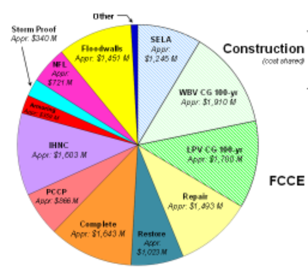
PROJECT OVERVIEWS

- Hurricane and Storm Damage Risk Reduction System (HSDRRS) authorization did not authorize future levee lifts to sustain risk reduction required for participation in the National Flood Insurance Program
- Current studies seek to determine if work necessary to sustain the 1% level of risk reduction is technically feasible, environmentally acceptable, and economically justified.
- General Reevaluation: a study to affirm, reformulate, or modify an existing plan. Similar to a feasibility study.

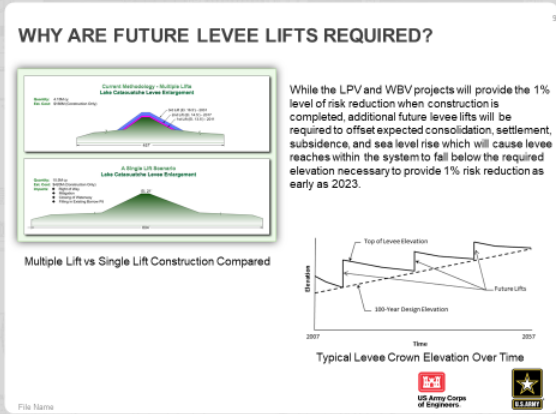
NEW ORLEANS TOPOGRAPHY



HURRICANE STORM DAMAGE AND RISK REDUCTION SYSTEM (HSDRRS) FUNDING



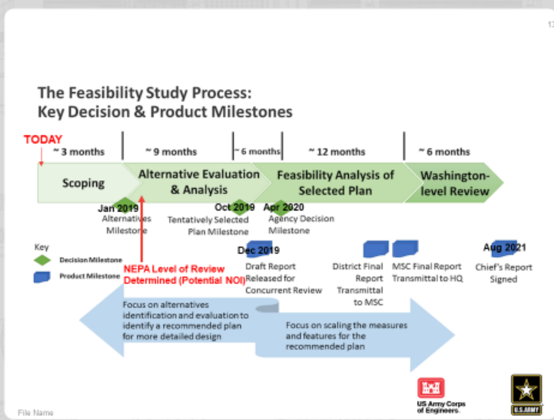
COMPONENT	$ (M)
SELA (Interior Drainage)	*$1,245*
WBV 100-year Level of Protection	*$1,910*
LPV 100-year Level of Protection	*$1,700*
Repair Existing System	*$1,493*
Restore to Design Height	*$1,023*
Complete Authorized System	*$1,643*
Permanent Pump Stations	*$866*
IHNC	*$1,603*
Selective Armoring	*$359*
Storm-proof Existing Pump Stations	*$340*
Incorporate non-Fed Levees in Plaquemines Parish	*$721*
Reinforce or Replace Floodwalls	*$1,451*
Other	*$130*

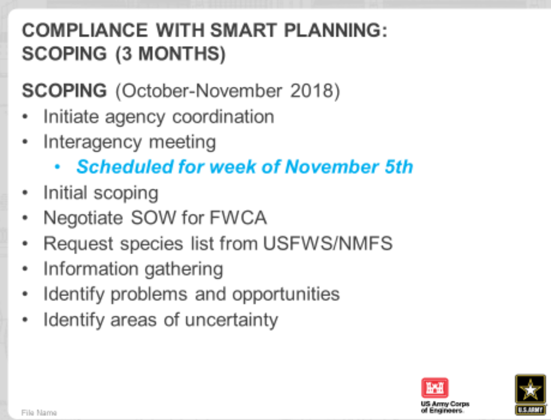

WHY ARE FUTURE LEVEE LIFTS REQUIRED?
While the LPV and WBV projects will provide the 1% level of risk reduction when construction is completed, additional future levee lifts will be required to offset expected consolidation, settlement, subsidence, and sea level rise which will cause levee reaches within the system to fall below the required elevation necessary to provide 1% risk reduction as early as 2023.
Multiple Lift vs Single Lift Construction Compared
Top of Levee Elevation
Future Lifts
100-Year Design Elevation
Elevation
Time
2007
2057
Typical Levee Crown Elevation Over Time
File Name


IMPACTS OF LEVEE OVERTOPPING
Without future lifts LPV and WBV levee heights will decrease over time, increasing the risk of flooding from storm surge to residents and property behind them.
File Name


USACE SMART & RISK-INFORMED PLANNING
WHAT IS SMART PLANNIING?
Smart Planning is:
S: Specific
M: Measurable
A: Attainable
R: Risk-Informed
T: Timely
RISK-INFORMED PLANNING
File Name


RISK-INFORMED PLANNING PROCESS
We are here
Evidence Gathering
Inventory & Forecast
Scoping
Problems & Opportunities
Risk Management
Implementation
Selection
Stakeholder Involvement
Plan Formulation
Evidence Gathering
Evidence Gathering
Deciding
Evaluation & Comparison
Evidence Gathering
File Name


The Feasibility Study Process:
Key Decision & Product Milestones
TODAY
~ 3 months
~ 9 months
~ 6 months
~ 12 months
~ 6 months
Scoping
Alternative Evaluation & Analysis
Feasibility Analysis of Selected Plan
Washington-level Review
Jan 2019
Alternatives Milestone
Oct 2019
Tentatively Selected Plan Milestone
Apr 2020
Agency Decision Milestone
Key
Decision Milestone
Product Milestone
NEPA Level of Review Determined (Potential NOI)
Dec 2019
Draft Report Released for Concurrent Review
District Final Report Transmittal to MSC
MSC Final Report Transmittal to HQ
Aug 2021
Chief's Report Signed
Focus on alternatives identification and evaluation to identify a recommended plan for more detailed design
Focus on scaling the measures and features for the recommended plan
File Name


COMPLIANCE WITH SMART PLANNING: SCOPING (3 MONTHS)
SCOPING (October-November 2018)
• Initiate agency coordination
• Interagency meeting
• Scheduled for week of November 5th
• Initial scoping
• Negotiate SOW for FWCA
• Request species list from USFWS/NMFS
• Information gathering
• Identify problems and opportunities
• Identify areas of uncertainty
File Name

COMPLIANCE WITH SMART PLANNING: SCOPING (3 MONTHS)

SCOPING (November 2018-January 2019)

- Brainstorm solutions to the identified problems
- Invite appropriate agencies and open dialog for FWCA, ESA, Section 106 coordination
- Compile public/agency/tribal concerns
- Identify significant resources to consider
- Identify resources that may require mitigation
- Inventory potential models
- Collaborate on environmental screening criteria
- Develop initial array of alternatives
- Hold Alternatives Milestone [***14 January 2019***]
- Determine level of NEPA investigation/Potential EIS

COMPLIANCE WITH SMART PLANNING – ALTERNATIVE EVALUATION & ANALYSIS (9 MONTHS)

Moving towards a Tentatively Selected Plan (TSP)
(February – October 2019)

- If EIS, publish NOI in Federal Register
- USACE provides Biological Assessment
- Develop EFH Assessment
- 404(b)1 analysis
- SHPO/THPO coordination
- HTRW Phase 1, if needed
- Identify mitigation per alternative
- Describe environmental impacts per alternative

Prior to TSP Milestone

- USFWS provides Draft FWCA Report [**15 Sept 2019**]

Hold TSP Milestone [***15 October 2019***]

COMPLIANCE WITH SMART PLANNING – FEASIBILITY LEVEL ANALYSIS (5 MONTHS)

Moving from TSP to Agency Decision (Nov 2019- April 2020)

- Public/agency concurrent reviews (If EIS, NOA) ***Dec 2019-January 2020***
  - Release of Draft Integrated Report with draft FONSI (if EA); EIS – File Draft with EPA
  - Release of BA to USFWS/NMFS
    - USFWS/NMFS response to BA (30 days)
    - ESA formal consultation begins, if required
  - Public meetings
- Identify relevant public/agency/tribal comments and develop strategies to resolve
- Conduct cultural resources field investigations, as needed
- Hold Agency Decision Milestone [***April 2020***]

COMPLIANCE WITH SMART PLANNING – FINAL REVIEW (15 MONTHS)

Getting to Chief's Report (May 2020-August 2021)

- ESA formal consultation continues, if required
- Final FWCAR incorporated with responses
- NEPA comment/response documented
- NEPA conclusions (FONSI/ROD)
- If EIS, release final (file feasibility report with EPA – Notice of Availability)

Chief's Report [**August 2021**]

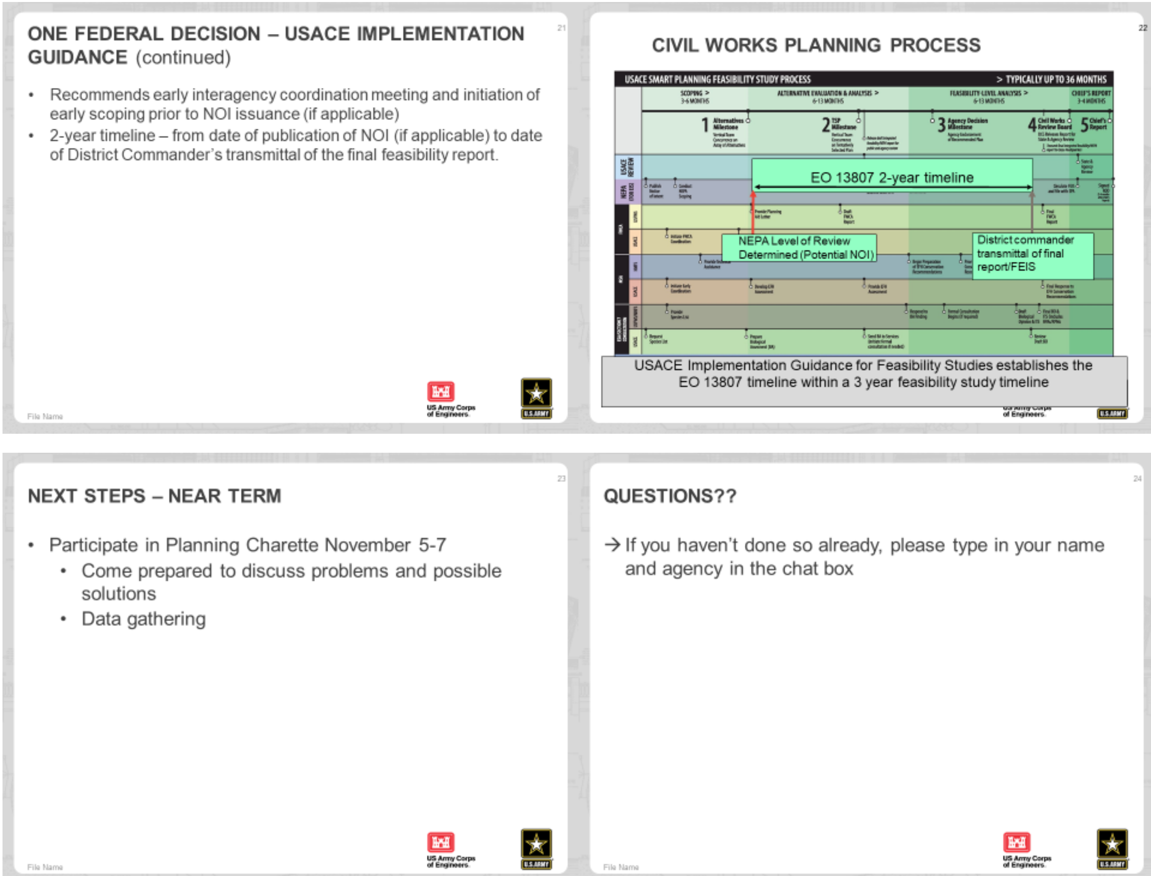
ONE FEDERAL DECISION

Executive Order 13807 – Establishing Discipline and Accountability in the Environmental Review and Permitting Process for Infrastructure Projects

- Signed 15 August 2017
- Policy…
  - (f) conduct environmental reviews and authorization processes in a coordinated, consistent, predictable, and timely manner…
  - (g) speak with a coordinated voice when conducting environmental reviews and making authorization decisions; and
  - (h) make timely decisions with the goal of completing all Federal environmental reviews and authorization decisions for major infrastructure projects with 2 years.

ONE FEDERAL DECISION – USACE IMPLEMENTATION GUIDANCE – SEPTEMBER 2018

- Coordinated Environmental Review
  - All Federal, Tribal, and State agencies required to conduct or issue a review for the study should be invited to serve as either a cooperating agency or a participating agency for the environmental review process.
  - Use risk-informed decision making to conduct environmental compliance concurrently with feasibility study – Use readily available information to gather only the information necessary for the next decision **based on feedback from coordinating with cooperating and participating agencies**…
- Develop and follow an environmental review and authorization schedule



1.2 6 NOVEMBER 2018 – STATE AGENCY MEETING

State Resource Agency Meeting Notes

7 November 2018

9:00AM

USACE: Kip Runyon, Monique Savage, Michelle Kniep, Matt Jones, Brian Johnson, Laura Lee Wilkinson, Brad Drouant, Frank Spiess, Terry Birkenstock

LDNR, Consistency Section – Jeff Harris

PHONE:

LWLF – Barry Hebert

LWLF - Dave Butler

LSHPO - Rachel Watson

LWLF - Zack Chain

Kip: Intros

Brad: Study/Project Intro

Kip: 13807-One Federal Decision Details

Kip: Existing NEPA documentation

Data/Coordination Needs:

- Planning Aid report from Fish and Wildlife in the next few months (from yesterday)
- Phone: Dave Butler can provide information on bald eagles and colonial nesting water birds; Zack from Ecological Services can provide information on invasive species
- Jeff: A lot of good information on SONRIS (Strategic Online Natural Resources Information System); www.sonris.com
- Thoughts on borrow sites: if commercial borrow sites are used they will not need coastal zone clearance;;
- Mitigation – if mitigation is necessary, typically DNR goes along with what we propose as long as NEPA compliant
- DNR cares about transportation even if borrow isn't from coastal zone
- If proposed action ends up being similar to what was done before, DNR could handle it as a modification of the existing consistency determinations done for the IERs rather than new determinations – would only work if minor changes; review process is the same for modification minus the requirement for public review
- Process requires that the action be consistent with Coastal Management Program. Consistency determination is typically presented to DNR when plans can still change. Typical review is 60-75 days at DNR. They have an issue with condemnation. As soon as we have the footprint of our potential impact, provide shapefile for consistency determination.
- Submit consistency determination electronically via email
- Mitigation for borrow sites - 3 options: Do it yourself, in lieu fee, or purchase credit at mitigation banks; there is limited availability at mitigation banks currently, more coming online; shouldn't have issues if prior developed, access routes, staging areas to the extent that they impact wetlands – if we can put them in already impacted sites, that would be great
- Zach - Need to avoid and minimize impacts to Salvador WMA in WBV area and Bayou St. John in LPV
- Rachel agreed – Avoid issues around Bayou St. John; bigger cultural issue if uplands are impacted by additional borrow sites. If structures are impacted, it could also be an issue. Coordinate with the tribes…Tribes may have additional concerns.
- Oyster seed grounds and leases: Water Bottom Assessment POC: 225-765-2386 Christy McDonough – only need assessment if in seed ground area; shouldn't be an issue for us – based on information in SONRIS, we aren't likely to impact – closest seed grounds and leases are in Lake Borgne
- Commercial Fisheries: don't impact business any more than you have to
- Recreation: avoid and minimize boat dock impacts, etc.
- LDNR generally accepts WVA results

Monique: Plan Formulation

- CPRA would be the first place to go for what works and what has not worked and what the costs are.
- Making marshes is not difficult if you have sediment. Possible to use existing dredge material from the harbor for marsh creation

- Rachel SHPO: a lot of the remaining high ground has archaeological resources – something to be aware of when considering nature-based features
- (Nonstructural): No major issues…superfund site on the northshore…there are existing projects like diversions we should avoid impacting; unanticipated discovery of human resources (pre-historic or European remains), small family cemeteries, etc. happens more frequently than you might think. 1. Unmarked burial act, 2. Land can't be re-purposed without removing remains.
- Nothing major from DNR Coastal: want to protect people from flooding…make sure to get the material NOT from bottomland hardwoods
- Team would prefer invitation for monthly teleconference meetings to be kept in the loop

Laura Lee will provide LDEQ contact information – we may want to touch

1.3 7 NOVEMBER 2018 – FEDERAL AGENCY MEETING

a. Attendees
   i. Corps: Kip Runyon, Brian Johnson, Karla Sparks, Laura Wilkinson Wolfson, Frank Spiess, Michelle Kniep, Matt Jones, Monique Savage, Joe Jordan, Brad Drouant, Elizabeth "Libby" Behrens, Jason Emery, Kevin Harper
   ii. National Park Service: Kelly Latenhofen, Guy Hughes
   iii. USFWS: Barret Fortier (web meeting), Dave Walther
   iv. NMFS: Craig Gothreaux
   v. USGS: Ann Hijuelos
b. Other agencies are getting similar guidance on EO 13807
c. Borrow. For HSDRRS we committed to not impacting wetlands
   i. However, since we don't have alternatives yet, we cannot commit to no wetland impact at this time.
d. ROW was purchased for future levee lifts
   i. There is a Planning Aide Letter from 2007
   ii. Dave (USFWS) said that they are probably going to resubmit a list of ranked borrow sites.
   iii. Footprint, physical location of the project and then the ROW, built to the ROW. Future mitigation has been identified for the 2057, hierarchy for borrow. Resubmit a new that lays this out. GIS map national landcover and crossed it with soil maps to minimizing impacts to wetlands and forested habitat. Latest information was 2007. May look at with state agencies.
e. CED estimated impacts of future lifts but only mitigated for actual footprint constructed so far
   i. Are we considering raises to hard structures?
   ii. USACE: No.
f. Foreshore protection on lake front(s)
   i. Water access and dredging requires NMFS coordination that might take a long time – Lake Pontchartrain east of the Causeway is Critical Habitat for the Gulf Sturgeon. Formal consultation for Gulf Sturgeon impacts would take 12 to 18 months. Construction consideration for water access.
   ii. Foreshore protection access through the water, dredging was involved. Probably have to put more rock. Not sure whether there is thru land and water.

g. FWS recommends not using IPAC – use SLOPES instead (Standard Local Operating Procedures for Endangered Species)
h. Need a new Phase I HTRW
i. West Shore Lake Pontchartrain project will be using a huge amount of borrow material which may impact us - Will likely use all Bonnet Carre borrow material.
j. 404c area. Need to try to avoid any more impacts to the Bayou aux Carpes Clean Water Act Section 404c area for WBV.
    i. EPA is contact on 404(c) area
    ii. Guy (National Park Service) will share EPA POC with USACE
k. Impacts to Bayou Sauvage National Wildlife Refuge in NE corner of LPV must be mitigated within the Refuge. In general, desire to keep mitigation for impacts to public lands located on those lands or added to them (stay in public use).
l. Cultural IER reports for those components, update that with the data LA State historical preservation areas, archeological site. Phase I HTRW all of these to the local sponsors for the whole 150 acres. BMP's for all the critical habitat. Howard Laderner slopes work with compliance.
m. FWS to provide Planning Aid Letter in advance of NOI, can include Essential Fish Habitat information; Dave will try to provide by end of calendar year.
n. NMFS would appreciate an early draft version of the EFH analysis – they can then provide suggestions to be included in the public draft document
o. USGS can help with some maps/data. Land loss analysis.
    i. Monique (USACE) asked if there are maps with all of the different species and cultural resources
    ii. Jasen (USACE Cultural) said that we can get updated maps with cultural sites.
p. Bald Eagles – Tammy Gilmore
q. Noise concerns along the lake front for local population
    i. Noise was a major issue. Used a press hammer to push to be less disruptive to the population and to meet the noise ordinance. Historic structures and paths, main roads used for temporary access for school zones and impacts. Construction managers, and CED to evaluate routes.
r. Look at haul roads from previous construction as possibly acceptable routes.
    i. Refine during PED, check with prior construction managers
    ii. CED Phase II did a traffic analysis (still draft)
s. Levees are used for recreation – walking, biking, access to other sites
    i. West Jefferson levee board doesn't allow rec
    ii. Andrew Perez knows where rec is happening
        1. Jefferson, Orleans, Bayou Sauvage
t. Invasive species – Tulane, Xavier, etc.
    i. Purple loose strife – new location
u. WVA model – plan on us using; tentatively plan on USACE doing analysis with FWS review, but FWS can likely help with analysis if needed – play by ear as we go through study.
v. Natural/Nature-based
    i. Marsh can reduce surge but need a LOT (many square miles) and need to buy land and maintain/rebuild.
    ii. Marshes in front – high wave energy environments, need to go with least cost alternative; if marshes get blown out will we re-create it. Trees don't work but

marsh may; 1 mile of marsh yields 3/10 of a foot surge reduction; but higher surges overwhelm marshes; marshes help more with minor surges. Armoring could be a natural feature.

iii. Any additional project features like marshes could impact the sponsor and their ability to maintain them
iv. Marshes not tree plantings
v. Turn open water into land
vi. Is armoring a natural feature?
vii. Avoid and Minimize vs. Mitigation
viii. Change grass species on the levee – potential for biodiversity without impacting protection
ix. Lake Pontchartrain Basin Foundation has info on multiple lines of defense
x. Foreshore protection?
xi. Need to be able to replace quickly and inexpensively
xii. Patrick Smith in MVN used to work for Lake Pont Basin Foundation

w. Lake Pont Foundation website…look up foreshore with reef-balls/oyster barriers "living shore"
x. Floodwalls wildlife passage 1 every 3 miles, maintain water flow. Stagnant water, BMP for water. Drainage, canal, to a pump – NPS coming back along that the park is interested. 31-34 wildlife passage 404C area. Bayou Sauvage some structures that flow out but not in. Water circulation is better. Pipe of a certain size. Screens in front of it.
y. 300 ft. buffer for the river
    i. Break water outside sea grass beds – what was there was good so do we add more and replenish the barrier?
z. Trees would be okay on the river but not from waves action (but it would maybe work on WBV because of level of current marshes)
aa. Milton project: earthen bags didn't work…replaced with rock.
bb. Remember wildlife passage for floodwalls
cc. Air quality – all areas currently in attainment
dd. Maintaining access during construction is important for recreation as well.
ee. Post-Katrina - Environmental Assessment #433 – Impacts of USACE response to Katrina and Rita – after-the-fact EA due to emergency nature; Murphy oil spill; transportation study on the HSDRSS. LA DEQ and DHH, population Andrew Perez and Joe Musso; other social effects, social/environmental justice in terms of phase construction…populations have moved around, where are the potentially disproportionately affected populations now; CED Phase 2 socio-economic report
ff. There are some sea-grass beds so maybe put some breakwaters on Lake Pont
gg. USFWS like a lot of coordination---like updates - don't wait for a month to let them know what's going on; supposed to be a member of the PDT per MOA
hh. Mondays are the worst for meetings…Thursdays seems to work
    i. National Park Service wants to be involved with WBV - development of the alternatives and then if things change.

1.4 13 NOVEMBER 2019 – RESOURCE PARTNER WEBINAR ON TSP

Attendees:

Monique Savage - USACE MVS

Rachel Mesko, USACE Planning

Hannah Sprinkle, USFWS

Dave Butler La Dept. Wildlife and Fisheries

Frank Spiess, USACE Project Management

Craig Gothreaux, NMFS Habitat Conservation Division

Elizabeth Barron, LDWF

Cornelius Williams, Louisiana Department of Wildlife & Fisheries

Dave Butler LA Dept. Wildlife and Fisheries

Barry Hebert-LDWF-Fisheries Habitat

Jeff Harris LDNR

Sara Krupa LDNR

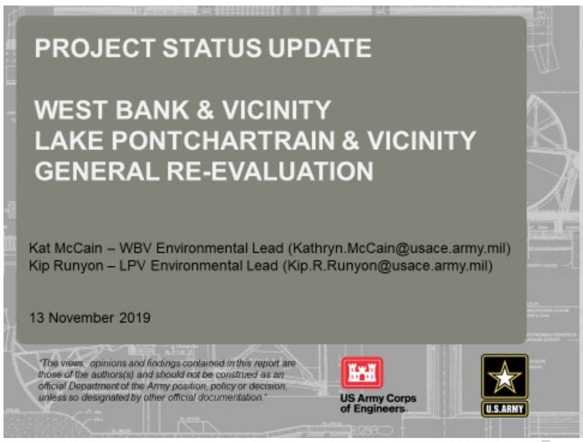
Joe Heublein NMFS SERO

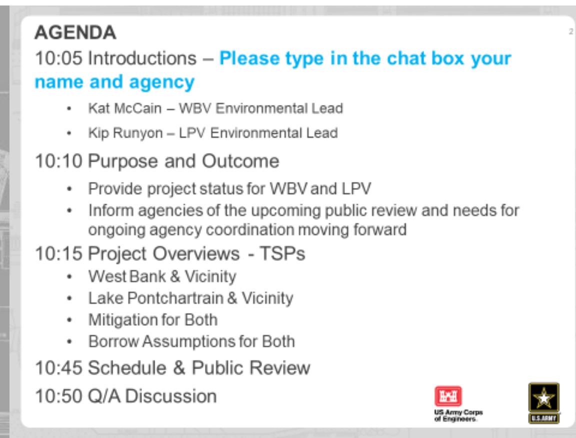
Mark Hogan LDNR

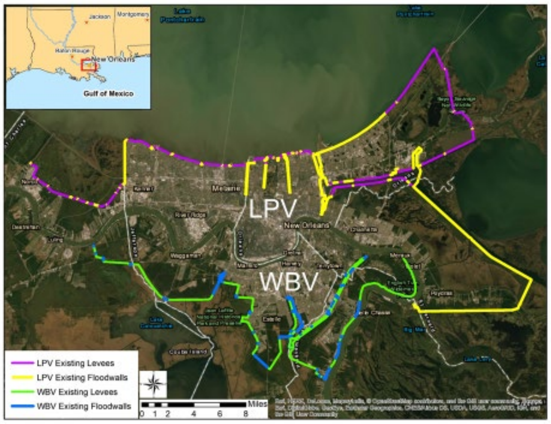
Kip Runyon USACE

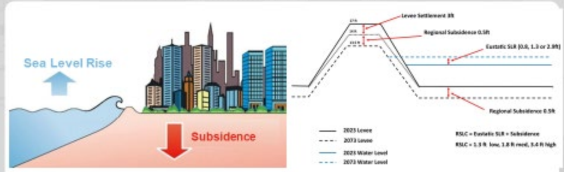
Kat McCain USACE

Laura Lee Wilkinson USACE









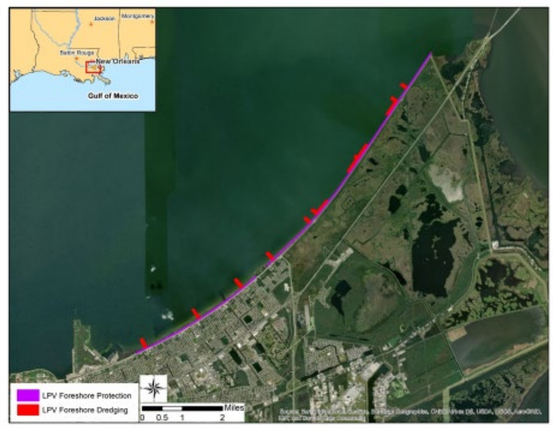
ALTERNATIVES CONSIDERED FOR BOTH WBV & LPV

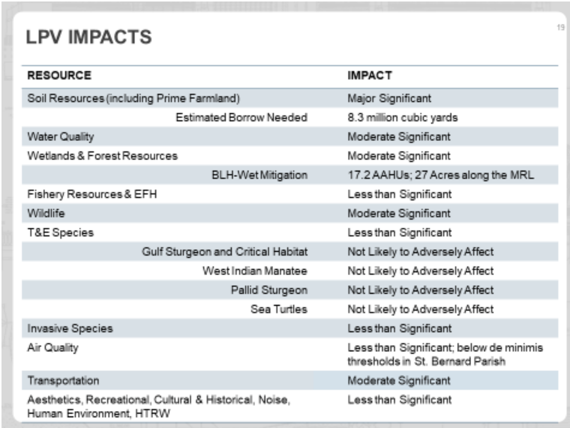
- Alt 1: No Action
- **Alt 2: 1% Annual Exceedance Probability (AEP)**
- Alt 3: 0.5% AEP

Tentatively Selected Plans for WBV & LPV

LAKE PONTCHARTRAIN & VICINITY TSP FEATURE ESTIMATES

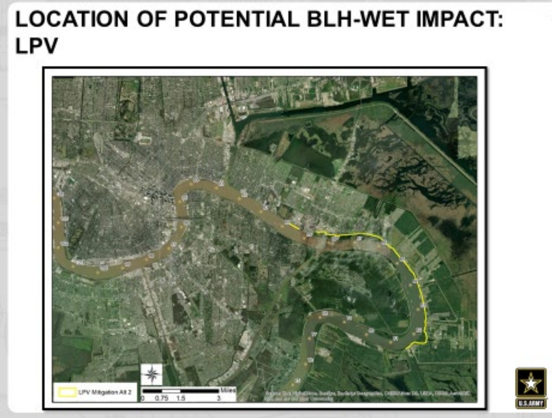
FEATURE	QUANTITY	Unit of Measure
Levee Lifts	46.4	Miles
Floodwall Raises	16.8	Miles
Foreshore Protection	75.1	Acres
Dredging	212.5	Acres

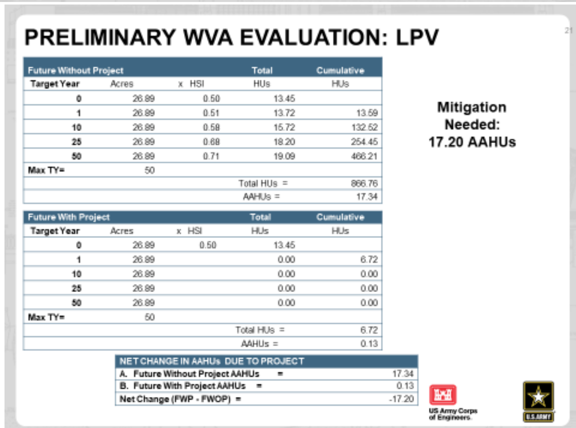




LPV IMPACTS

RESOURCE	IMPACT
Soil Resources (including Prime Farmland)	Major Significant
Estimated Borrow Needed	8.3 million cubic yards
Water Quality	Moderate Significant
Wetlands & Forest Resources	Moderate Significant
BLH-Wet Mitigation	17.2 AAHUs; 27 Acres along the MRL
Fishery Resources & EFH	Less than Significant
Wildlife	Moderate Significant
T&E Species	Less than Significant
Gulf Sturgeon and Critical Habitat	Not Likely to Adversely Affect
West Indian Manatee	Not Likely to Adversely Affect
Pallid Sturgeon	Not Likely to Adversely Affect
Sea Turtles	Not Likely to Adversely Affect
Invasive Species	Less than Significant
Air Quality	Less than Significant; below de minimis thresholds in St. Bernard Parish
Transportation	Moderate Significant
Aesthetics, Recreational, Cultural & Historical, Noise, Human Environment, HTRW	Less than Significant





PRELIMINARY WVA EVALUATION: LPV

Future Without Project			Total	Cumulative
Target Year	Acres	x HSI	HUs	HUs
0	26.89	0.50	13.45	
1	26.89	0.51	13.72	13.59
10	26.89	0.58	15.72	132.52
25	26.89	0.68	18.20	254.45
50	26.89	0.71	19.09	466.21
Max TY=	50			
			Total HUs =	866.76
			AAHUs =	17.34

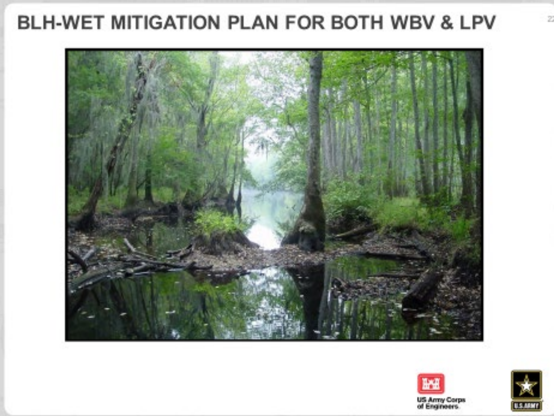
Future With Project			Total	Cumulative
Target Year	Acres	x HSI	HUs	HUs
0	26.89	0.50	13.45	
1	26.89		0.00	6.72
10	26.89		0.00	0.00
25	26.89		0.00	0.00
50	26.89		0.00	0.00
Max TY=	50			
			Total HUs =	6.72
			AAHUs =	0.13

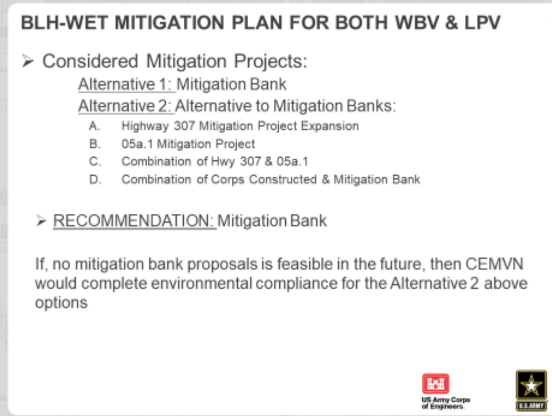
NET CHANGE IN AAHUs DUE TO PROJECT	
A. Future Without Project AAHUs =	17.34
B. Future With Project AAHUs =	0.13
Net Change (FWP - FWOP) =	-17.20

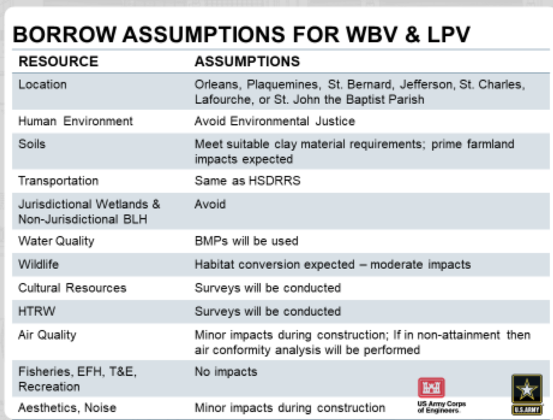
Mitigation Needed: 17.20 AAHUs

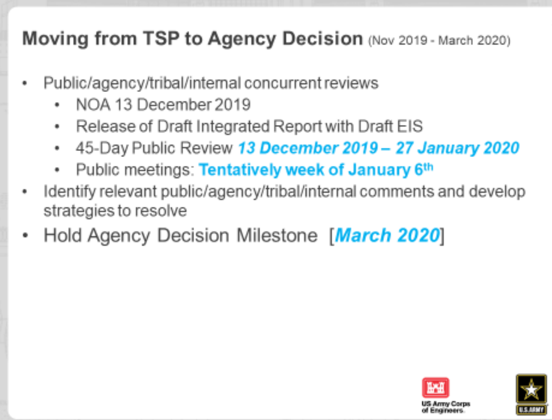
US Army Corps of Engineers

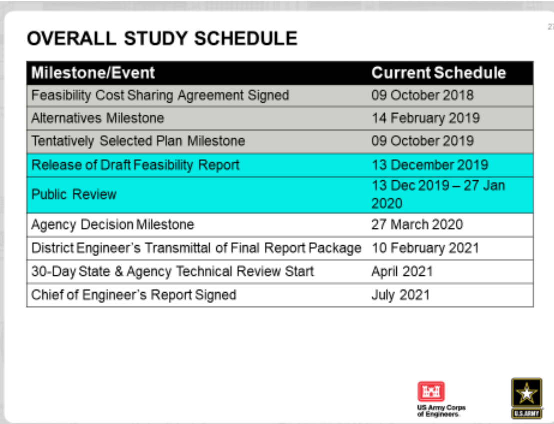
SLIDES ON West Bank & Vicinity Project available upon request











QUESTIONS:

1) Will the slides be made available?
   a. Response: yes

2 ONE FEDERAL DECISION COORDINATION

2.1 USFWS

2.1.1 4 APRIL 2019: USACE COOPERATING AGNECY REQUEST TO USFWS

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, NEW ORLEANS DISTRICT
7400 LEAKE AVE
NEW ORLEANS LA 70118-3651

April 4, 2019

Mr. Joe Ranson
Field Supervisor
U.S. Fish and Wildlife Service
200 Dulles Drive
Lafayette, LA 70506

Dear Mr. Ranson:

The U.S. Army Corps of Engineers (Corps), New Orleans District, is initiating preparation of a general re-evaluation report with integrated environmental impact statement pursuant to the National Environmental Policy Act (NEPA) of 1969, as amended, for the proposed Lake Pontchartrain and Vicinity Project, located in St. Charles, Jefferson, Orleans, and St. Bernard parishes, Louisiana. The study seeks to determine if the work necessary to sustain the 1% level of hurricane storm damage risk reduction is technically feasible, environmentally acceptable, and economically justified. The non-Federal sponsor is the Louisiana Coastal Protection and Restoration Authority.

Your agency has been identified as an agency that may have an interest in the proposed project based on your jurisdiction by law and/or special expertise. As the lead Federal agency under NEPA, we invite you to be a Cooperating Agency with the Corps in the development of the environmental decision document per the One Federal Decision, Executive Order (EO) 13807, Establishing Discipline and Accountability in the Environmental Review and Permitting Process for Infrastructure Projects, 15 August 2017. Your designation as a cooperating agency does not imply you support the proposed project nor does it diminish or otherwise modify your agency's independent statutory obligations and responsibilities under applicable Federal laws, regulations, and Executive Orders.

Enclosed for your information is one copy of the project fact sheet (ENCL 1). This fact sheet provides a brief project description, relevant background information, and study area information.

In accordance with the Council on Environmental Quality (CEQ) final implementing regulations for NEPA (40 C.F.R. § 1501.6 and § 1508.5); the One Federal Decision (EO 13807) and Corps Implementation Guidance, 26 September 2018 (ENCL 2); and CECW-P Planning Bulletin 2018-01, Feasibility Study Milestones, 26 September 2018 (ENCL 3)), the Corps requests your assistance and participation in the NEPA process in the following ways:

- Invite you to participate and provide input during agency coordination meetings, including pre-scoping and scoping;
- Consult with you on any relevant technical studies that will be required for the project;

Mr. Joe Ranson 2

- Provide comment and feedback on identifying the overall scope of the project (including project schedule to complete all federal environmental reviews and authorization decisions within two years), study and assessment methodologies, range of alternatives, and important issues and impacts to be evaluated during the environmental review;
- Participate in identifying and eliminating from detailed study the issues which are not important;
- Identify issues related to your agency's jurisdiction by law and special expertise; and
- Review the administrative and public drafts of the Draft and Final environmental impact statement.

Please provide your written acceptance or declination of this invitation on or before May 4, 2019. Should you decline to accept our invitation to be a cooperating agency, we advise that you provide a copy of your response to CEQ as specified at 40 C.F.R. § 1501.6(c). We look forward to working with your agency on the preparation of the environmental decision document. If you have any questions or would like to discuss in more detail the project or our agencies' respective roles and responsibilities during the study, please contact Mr. Bradley Drouant, P.E., the Project Manager (504-862-1516), or Mr. Kip Runyon, the Environmental Manager (314-331-8396).

Sincerely,

Brian Johnson

Brian Johnson
Environmental Compliance Branch Chief
Regional Planning and Environmental Division North - St Louis
1222 Spruce St.
St. Louis, MO 63103
Brian.L.Johnson@usace.army.mil
314-331-8146

ENCL 1 - Study Fact Sheet
ENCL 2 - Implementation Guidance for Feasibility Studies for Executive Order 13807, Establishing Discipline and Accountability in the Environmental Review and Permitting Process for Infrastructure Projects
ENCL 3 - Planning Bulletin PB 2018-01, Feasibility Study Milestones, 26 September 2018

24 Apr 2019: USFWS Cooperating Agency Response Letter

United States Department of the Interior

FISH AND WILDLIFE SERVICE
200 Dulles Drive
Lafayette, Louisiana 70506

April 24, 2019

Brian Johnson
Environmental Compliance Branch Chief
Regional Planning and Environmental Division North - St Louis
1222 Spruce St.
St. Louis, MO 63103

Dear Mr Johnson:

Please reference your April 4, 2019, letter requesting our participation as a cooperating agency during the U.S. Army Corps of Engineers' (USACE) preparation of a draft general re-evaluation report with integrated environmental impact statement (DGRR-EIS) pursuant to the National Environmental policy Act (NEPA) of 1969, as amended, for the proposed Lake Pontchartrain and Vicinity Project, located in St. Charles, Jefferson, Orleans, and St. Bernard Parishes, Louisiana. The study seeks to determine if the work necessary to sustain the 1 percent level of hurricane storm damage risk reduction is technically feasible, environmentally acceptable, and economically justified. The non-Federal sponsor is the Louisiana Coastal Protection and Restoration Authority. The U.S. Fish and Wildlife Service (Service) has reviewed the information provided, and offers the following comments in accordance with the National Environmental Policy Act (NEPA) of 1969, as amended (83 Stat. 852; 42 U.S.C. 4321 et seq.).

The USACE and the Fish and Wildlife Service (Service) have formally committed to work together to conserve, protect, and restore fish and wildlife resources while ensuring environmental sustainability of our Nation's water resources under the January 22, 2003, Partnership Agreement for Water Resources and Fish and Wildlife. Accordingly, the Service would be pleased to serve as a cooperating agency in developing the DGRR-EIS for the proposed project in accordance with applicable NEPA/Council on Environmental Quality guidance. Our participation will include: 1) participation in and providing input during agency coordination meetings, including pre-scoping and scoping; 2) consultation on any relevant technical studies that will be required for the project; 3) providing comment and feedback on identifying the overall scope of the project (including project schedule to complete all federal environmental reviews and authorization decisions within two years), study and assessment methodologies, range of alternatives, and important issues and impacts to be evaluated during the environmental review; 4) participation in identifying and eliminating from detailed study the issues which are not important; 5) identifying issues related to the Service's jurisdiction by law and special expertise; and 6) reviewing the administrative and public drafts of the Draft and Final Environmental Impact Statement. The Service will also provide technical assistance in the development of a Biological Assessment describing the impacts of the proposed activity to federally listed threatened or endangered species and/or their critical habitat. Agreeing to be a cooperating agency does not preclude the Service from providing comments on the draft and final SEISs and does not ensure our support of the final selected plan.

We appreciate the opportunity to assist the USACE during the development of the DGRR-EIS. If you require further assistance in this matter, please contact Mr. David Walther (337-291-3122) of this office.

Sincerely,

Joseph A. Ranson
Field Supervisor
Louisiana Ecological Services Office

2.1.2 29 APRIL 2019: RESPONSE TO NOTICE OF INTENT TO PREPARE DGRR-EIS

United States Department of the Interior

FISH AND WILDLIFE SERVICE
200 Dulles Drive
Lafayette, Louisiana 70506

April 29, 2019

Mr. Bradley Drouant, P.E.
U.S. Army Corps of Engineers
CEMVN-PMO-L, Room 361
7400 Leake Avenue
New Orleans, LA 70118

Dear Mr. Drouant:

The U.S. Fish and Wildlife Service (Service) has reviewed the Notice of Intent (ER 19/130) to prepare a Draft Integrated General Reevaluation Report and Environmental Impact Statement (DGRR-EIS) for the Lake Pontchartrain and Vicinity Coastal Storm Risk Management Project.

The authorization for the Hurricane and Storm Damage Risk Reduction System (HSDRRS) requires it to provide the 1% level of risk reduction needed for participation in the National Flood Insurance Program at the time of construction. It did not authorize future levee lifts that will be required to sustain the 1% level of risk reduction over the long term. The Future Levee Lifts study was first authorized in WRDA 2014 Section 3017. The authority terminates on 10 June 2024. The act requires a report be provided to Congress in 2019 with recommendations relating to continued need for this authority. The study seeks to determine if the work necessary to sustain the 1% level of hurricane storm damage risk reduction is technically feasible, environmentally acceptable, and economically justified.

The lead agency for this proposed action is the U.S. Army Corps of Engineers (USACE). The Louisiana Coastal Protection and Restoration Authority (CPRA) is the non-Federal sponsor. The USACE is preparing the DGRR–EIS under the authority of Section 3017 of WRDA 2014. Public Law 115–123 (Bipartisan Budget Act of 2018) funded the study as a new start. The study phase is 100% federally funded.

The USACE will evaluate a range of alternatives for the proposed action including structural and nonstructural measures. The USACE will fully evaluate reasonable and practicable alternatives, including the no action alternative. Alternatives may result in avoidance, minimization, and mitigation measures to reduce or offset any impacts.

To aid in the planning of that study the Service submits the following comments as

1

technical assistance in accordance with the National Environmental Policy Act of 1969 (83 Stat. 852, as amended; 42 U.S.C. 4321 et seq.), the Migratory Bird Treaty Act (MBTA, 40 Stat. 755, as amended; 16 U.S.C. 703 et seq.), the Endangered Species Act (ESA) of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.), the Bald and Golden Eagle Protection Act (54 Stat. 250, as amended, 16 U.S.C. 668a-d), and the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.).

Endangered Species Act and other Acts

Various species protected under the Endangered Species Act (ESA), Bald and Golden Eagle Protection Act (BGEPA), and the Migratory Bird Treaty Act (MBTA) are known to occur in the project vicinity. Protected species that may occur in the coastal parishes of this project study include colonial nesting water/wading birds including the formerly listed brown pelican (*Pelecanus occidentalis)*, various raptors including the formerly listed bald eagle (*Haliaeetus leucocephalus*) and peregrine falcon (*Falco peregrines)*. Forest clearing associated with project features should be conducted during the fall or winter to minimize impacts to nesting migratory birds, when practicable.

Federally-listed threatened and endangered species that could be encountered in the project area are the endangered pallid sturgeon (*Scaphirhynchus albus*), the threatened Atlantic Sturgeon (*Acipenser oxyrinchus desotoi*), and the threatened West Indian manatee (*Trichechus manatus)* and sea turtles. The USACE should consult with the NMFS regarding sea turtles.

The Service recommends that USACE conduct ESA consultation on the DGRR-EIS as soon as plans are developed and impact locations are identified. Following that coordination, the Service recommends that the USACE contact the Service for additional consultation if: 1) the scope or location of the proposed project is changed significantly, 2) new information reveals that the action may affect listed species or designated critical habitat; 3) the action is modified in a manner that causes effects to listed species or designated critical habitat; or 4) a new species is listed or critical habitat designated. Additional consultation as a result of any of the above conditions or for changes not covered in this consultation should occur before those changes are made and or finalized.

National Environmental Policy Act and the Fish and Wildlife Coordination Act

The President's Council on Environmental Quality defined the term "mitigation" in the National Environmental Policy Act regulations to include: (a) avoiding the impact altogether by not taking a certain action or parts of an action; (b) minimizing impacts by limiting the degree or magnitude of the action and its implementation; (c) rectifying the impact by repairing, rehabilitating, or restoring the affected environment; (d) reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and (e) compensating for the impact by replacing or providing substitute resources or environments. The Service supports and adopts this definition and considers the specific elements to represent the

2

desirable sequence of steps in the mitigation planning process.

The Service's Mitigation Policy (Federal Register, Vol. 46, pp. 7644-7663, January 23, 1981) has designated four resource categories which are used to ensure that the level of mitigation recommended will be consistent with the fish and wildlife resources involved. The mitigation planning goals and associated Service recommendations should be based on those four categories, as follows:

> Resource Category 1 - Habitat to be impacted is of high value for evaluation species and is unique and irreplaceable on a national basis or in the ecoregion section. The mitigation goal for this Resource Category is that there should be no loss of existing habitat value.
>
> Resource Category 2 - Habitat to be impacted is of high value for evaluation species and is relatively scarce or becoming scarce on a national basis or in the ecoregion section. The mitigation goal for habitat placed in this category is that there should be no net loss of in-kind habitat value.
>
> Resource Category 3 - Habitat to be impacted is of high to medium value for evaluation species and is relatively abundant on a national basis. FWS's mitigation goal here is that there be no net loss of habitat value while minimizing loss of in-kind habitat value.
>
> Resource Category 4 - Habitat to be impacted is of medium to low value for evaluation species. The mitigation goal is to minimize loss of habitat value.

The four resource categories are used to ensure that the level of mitigation recommended by Service biologists will be consistent with the fish and wildlife resource values involved. Considering the high value of forested wetlands and marsh for fish and wildlife and the relative scarcity of those habitats they are designated as Resource Category 2, the mitigation goal for which is no net loss of in-kind habitat value. Therefore, the Service recommends to the greatest extent possible, future levee lift features avoid or minimize the destruction of wetlands (see Attachment 1). Scrub-shrub habitat, open water areas with an abundance of submerged aquatic vegetation, and dry bottomland hardwoods are placed in Resource Category 3 due to their relatively reduced value to wildlife, fisheries and degraded wetland functions. The mitigation goal for Resource Category 3 habitats is no net loss of habitat value. Mitigation needs will be evaluated during the feasibility stage and proposed mitigation should comply with the twelve performance standards and criteria (see Attachment 2). For those project impacts that cannot be fully ascertained during the Feasibility Study the Service recommends that adaptive management be employed post construction to correctly identify the extend of such impacts and develop appropriate mitigation. All adaptive management measures should be developed in coordination with the Service and other natural resource agencies.

Public Lands

3

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: Neil Lalonde, Project Leader for the Service's Southeast Louisiana National Wildlife Refuges and Pon Dixson (985) 882-2000, Refuge Manager for the Bayou Sauvage National Wildlife Refuge (NWR).

<u>Other comments</u>

The Service assumes this study will evaluate placement of additional earthen fill on existing levees to restore them to target elevations. Other existing project features, such as water control structures, have operational plans in place. All previous Service recommendations in our November 2007 Fish and Wildlife Coordination Act Report for those existing features are incorporated herein by reference.

For any new access roads or staging areas the Service has the following recommendations:

Culverts should be installed and maintained 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 feet 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-feet long and an area would be hydrologically isolated without that culvert. Additionally, all existing and new drainage structures should be cleared and maintained.

New structural or nonstructural features should avoid impacts to wetlands and fish and wildlife resources. The USACE shall fully compensate for any unavoidable losses of wetland habitat or non-wet bottomland hardwoods caused by project features.

Acquisition, habitat development, 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 Corps should provide the necessary funding to ensure mitigation obligations are met on behalf of the public interest.

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

We appreciate the opportunity to review the Notice of Intent and to provide comments during the DGRR-EIS scoping period. We look forward to working with you and your staff as project development continues. If you or your staff have further questions regarding the above recommendations or would like to meet and discuss our recommendations, please contact David Walther (337-291-3122).

Sincerely,

Joseph A. Ranson
Field Supervisor
Louisiana Ecological Services Office

Enclosure

cc: EPA, Dallas, TX
NMFS, Baton Rouge, LA
LDWF, Baton Rouge, LA
LDNR, CMD, Baton Rouge, LA
OCPR, Baton Rouge, LA

ATTACHMENT 1
BORROW PROTOCOL

Through the efforts of Task Force Guardian and HSDRRS, the Corps restored Hurricane Katrina-damaged hurricane/flood protection projects to their authorized or previously permitted/constructed protection levels. Identification of borrow areas needed to complete those repairs utilized a protocol that prioritized selection of those sites in the following order: existing commercial pits, upland sources, previously disturbed/manipulated wetlands within a levee system, and low-quality wetlands outside a levee system. The Service supports the use of such protocols to avoid and minimize impacts to wetlands and bottomland hardwoods within project areas. Avoidance and minimization of those impacts helps to provide consistency with restoration strategies and compliments the authorized hurricane protection efforts. Such consistency is also required by Section 303(d)(1) of the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA).

Accordingly, the Service recommends that prior to utilizing borrow sites every effort should be made to reduce impacts by using sheetpile, deep soil mixing, and/or floodwalls to increase levee heights wherever feasible. In addition, the Service recommends that the following protocol be adopted and utilized to identify borrow sources in descending order of priority:

1. Permitted commercial sources, authorized borrow sources for which environmental clearance and mitigation have been completed, or non-functional levees after newly constructed adjacent levees are providing equal protection.

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., Chinese tallow-trees) or non-forested wetlands(e.g., wet pastures), excluding marshes;

   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., Chinese tallow-trees) or non-forested wetlands(e.g., wet pastures), excluding marshes;

   c) disturbed wetlands (e.g., hydrologically altered, artificially impounded).

Notwithstanding this protocol, the location, size and configuration of borrow sites within the landscape is also critically important. Coastal ridges, natural levee flanks and other geographic features that provide forested/wetland habitats and/or potential barriers to hurricane surges should not be utilized as borrow sources, especially where such uses would diminish the natural functions and values of those landscape features.

ATTACHMENT 2
MITIGATION GUIDANCE AND RECOMMENDATIONS

On April 10, 2008, the U.S. Army Corps of Engineers (Corps) and the Environmental Protection Agency (EPA) issued regulations governing compensatory mitigation for activities authorized by Department of the Army permits (Federal Register, Vol. 73, No. 70). According to the Federal Register, those regulations establish performance standards and criteria for the use of permittee-responsible compensatory mitigation, mitigation banks, and in-lieu programs to improve the quality and success of compensatory mitigation projects. The following summary outline generally describes the process of developing a mitigation plan as outlined in those regulations (see the Federal Register for a detailed description of each step).

1. Objectives: a description of the resource type(s) and amount(s) that would be provided as mitigation, the method of compensation, and the manner in which the resource functions of the compensatory mitigation project would address the needs of the geographic area of interest.
2. Site Selection: a description of the factors considered during the site selection process.
3. Site Protection Instrument: a description of the legal arrangements and instrument that would be used to ensure long-term protection of the compensatory mitigation project site.
4. Baseline Information: a description of the ecological characteristics of the proposed compensatory mitigation project site.
5. Determination of Credits: a description of the number of credits to be provided, including a rationale for that determination.
6. Mitigation Work Plan: detailed written specifications and work descriptions for the compensatory mitigation project.
7. Maintenance Plan: a description and schedule of maintenance requirements to ensure the continued viability of the resource once initial construction is completed.
8. Performance Standards: ecologically based standards that will be used to determine whether the compensatory mitigation project is achieving its objective.
9. Monitoring Requirements: a description of parameters to be monitored in order to determine if the mitigation project is on track for achieving its performance standards and if adaptive management is needed.
10. Long-term Management Plan: a description of the manner in which the compensatory mitigation project will be managed after the performance standards have been achieved to ensure the long-term sustainability of the resource.
11. Adaptive Management Plan: a management strategy to address unforeseen changes in site conditions or other mitigation project components.
12. Financial Assurances: a description of the financial assurances that would be provided and how they are sufficient to ensure a high level of confidence that the mitigation project will be successfully completed in accordance with its performance standards.

2.1.3 17 OCTOBER 2019: USACE CONCURRENCE LETTER ON TSP REQUEST LETTER

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, ST. LOUIS DISTRICT
1222 SPRUCE STREET
ST. LOUIS, MISSOURI 63103-2833

REPLY TO ATTENTION OF:
Regional Planning and Environmental Division North
Environmental Compliance Section (CEMVP-PD-C)

17 October 2019

SUBJECT: Request for Concurrence on Alternatives to be carried forward and the Preferred Alternative for the Lake Pontchartrain and Vicinity, Louisiana General Re-evaluation Report

Mr. Joseph A. Ranson
Field Supervisor
Louisiana Ecological Services Office
U.S. Fish and Wildlife Service
200 Dulles Drive
Lafayette, Louisiana 70506

Dear Mr. Ranson,

The U.S. Army Corps of Engineers, New Orleans District (CEMVN), is preparing the Lake Pontchartrain and Vicinity (LPV), Louisiana General Re-evaluation Report with integrated Environmental Impact Statement to re-evaluate the performance of the LPV system given the combined effects of consolidation, settlement, subsidence, and sea level rise over time, and determine if additional actions are recommended to sustain the current 1% level of risk reduction for coastal storms. The measures that have been identified as part of the proposed action include lifts to existing levees, raising of existing flood walls, placement of foreshore protection in existing foreshore protection locations, and construction access dredging for placement of foreshore protection. The non-Federal sponsor is the Coastal Protection and Restoration Authority Board of Louisiana.

The Executive Order 13807: Establishing Discipline and Accountability in the Environmental Review and Permitting Process for Infrastructure Projects, (also known as One Federal Decision (OFD)), Memorandum of Understanding for Major Infrastructure Projects (MOU) establishes a coordinated and timely process for environmental reviews of major infrastructure projects. It sets forth the agreement under which agencies will cooperate to complete environmental reviews and make authorization decisions for major infrastructure projects. It describes the permitting timetable milestones, roles, and responsibilities for the lead, cooperating, and participating agencies.

The OFD MOU identifies three concurrence points in the environmental review process where the lead Federal agency must request the concurrence of cooperating agencies with authorization decision responsibilities (See Enclosure 1, Section XI). These are 1) Purpose and Need, 2) Alternatives to be Carried Forward for Evaluation, and 3) Preferred Alternative.

The CEMVN recently narrowed its list of feasible alternatives to the final array of alternatives to be carried forward for analysis in the EIS. The final array consists of the following alternatives:

Alternative 1: The No Action Alternative
Alternative 2: System Levee and Floodwall Lifts to the Projected 1% Event at 2073 with Intermediate Relative Sea Level Rise
Alternative 3: System Levee and Floodwall Lifts to the Projected 0.5% Event at 2073 with Intermediate Relative Sea Level Rise

Based on reasonably maximizing the net economic benefits of the alternatives while remaining consistent with the Federal objective of protecting the nation's environment, the CEMVN recently identified the Tentatively Selected Plan (i.e. the Preferred Alternative). Based on the evaluation of net economic benefits and potential environmental impacts, Alternative 2 was identified as the Preferred Alternative.

The CEMVN is seeking your agency's concurrence on the alternatives to be carried forward for analysis in the EIS and on the Preferred Alternative. Please provide your written concurrence within 30 days from the date of this letter. Concurrence, as defined in the MOU, means confirmation by the agency that the information is sufficient for the stage in the NEPA process and the environmental review process may proceed to the next stage. If, after concurrence, the CEMVN determines that changes to the alternatives to be carried forward or the Preferred Alternative are necessary, then the CEMVN and cooperating agencies will review such changes to determine if concurrence should be revisited.

We look forward to continuing to work with your agency on this study and appreciate the working relationship thus far. If you have any questions or would like to discuss this in more detail, please contact the Environmental Manager, Kip Runyon, at 314-331-8396 or kip.r.runyon@usace.army.mil.

Sincerely,

JOHNSON.BRIAN.LLOYD.1231330336 Digitally signed by JOHNSON.BRIAN.LLOYD.1231330336 Date: 2019.10.17 14:23:19 -05'00'

Brian Johnson
Chief, Environmental Compliance Branch
Regional Planning and Environmental Division North

ENCL 1 – Memorandum of Understanding Implementing One Federal Decision Under Executive Order 13807

2.1.4 7 NOVEMBER 2019: CONCURRENCE LETTER FROM USFWS ON TSP

United States Department of the Interior

FISH AND WILDLIFE SERVICE
200 Dulles Drive
Lafayette, Louisiana 70506

November 7, 2019

Colonel Stephen Murphy
District Commander
U.S. Army Corps of Engineers
7400 Leake Avenue
New Orleans, LA 701118-3651

Dear Colonel Murphy;

Please reference the Lake Pontchartrain and Vicinity Hurricane Storm Damage and Risk Reduction Re-evaluation Study (LPV) being conducted by the Corps of Engineers' (USACE). This reevaluation addresses levee lifts that will be required to offset expected consolidation, settlement, subsidence and sea level rise and addresses impacts to fish and wildlife resources and public lands.

This letter is transmitted in accordance with the Executive Order 13807: Establishing Discipline and Accountability in the Environmental Review and Permitting Process for Infrastructure Projects, (also known as One Federal Decision (OFD)). This letter is also transmitted under the authority of the Fish and Wildlife Coordination Act (FWCA) but does not constitutes the final report of the Secretary of the Interior as required by Section 2(b) of that act.

At the current stage of planning USACE has completed preliminary studies to identify alternatives to be carried forward in the study process. Those alternatives have the potential to impact public lands, i.e., Bayou Sauvage National Wildlife Refuge managed by the U.S. Fish and Wildlife Service (Service) and Jean Lafitte National Historical Park and Preserve, Chalmette National Cemetery managed by the National Park Service (NPS).

Following a telephone conversation with Kip Runyon, USACE Environmental Manager (October 30, 2019), the Service does not object to the selected alternatives but reserves the right to voice an objection to project features that may impact those public lands. Continued coordination with the Service and the NPS, Jean Lafitte National Historical Park and Preserve will be necessary as engineering and design of those features is undertaken. The Service and Park Service will continue to work closely with USACE to identify those alternatives that are least damaging and acceptable.

We appreciate the opportunity to assist in the development of this project and to provide comments and recommendations to the proposed alternatives. However, the Service remains concerned with the lack of information provided in this stage of the feasibility study. If practicable, the Service recommends the USACE provide project feature details at an earlier phase in the study process. Lack of data limits the ability to fully address impacts to public lands and causes concern in our concurrence of alternatives.

Should you or your staff have any questions, or if you would like to meet with us regarding the content of this letter, please contact Hannah Sprinkle (337-291-3121).

Sincerely,

Joseph A. Ranson
Field Supervisor
Louisiana Ecological Services Office

2.2 NATIONAL MARINES FISHERIES SERVICE (NMFS)

2.2.1 4 APRIL 2019: USACE COOPERATING AGENCY REQUEST TO NMFS

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, NEW ORLEANS DISTRICT
7400 LEAKE AVE
NEW ORLEANS LA 70118-3651

April 4, 2019

Mr. David Bernhart
NMFS – Protected Species Division
263 13th Avenue South
St. Petersburg, FL 33701

Dear Mr. Bernhart:

The U.S. Army Corps of Engineers (Corps), New Orleans District, is initiating preparation of a general re-evaluation report with integrated environmental impact statement pursuant to the National Environmental Policy Act (NEPA) of 1969, as amended, for the proposed Lake Pontchartrain and Vicinity Project, located in St. Charles, Jefferson, Orleans, and St. Bernard parishes, Louisiana. The study seeks to determine if the work necessary to sustain the 1% level of hurricane storm damage risk reduction is technically feasible, environmentally acceptable, and economically justified. The non-Federal sponsor is the Louisiana Coastal Protection and Restoration Authority.

Your agency has been identified as an agency that may have an interest in the proposed project based on your jurisdiction by law and/or special expertise. As the lead Federal agency under NEPA, we invite you to be a Cooperating Agency with the Corps in the development of the environmental decision document per the One Federal Decision, Executive Order (EO) 13807, Establishing Discipline and Accountability in the Environmental Review and Permitting Process for Infrastructure Projects, 15 August 2017. Your designation as a cooperating agency does not imply you support the proposed project nor does it diminish or otherwise modify your agency's independent statutory obligations and responsibilities under applicable Federal laws, regulations, and Executive Orders.

Enclosed for your information is one copy of the project fact sheet (ENCL 1). This fact sheet provides a brief project description, relevant background information, and study area information.

In accordance with the Council on Environmental Quality (CEQ) final implementing regulations for NEPA (40 C.F.R. § 1501.6 and § 1508.5); the One Federal Decision (EO 13807) and Corps Implementation Guidance, 26 September 2018 (ENCL 2); and CECW-P Planning Bulletin 2018-01, Feasibility Study Milestones, 26 September 2018 (ENCL 3)), the Corps requests your assistance and participation in the NEPA process in the following ways:

- Invite you to participate and provide input during agency coordination meetings, including pre-scoping and scoping;
- Consult with you on any relevant technical studies that will be required for the project;
- Provide comment and feedback on identifying the overall scope of the project (including

project schedule to complete all federal environmental reviews and authorization decisions within two years), study and assessment methodologies, range of alternatives, and important issues and impacts to be evaluated during the environmental review;

- Participate in identifying and eliminating from detailed study the issues which are not important;
- Identify issues related to your agency's jurisdiction by law and special expertise; and
- Review the administrative and public drafts of the Draft and Final environmental impact statement.

Please provide your written acceptance or declination of this invitation on or before May 4, 2019. Should you decline to accept our invitation to be a cooperating agency, we advise that you provide a copy of your response to CEQ as specified at 40 C.F.R. § 1501.6(c). We look forward to working with your agency on the preparation of the environmental decision document. If you have any questions or would like to discuss in more detail the project or our agencies' respective roles and responsibilities during the study, please contact Mr. Bradley Drouant, P.E., the Project Manager (504-862-1516), or Dr. Kathryn McCain, the Environmental Manager (314-331-8047).

Sincerely,

Brian Johnson

Brian Johnson
Environmental Compliance Branch Chief
Regional Planning and Environmental Division North - St Louis
1222 Spruce St.
St. Louis, MO 63103
Brian.L.Johnson@usace.army.mil
314-331-8146

ENCL 1 - Study Fact Sheet
ENCL 2 - Implementation Guidance for Feasibility Studies for Executive Order 13807, Establishing Discipline and Accountability in the Environmental Review and Permitting Process for Infrastructure Projects
ENCL 3 - Planning Bulletin PB 2018-01, Feasibility Study Milestones, 26 September 2018

2.2.2 17 MAY 2019: NMFS COOPERATING AGENCY RESPONSE LETTER

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701-5505
http://sero.nmfs.noaa.gov

05/17/2019 F:SER/NS

Brian Johnson
Environmental Compliance Branch Chief
Regional Planning and Environmental Division North – St. Louis
1222 Spruce Street
St. Louis, MO 63103

Attention: Bradley Drouant, and Kathryn McCain

Dear Mr. Johnson:

NOAA's National Marine Fisheries Service (NMFS) has received your letter dated April 04, 2019, requesting our participation as a Cooperating Agency on the proposed Lake Pontchartrain and Vicinity project. Given that we have special expertise and jurisdiction by law in regards to the Endangered Species Act, Marine Mammal Protection Act, and Magnuson Stevens Act, NMFS agrees to serve as a Cooperating Agency for this project. Due to staffing and travel constraints, and our heavy involvement in several other USACE One Federal Decision Projects, our participation may be limited to our review and comment on draft National Environmental Policy Act documents, teleconferences, and occasional travel to meetings.

We appreciate your invitation to serve as a Cooperating Agency for the proposed Lake Pontchartrain and Vicinity project. Please direct project correspondence related to habitat impacts and/or Essential Fish Habitat consultation to Craig Gothreaux, 5757 Corporate Blvd., Suite 375, Baton Rouge, LA 70808; by telephone at (225) 380-0078, or by e-mail at craig.gothreaux@noaa.gov . All other project correspondence can be directed to Noah Silverman, at the letterhead address; by telephone at (727) 824-5353, or by email at noah.silverman@noaa.gov .

Sincerely,

STRELCHECK.ANDREW.J.1365863152 Digitally signed by STRELCHECK.ANDREW.J.1365863152 Date: 2019.05.17 12:23:59 -04'00'

for Roy E. Crabtree, Ph.D.
Regional Administrator

cc:
GCERC, Renshaw, Lipsy
F/SER, Strelcheck, Blough, Silverman,
F/SER3, Bernhart,
F/SER4, Fay, Dale
F/SER45, Wilber, Cooksey

2.2.3 17 OCTOBER 2019: USACE CONCURRENCE ON TSP REQUEST LETTER

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, ST. LOUIS DISTRICT
1222 SPRUCE STREET
ST. LOUIS, MISSOURI 63103-2833

REPLY TO ATTENTION OF:
Regional Planning and Environmental Division North
Environmental Compliance Section (CEMVP-PD-C)

17 October 2019

SUBJECT: Request for Concurrence on Alternatives to be carried forward and the Preferred Alternative for the Lake Pontchartrain and Vicinity, Louisiana General Re-evaluation Report

Roy E. Crabtree, Ph.D.
Regional Administrator
National Oceanic and Atmospheric Administration
National Marine Fisheries Service Southeast Regional Office
263 13th Avenue South
St. Petersburg, FL 33701-5505

Dear Dr. Crabtree,

The U.S. Army Corps of Engineers, New Orleans District (CEMVN), is preparing the Lake Pontchartrain and Vicinity (LPV), Louisiana General Re-evaluation Report with integrated Environmental Impact Statement to re-evaluate the performance of the LPV system given the combined effects of consolidation, settlement, subsidence, and sea level rise over time, and determine if additional actions are recommended to sustain the current 1% level of risk reduction for coastal storms. The measures that have been identified as part of the proposed action include lifts to existing levees, raising of existing flood walls, placement of foreshore protection in existing foreshore protection locations, and construction access dredging for placement of foreshore protection. The non-Federal sponsor is the Coastal Protection and Restoration Authority Board of Louisiana.

The Executive Order 13807: Establishing Discipline and Accountability in the Environmental Review and Permitting Process for Infrastructure Projects, (also known as One Federal Decision (OFD)), Memorandum of Understanding for Major Infrastructure Projects (MOU) establishes a coordinated and timely process for environmental reviews of major infrastructure projects. It sets forth the agreement under which agencies will cooperate to complete environmental reviews and make authorization decisions for major infrastructure projects. It describes the permitting timetable milestones, roles, and responsibilities for the lead, cooperating, and participating agencies.

The OFD MOU identifies three concurrence points in the environmental review process where the lead Federal agency must request the concurrence of cooperating agencies with authorization decision responsibilities (See Enclosure 1, Section XI). These are 1) Purpose and Need, 2) Alternatives to be Carried Forward for Evaluation, and 3) Preferred Alternative.

The CEMVN recently narrowed its list of feasible alternatives to the final array of alternatives to be carried forward for analysis in the EIS. The final array consists of the following alternatives:

Alternative 1: The No Action Alternative
Alternative 2: System Levee and Floodwall Lifts to the Projected 1% Event at 2073 with Intermediate Relative Sea Level Rise
Alternative 3: System Levee and Floodwall Lifts to the Projected 0.5% Event at 2073 with Intermediate Relative Sea Level Rise

Based on reasonably maximizing the net economic benefits of the alternatives while remaining consistent with the Federal objective of protecting the nation's environment, the CEMVN recently identified the Tentatively Selected Plan (i.e. the Preferred Alternative). Based on the evaluation of net economic benefits and potential environmental impacts, Alternative 2 was identified as the Preferred Alternative.

The CEMVN is seeking your agency's concurrence on the alternatives to be carried forward for analysis in the EIS and on the Preferred Alternative. Please provide your written concurrence within 30 days from the date of this letter. Concurrence, as defined in the MOU, means confirmation by the agency that the information is sufficient for the stage in the NEPA process and the environmental review process may proceed to the next stage. If, after concurrence, the CEMVN determines that changes to the alternatives to be carried forward or the Preferred Alternative are necessary, then the CEMVN and cooperating agencies will review such changes to determine if concurrence should be revisited.

We look forward to continuing to work with your agency on this study and appreciate the working relationship thus far. If you have any questions or would like to discuss this in more detail, please contact the Environmental Manager, Kip Runyon, at 314-331-8396 or kip.r.runyon@usace.army.mil.

Sincerely,

JOHNSON.BRIAN.L
LOYD.1231330336
Digitally signed by JOHNSON.BRIAN.LLOYD.1231330336
Date: 2019.10.17 14:24:31 -05'00'

Brian Johnson
Chief, Environmental Compliance Branch
Regional Planning and Environmental Division North

ENCL 1 – Memorandum of Understanding Implementing One Federal Decision Under Executive Order 13807

2.2.4 12 NOVEMBER 2019: CONCURRENCE LETTER FROM NMFS ON TSP

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701-5505
https://www.fisheries.noaa.gov/region/southeast

11/12/2019 F:SER/NS

Brian Johnson
Chief, Environmental Compliance Branch
Regional Planning and Environmental Division North
1222 Spruce Street
St. Louis, MO 63103

Attention: Kip Runyon, Regional Planning and Environmental Division North Environmental Compliance Section (CEMVP-PD-C)

Dear Mr. Johnson:

NOAA's National Marine Fisheries Service (NMFS) has received your letter dated October 17, 2019, seeking our concurrence pursuant to the One Federal Decision Memorandum of Understanding on the alternatives to be carried forward for analysis in the EIS and on the Preferred Alternative on the proposed Lake Ponchartrain Vicinity project. After reviewing the information you've provided, including details provided during inter-agency meetings and conference calls, we do not have any concerns with your range of alternatives or tentatively selected preferred alternative, and as such we concur. If project scope changes, and/or new alternatives are added than we would appreciate the opportunity to review those changes/additions.

.

Sincerely,

STRELCHECK.ANDREW.J.1365863152 Digitally signed by STRELCHECK.ANDREW.J.1365863152 Date: 2019.11.12 16:08:48 -05'00'

for Roy E. Crabtree, Ph.D.
Regional Administrator

cc:
GCERC, Renshaw, Lipsy
F, Chabot, Youngkin
F/SER, Strelcheck, Blough, Silverman,
F/SER3, Bernhart,
F/SER4, Fay, Dale
F/SER45, Wilber, Cooksey

3 PUBLIC SCOPING AND REVIEW

3.1 FEDERAL REGISTER

3.1.1 NOTICE OF INTENT – 2 APRIL 2019

AUTHENTICATED U.S. GOVERNMENT INFORMATION GPO

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Decision (ROD) and issue all necessary authorizations within 90 days thereafter, subject to limited exceptions. An essential element of the OFD framework is the development of a schedule, referred to the "Permitting Timetable," including key milestones critical to completion of the environmental review and issuance of a ROD. Cooperating agencies required by law to develop schedules for environmental review or authorization processes should transmit a summary of such schedules to the lead agency for integration into the Permitting Timetable.

To ensure timely completion of the environmental review and issuance of necessary authorizations, OMB and CEQ recommend the Permitting Timetable for major infrastructure projects provide for environmental review according to the following schedule:

(1) Formal scoping and preparation of a Draft EIS (DEIS) within 14 months, beginning on the date of publication of the NOI to publish an EIS and ending on the date of the Notice of Availability of the DEIS;

(2) Completion of the formal public comment period and development of the Final EIS (FEIS) within eight months of the date of the Notice of Availability of the DEIS; and

(3) Publication of the final ROD within two months of the publication of the Notice of Availability of the FEIS. While the actual schedule for any given project may vary based upon the circumstances of the project and applicable law, agencies should endeavor to meet the two-year goal established in E.O. 13807.

The U.S. Fish and Wildlife Service (Service) will assist in documenting existing conditions and assessing effects of project alternatives through the Fish and Wildlife Start Coordination Act consultation procedures. Other environmental review and consultation requirements for the proposed project include the need for Louisiana Department of Environmental Quality Clean Water Act Section 401 water quality. In addition, because the proposed project may affect federally listed species, the USACE will consult with the Service and the National Marine Fisheries Service (NMFS) in accordance with Endangered Species Act, Section 7. The NMFS will be consulted regarding the effects of this proposed project on Essential Fish Habitat per the Magnuson-Stevens Act. The USACE will also be consulting with the State Historic Preservation Officer under Section 106 of the National Historic Preservation Act concerning properties listed, or potentially eligible for listing. The USACE will also be coordinating with the Louisiana Department of Natural Resources for Coastal Zone Management Consistency per the Coastal Zone Management Act.

7. *Availability:* The Draft EIS (DEIS) is expected to be available for public comment and review no sooner than December 2019. At that time, a 45-day public review period will be provided for individuals and agencies to review and comment on the DEIS. All interested parties are encouraged to respond to this notice and provide a current address if they wish to be notified of the DEIS circulation.

Brenda S. Bowen,

Army Federal Register Liaison Officer.

[FR Doc. 2019–06359 Filed 4–1–19; 8:45 am]

BILLING CODE 3720–58–P

DEPARTMENT OF DEFENSE

Department of the Army, Corps of Engineers

Notice of Intent To Prepare a Draft Environmental Impact Statement for the Lake Pontchartrain and Vicinity General Re-Evaluation Report, Louisiana

AGENCY: Department of the Army, U.S. Army Corps of Engineers, DoD.

ACTION: Notice of intent.

SUMMARY: Pursuant to the National Environmental Policy Act (NEPA), the U.S. Army Corps of Engineers, New Orleans District (USACE) intends to prepare a Draft Integrated General Re-evaluation Report and Environmental Impact Statement (DGRR–EIS) for the Lake Pontchartrain and Vicinity Coastal Storm Risk Management Project. The study seeks to determine if the work necessary to sustain the 1% level of hurricane storm damage risk reduction is technically feasible, environmentally acceptable, and economically justified.

ADDRESSES: Questions or comments about the proposed action or requests to be added to the project mailing list should be directed to Mr. Bradley Drouant, P.E., CEMVN–PMO–L, Room 361, 7400 Leake Avenue, New Orleans, LA 70118; *CEMVN-LPVGRR@usace.army.mil.* For additional information, please visit the following website: *https://www.mvn.usace.army.mil/About/Projects/BBA-2018/studies/.*

FOR FURTHER INFORMATION CONTACT: Mr. Bradley Drouant, (504) 862–1516.

SUPPLEMENTARY INFORMATION: The lead agency for this proposed action is the USACE. The Louisiana Coastal Protection and Restoration Authority (CPRA) is the non-Federal sponsor.

1. *Authority.* The USACE is preparing the DGRR–EIS under the authority of Section 3017 of WRRDA 2014. Public Law 115–123 (Bipartisan Budget Act of 2018) funded the study as a new start. The study phase is 100% federal funding.

2. *Background.* 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.

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. The project included 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). The completion of the levees, floodwalls, gates, and pumps that together form the HSDRRS brought 100-year level of hurricane and storm damage risk reduction to the areas within LPV and WBV.

Southeast Louisiana, including the Greater New Orleans area, is generally characterized by weak soils, general subsidence, and the global incidence of sea level rise that will cause levees to require future lifts to sustain performance of the HSDRRS. The HSDRRS project authority did not provide for future lifts. Engineering analysis indicates the HSDRRS will no longer provide 1% level of risk reduction as early as 2023. Absent future levee lifts to offset consolidation, settlement, subsidence, and sea level rise, risk to life and property in the Greater New Orleans area will progressively increase. USACE will notify FEMA once the system no longer provides the 1% level of risk reduction, which may result in the loss of accreditation required for participation in the National Flood Insurance Program.

The DGRR–EIS seeks to determine if the work necessary to sustain the 1% level of risk reduction is technically feasible, environmentally acceptable, and economically justified. The study will also consider other levels of risk reduction. A positive determination

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would make construction of future levee lifts eligible for future budget requests.

The significant issues that are likely to be analyzed in depth in the DGRR–EIS include: Climate; relative sea level rise; levee consolidation and compaction; annual probability of failure; life loss; economic damages; geology and soils; hydrology and hydraulics; water resources; forest and wetland resources; uplands; fisheries; essential fish habitat; wildlife; invasive species; threatened and endangered species; cultural and historical resources; scenic and aesthetic resources; recreation; air quality; noise; transportation; population and housing; employment, business, and industrial activity; public facilities and services; community and regional growth; tax revenue and property values; community cohesion; environmental justice; and hazardous, toxic, and radioactive waste.

3. *Alternatives.* The USACE will evaluate a range of alternatives for the proposed action including structural and nonstructural measures. The USACE will fully evaluate reasonable and practicable alternatives, including the no action alternative. Alternatives may result in avoidance, minimization, and mitigation measures to reduce or offset any impacts.

4. *Public Involvement.* Public involvement, an essential part of the NEPA process, is integral to assessing the environmental consequences of the proposed action and improving the quality of the environmental decision making. The public includes affected and interested Federal, state, and local agencies, Indian tribes, concerned citizens, stakeholders, and other interested parties. Public participation in the NEPA process will be strongly encouraged, both formally and informally, to enhance the probability of a more technically accurate, economically feasible, and socially acceptable EIS. Public involvement will include, but is not limited to: Information dissemination; identification of problems, needs, and opportunities; idea generation; public education; problem solving; providing feedback on proposals; evaluation of alternatives; conflict resolution; public and scoping notices and meetings; public, stakeholder, and advisory groups consultation and meetings; and making the EIS and supporting information readily available in conveniently located places, such as libraries and on the world wide web.

5. *Scoping.* Scoping, an early and open process for identifying the scope of significant issues related to the proposed action to be addressed in the EIS, will be used to: (a) Identify the affected public and agency concerns; (b) facilitate an efficient EIS preparation process; (c) define the issues and alternatives that will be examined in detail in the EIS; and (d) save time in the overall process by helping to ensure that the draft EIS adequately addresses relevant issues.

A Scoping Meeting Notice announcing the locations, dates and times for scoping meetings is anticipated to be posted on the project website, *https://www.mvn.usace.army.mil/About/Projects/BBA-2018/studies/* and through various advertising avenues widely available to the public no later than 15 days prior to the meeting dates.

6. *Environmental Consultation and Review.* The USACE will serve as the lead Federal agency in the preparation of the DGRR–EIS. Other Federal and/or state agencies may participate as cooperating and/or commenting agencies throughout the study process. The U.S. Fish and Wildlife Service (USFWS) will assist in documenting existing conditions and assessing effects of project alternatives through the Fish and Wildlife Coordination Act consultation procedures. In addition, because the proposed project may affect federally listed species, the USACE will consult with the USFWS and the National Marine Fisheries Service (NMFS) in accordance with the Endangered Species Act, Section 7. The USACE will consult the NMFS regarding the effects of the project on Essential Fish Habitat per the Magnuson-Stevens Fishery Conservation and Management Act. The USACE will also consult with affected Federally Recognized Tribes. Other environmental review and consultation requirements for the proposed project include the need for Louisiana Department of Environmental Quality Clean Water Act Section 401 water quality certification and Clean Air Act coordination. The USACE will also consult with the State Historic Preservation Officer under Section 106 of the National Historic Preservation Act concerning properties listed or potentially eligible for listing. The USACE will also coordinate with the Louisiana Department of Natural Resources for coastal zone management consistency per the Coastal Zone Management Act.

7. *Availability.* The USACE currently estimates that the DGRR–EIS will be available for public review and comment in December 2019. At that time, the USACE will provide a 45-day public review period for individuals and agencies to review and comment. The USACE will notify all interested agencies, organizations, and individuals of the availability of the draft document at that time.

Brenda S. Bowen,

Army Federal Register Liaison Officer.

[FR Doc. 2019–06354 Filed 4–1–19; 8:45 am]

BILLING CODE 3720–58–P

DEPARTMENT OF DEFENSE

Department of the Army, Corps of Engineers

Notice of Intent To Prepare a Draft Environmental Impact Statement for the West Bank and Vicinity General Re-evaluation Report, Louisiana

AGENCY: Department of the Army, U.S. Army Corps of Engineers, DoD.

ACTION: Notice of intent.

SUMMARY: Pursuant to the National Environmental Policy Act (NEPA), the U.S. Army Corps of Engineers, New Orleans District (USACE) intends to prepare a Draft Integrated General Re-evaluation Report and Environmental Impact Statement (DGRR–EIS) for the West Bank and Vicinity Coastal Storm Risk Management Project. The study seeks to determine if the work necessary to sustain the 1% level of hurricane storm damage risk reduction is technically feasible, environmentally acceptable, and economically justified.

ADDRESSES: Questions or comments about the proposed action or requests to be added to the project mailing list should be directed to Mr. Bradley Drouant, P.E., CEMVN–PMO–L, Room 361, 7400 Leake Avenue, New Orleans, LA 70118; *CEMVN-WBVGRR@usace.army.mil.* For additional information, please visit the following website: *https://www.mvn.usace.army.mil/About/Projects/BBA-2018/studies/.*

FOR FURTHER INFORMATION CONTACT: Mr. Bradley Drouant, (504) 862–1516.

SUPPLEMENTARY INFORMATION: The lead agency for this proposed action is the USACE. The Louisiana Coastal Protection and Restoration Authority (CPRA) is the non-Federal sponsor.

1. *Authority.* The USACE is preparing the DGRR–EIS under the authority of Section 3017 of WRRDA 2014. Public Law 115–123 (Bipartisan Budget Act of 2018) funded the study as a new start. The study phase is 100% federal funding.

2. *Background.* The devastation to New Orleans and the Gulf Coast from Hurricanes Katrina and Rita included the loss of over 1,800 lives, it

3.1.2 13 DECEMBER 2019: NOTICE OF AVAILABILITY

AUTHENTICATED U.S. GOVERNMENT INFORMATION GPO

Federal Register / Vol. 84, No. 240 / Friday, December 13, 2019 / Notices **68169**

Signed in Washington, DC, on November 26, 2019.

John Bashista,

Director, Office of Acquisition Management, Department of Energy.

[FR Doc. 2019–26908 Filed 12–12–19; 8:45 am]

BILLING CODE 6450–01–P

ENVIRONMENTAL PROTECTION AGENCY

[ER–FRL–9048–4]

Environmental Impact Statements; Notice of Availability

Responsible Agency: Office of Federal Activities, General Information 202–564–5632 or *https://www.epa.gov/nepa/.*

Weekly receipt of Environmental Impact Statements

Filed 12/02/2019 10 a.m. ET Through 12/09/2019 10 a.m. ET

Pursuant to 40 CFR 1506.9.

Notice: Section 309(a) of the Clean Air Act requires that EPA make public its comments on EISs issued by other Federal agencies. EPA's comment letters on EISs are available at: *https://cdxnodengn.epa.gov/cdx-enepa-public/action/eis/search.*

EIS No. 20190288, Draft, USFS, AZ, Pinto Valley Mine, *Comment Period Ends:* 01/27/2020, *Contact:* Judd Sampson 602–525–1914.

EIS No. 20190289, Draft, NOAA, FL, Coral Reef Conservation Program Programmatic Environmental, Impact Statement, *Comment Period Ends:* 01/27/2020, *Contact:* Elizabeth Fairey 301–427–8632.

EIS No. 20190290, Draft, USACE, NE, US–275 West Point to Scribner Expressway, *Comment Period Ends:* 01/27/2020, *Contact:* Phil Rezac 402–896–0896.

EIS No. 20190291, Draft, USFS, AZ, Tonto National Forest Plan Revision, *Comment Period Ends:* 03/12/2020, *Contact:* Kenna Belsky 602–225–5200.

EIS No. 20190292, Draft, USACE, LA, West Bank and Vicinity, Louisiana, General Re-Evaluation Report, *Comment Period Ends:* 02/07/2020, *Contact:* Bradley Drouant 504–862–1516.

EIS No. 20190293, Draft, USACE, LA, Lake Pontchartrain and Vicinity Draft General Re-Evaluation Report with Integrated EIS, *Comment Period Ends:* 02/07/2020, *Contact:* Bradley Drouant 504–862–1516.

Amended Notice

EIS No. 20190256, Draft Supplement, NASA, CA, Draft Supplemental Environmental Impact Statement for Soil Cleanup Activities at Santa Susana Field Laboratory, *Comment Period Ends:* 01/08/2020, *Contact:* Peter Zorba *msfc-ssfl-information@mail.nasa.gov,* Revision to FR Notice Published 10/25/2019; Extending the Comment Period from 12/9/2019 to 1/8/2020.

EIS No. 20190261, Draft, USAF, NM, Special Use Airspace Optimization Holloman Air Force Base, New Mexico, *Comment Period Ends:* 01/31/2020, *Contact:* Robin Divine 210–925–2730, Revision to FR Notice Published 11/01/2019; Extending the Comment Period from 12/16/2019 to 1/31/2020.

EIS No. 20190282, Draft, USA, LA, Amite River and Tributaries East of Mississippi River, Louisiana, *Comment Period Ends:* 01/13/2020, *Contact:* US Army Corps of Engineers 504–862–1014, Revision to FR Notice Published 11/29/2019; Correcting Lead Agency from USA to USACE.

Dated: December 9, 2019.

Robert Tomiak,

Director, Office of Federal Activities.

[FR Doc. 2019–26879 Filed 12–12–19; 8:45 am]

BILLING CODE 6560–50–P

EXPORT-IMPORT BANK

[Public Notice: 2019–6028]

Agency Information Collection Activities: Comment Request

AGENCY: Export-Import Bank of the United States.

ACTION: Submission for OMB review and comments request.

SUMMARY: The Export-Import Bank of the United States (EXIM Bank), as part of its continuing effort to reduce paperwork and respondent burden, invites the general public and other Federal Agencies to comment on the proposed information collection, as required by the Paperwork Reduction Act of 1995.

DATES: Comments must be received on or before February 11, 2020 to be assured of consideration.

ADDRESSES: Comments may be submitted electronically on *WWW.REGULATIONS.GOV* or by mail to Smaro Karakatsanis, Export-Import Bank of the United States, 811 Vermont Ave. NW, Washington, DC 20571.

SUPPLEMENTARY INFORMATION: The Export-Import Bank has made changes to the form to reflect an application process decoupled from the SBA's export working capital program. EXIM will also be moving forward to an electronic application submission process, which results in a stand-alone application versus the previous joint application with the SBA. Therefore, all references and information previously required from the SBA have been removed. There is one material change in the application to reflect EXIM's local cost support on short-term transactions, including working capital. Local costs are costs incurred in the buyer's country (*i.e.* local delivery, installation, taxes), eligible for EXIM cover, provided that: U.S. content requirements are met; included within the contracts; do not exceed 15% of export contract; and no local goods are included. Therefore, three questions are added to the application: Are local costs to be included under the working capital loan facility; if yes, how much in terms of USD or percentage per contract or invoice; and what is the nature of the local costs to be supported?

The application tool can be reviewed at: *https://www.exim.gov/sites/default/files/pub/pending/eib84-01.pdf.*

Title and Form Number: EIB 84–01 Application for Export Working Capital Guarantee.

OMB Number: 3048–0013.

Type of Review: Renewal.

Need and Use: This form provides EXIM Bank staff with the information necessary to determine if the application and transaction is eligible for EXIM Bank assistance under their export working capital guarantee program.

Affected Public

This form affects entities involved in the export of U.S. goods and services.

EXIM Bank

Annual Number of Respondents: 200.

Estimated Time per Respondent: 2 hours.

Annual Burden Hours: 400 hours.

Frequency of Reporting of Use: Annually.

Government Expenses

EXIM Bank

Reviewing time per year: 300 hours.

Average Wages per Hour: $42.50.

*Average Cost per Year (time * wages):* $12,750.00.

Benefits and Overhead: 20%.

Total Government Cost: $15,300.00.

Bassam Doughman,

IT Project Manager, Office of the Chief Information Officer.

[FR Doc. 2019–26516 Filed 12–12–19; 8:45 am]

BILLING CODE 6690–01–P

3.2 PUBLIC WEBSITE

Project information, including review plan, public meeting information, presentations, fact sheets, and draft report available online at:

https://www.mvn.usace.army.mil/About/Projects/BBA-2018/studies/LPV-GRR/

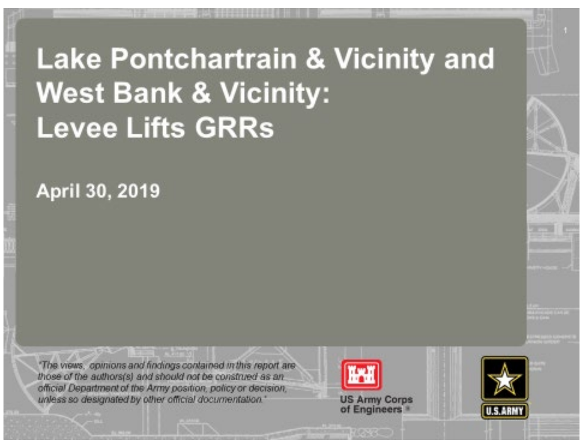
3.3 OVERVIEW OF PUBLIC MEETINGS

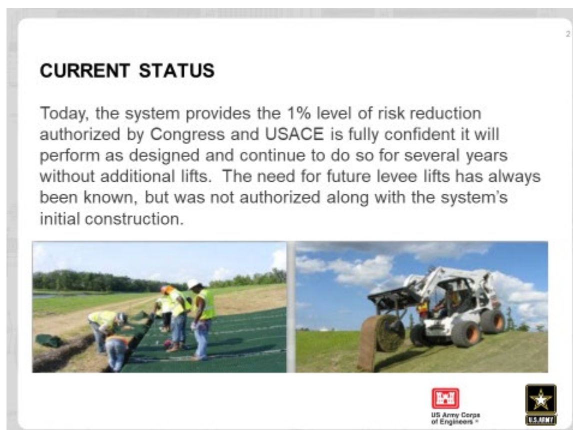
Date	Location	Number of Attendees
30 April 2019 Public Meeting	USACE New Orleans District Office	~20
22 January 2020	6500 Spanish Ft. Blvd New Orleans, LA 70124	~25

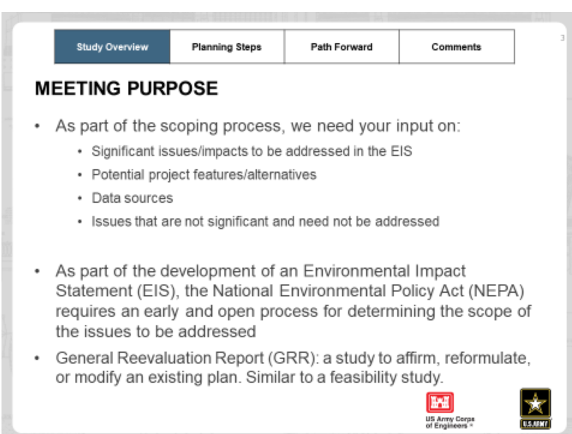
3.3.1 PUBLIC MEETING 30 APRIL 2019

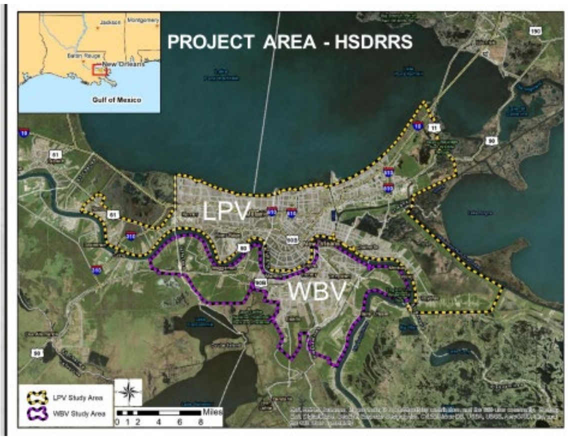
Video of public meeting available at:
https://www.youtube.com/watch?v=XtM3tAO2EMk&feature=youtu.be

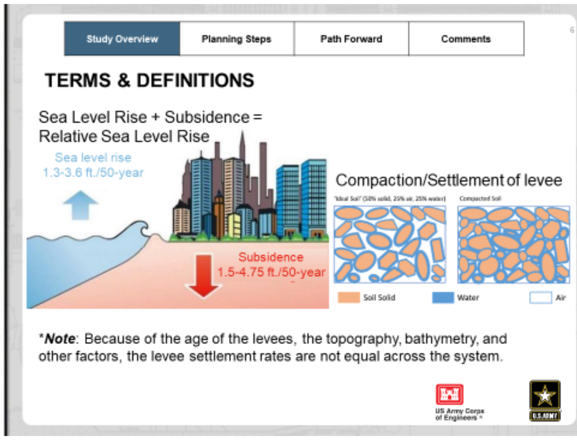
3.3.1.1 PRESENTATION SLIDES FROM PUBLIC MEETING

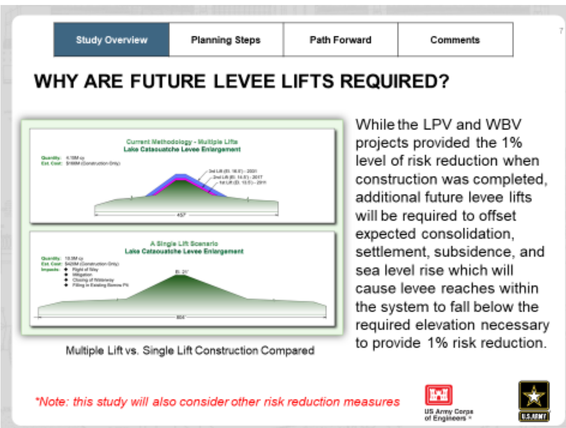


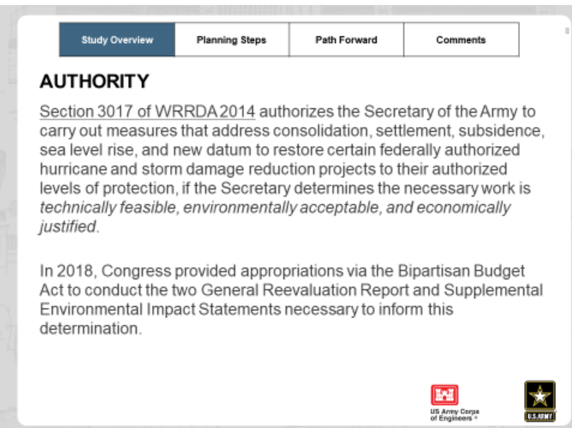


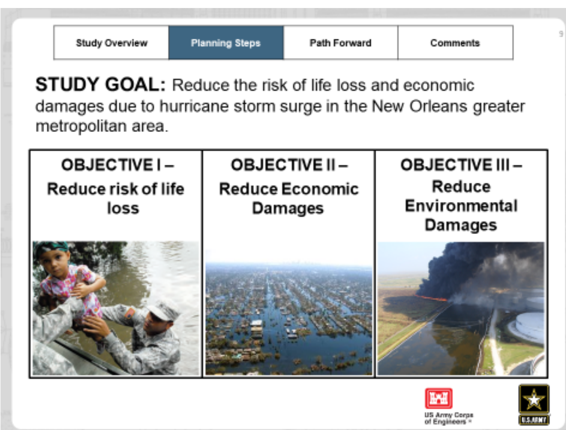


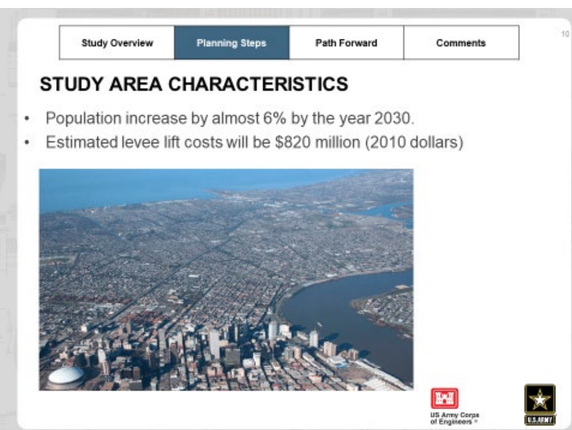

PROJECT AREA - HSDRRS
Gulf of Mexico
LPV
WBV
LPV Study Area
WBV Study Area
Miles
0 1 2 4 6 8


Study Overview
Planning Steps
Path Forward
Comments
TERMS & DEFINITIONS
Sea Level Rise + Subsidence =
Relative Sea Level Rise
Sea level rise
1.3-3.6 ft./50-year
Compaction/Settlement of levee
Subsidence
1.5-4.75 ft./50-year
Soil Solid
Water
Air
*Note: Because of the age of the levees, the topography, bathymetry, and other factors, the levee settlement rates are not equal across the system.


Study Overview
Planning Steps
Path Forward
Comments
WHY ARE FUTURE LEVEE LIFTS REQUIRED?
Current Methodology - Multiple Lifts
Lake Cataouatche Levee Enlargement
A Single Lift Scenario
Lake Cataouatche Levee Enlargement
While the LPV and WBV projects provided the 1% level of risk reduction when construction was completed, additional future levee lifts will be required to offset expected consolidation, settlement, subsidence, and sea level rise which will cause levee reaches within the system to fall below the required elevation necessary to provide 1% risk reduction.
Multiple Lift vs. Single Lift Construction Compared
*Note: this study will also consider other risk reduction measures

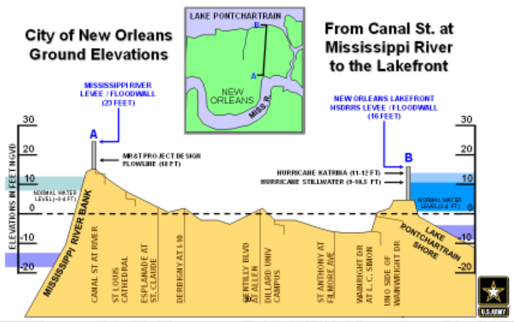

Study Overview
Planning Steps
Path Forward
Comments
AUTHORITY
Section 3017 of WRRDA 2014 authorizes the Secretary of the Army to carry out measures that address consolidation, settlement, subsidence, sea level rise, and new datum to restore certain federally authorized hurricane and storm damage reduction projects to their authorized levels of protection, if the Secretary determines the necessary work is technically feasible, environmentally acceptable, and economically justified.
In 2018, Congress provided appropriations via the Bipartisan Budget Act to conduct the two General Reevaluation Report and Supplemental Environmental Impact Statements necessary to inform this determination.


Study Overview
Planning Steps
Path Forward
Comments
STUDY GOAL: Reduce the risk of life loss and economic damages due to hurricane storm surge in the New Orleans greater metropolitan area.
OBJECTIVE I – Reduce risk of life loss
OBJECTIVE II – Reduce Economic Damages
OBJECTIVE III – Reduce Environmental Damages


Study Overview
Planning Steps
Path Forward
Comments
STUDY AREA CHARACTERISTICS
• Population increase by almost 6% by the year 2030.
• Estimated levee lift costs will be $820 million (2010 dollars)

Study Overview | Planning Steps | Path Forward | Comments

STUDY AREA TOPOGRAPHY



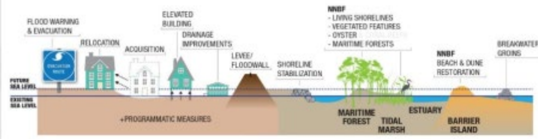
Study Overview | Planning Steps | Path Forward | Comments

RISK REDUCTION MEASURES

Structural
- Levee Raise
- Island/Surge Barrier
- New Floodwalls
- Breakwaters standalone/ in combination
- Interior drainage improvements
- Add armoring on the flood side
- Wave Berms

Non-Structural
- Risk Communication with the public/Flood Warning
- Buyouts
- Flood-proofing
- Elevated buildings

Nature-Based
- Marshes
- Dunes/Beaches
- Living Shoreline



Study Overview | Planning Steps | Path Forward | Comments

OVERALL STUDY TIMELINE

Nov 2019	• Project Initiation • Alterative Development
Dec 2018 - Oct 2019	• Public & Agency Meetings • Alternative Evaluation
Dec 2019	• Tentatively Select Plan • Public Review *(anticipated mid-December 2019)*
Apr 2020	• Agency Endorsement of Recommended Plan
Sept 2021	• Approval of Final Report

Study Overview | Planning Steps | Path Forward | Comments

WHAT WE NEED FROM YOU

1. What hurricane event did your community see the most damages?
2. Are there risk reduction measures that you would like the planning team to evaluate to address the problems?
3. Are there specific things the planning team should consider?
4. Is there data/studies that you know of that could help the study?
5. Significant issues/impacts to be addressed
6. Issues that are not significant and need not be addressed

Study Overview | Planning Steps | Path Forward | Comments

COMMENTS & QUESTIONS

Comments or information can be provided to:

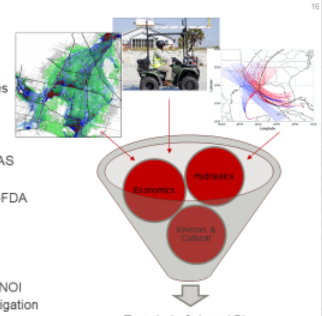
U.S. Army Corps of Engineers, New Orleans District
C/O Mr. Bradley Drouant, P.E.
CEMVN-PMO-L
7400 Leake Avenue
New Orleans, LA 70118

Or by email to

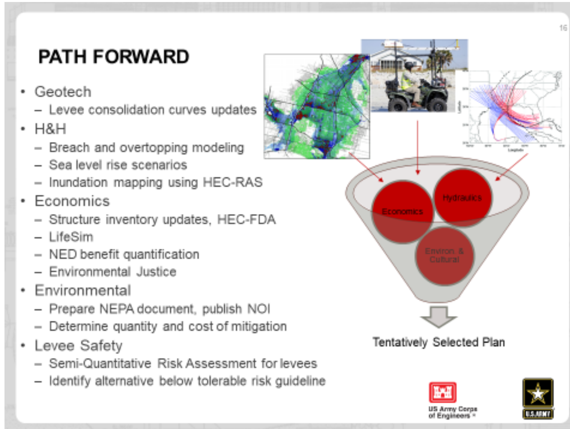
CEMVN-WBVGRR@usace.army.mil
CEMVN-LPVGRR@usace.army.mil

PATH FORWARD

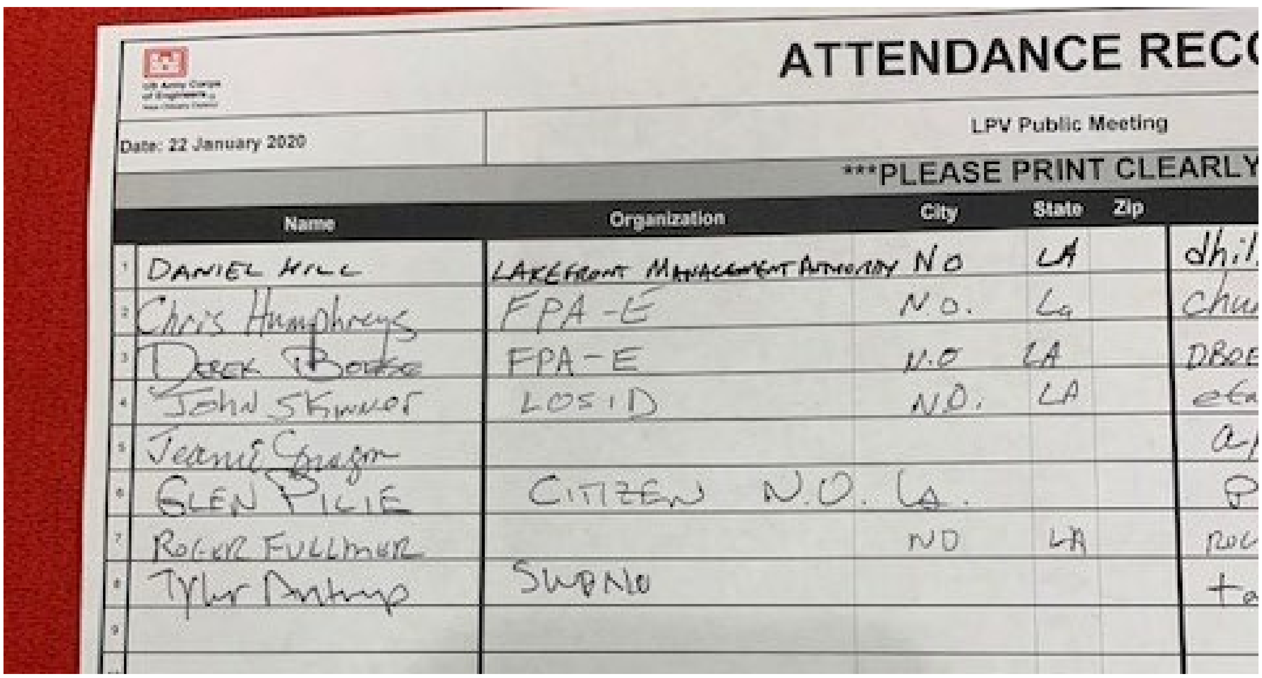
- Geotech
  - Levee consolidation curves updates
- H&H
  - Breach and overtopping modeling
  - Sea level rise scenarios
  - Inundation mapping using HEC-RAS
- Economics
  - Structure inventory updates, HEC-FDA
  - LifeSim
  - NED benefit quantification
  - Environmental Justice
- Environmental
  - Prepare NEPA document, publish NOI
  - Determine quantity and cost of mitigation
- Levee Safety
  - Semi-Quantitative Risk Assessment for levees
  - Identify alternative below tolerable risk guideline



Tentatively Selected Plan



3.3.1.2 ATTENDEE LIST



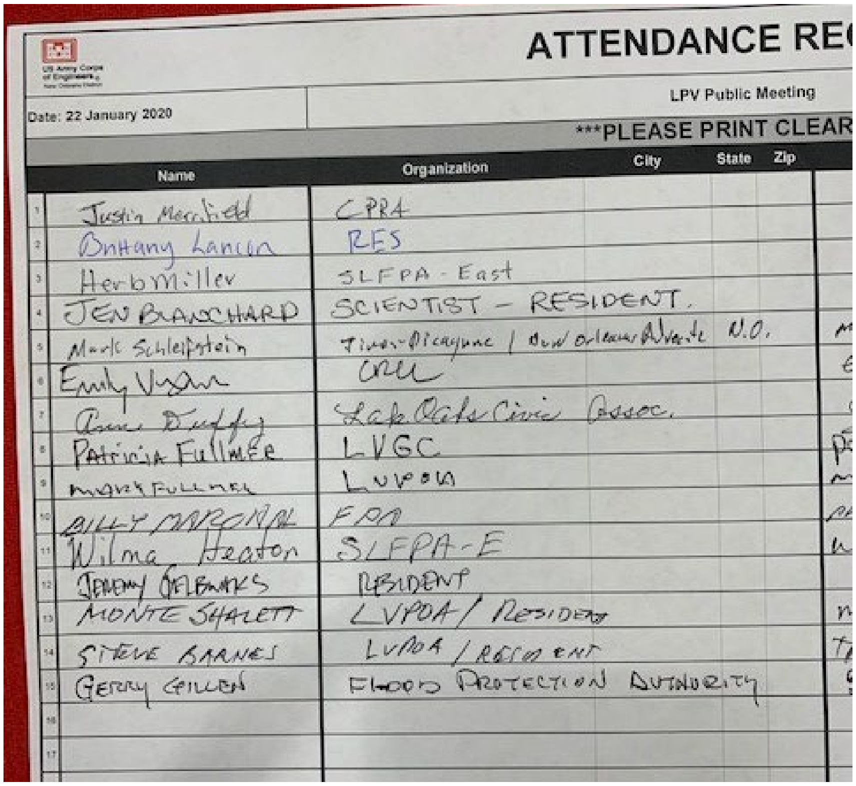
ATTENDANCE REC

Date: 22 January 2020

LPV Public Meeting

***PLEASE PRINT CLEARLY

	Name	Organization	City	State	Zip	
1	DANIEL HILL	LAKEFRONT MANAGEMENT AUTHORITY	NO	LA		dhil
2	Chris Humphreys	FPA-E	N.O.	La		chu
3	Derek Boese	FPA-E	N.O	LA		DBOE
4	John Skinner	LOSID	N.O.	LA		e
5	Jeanne Gragm					a
6	GLEN PILIE	CITIZEN	N.O.	La.		
7	ROGER FULLMER		NO	LA		Rog
8	Tyler Antrup	SWBNO				te
9						



ATTENDANCE RE

US Army Corps of Engineers

Date: 22 January 2020

LPV Public Meeting

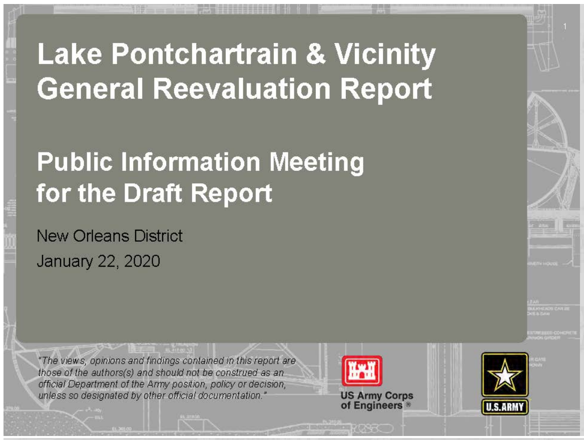
***PLEASE PRINT CLEAR

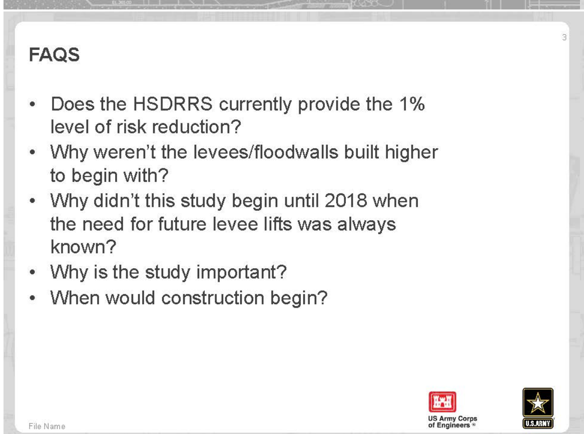
	Name	Organization	City	State	Zip
1	Justin Merrifield	CPRA			
2	Brittany Lancon	RES			
3	Herb Miller	SLFPA - East			
4	JEN BLANCHARD	SCIENTIST - RESIDENT.			
5	Mark Schleifstein	Times-Picayune / New Orleans Advocate	N.O.		
6	Emily Vuxton	CRCL			
7	Anne Duffy	Lake Oaks Civic Assoc.			
8	Patricia Fullmer	LVGC			
9	MARK FULLMER	LVPOA			
10	BILLY MARCHAL	FPA			
11	Wilma Heaton	SLFPA-E			
12	JEREMY [illegible]	RESIDENT			
13	MONTE SHALETT	LVPOA / RESIDENT			
14	STEVE BARNES	LVPOA / RESIDENT			
15	GERRY GILLEN	FLOOD PROTECTION AUTHORITY			
16					
17					

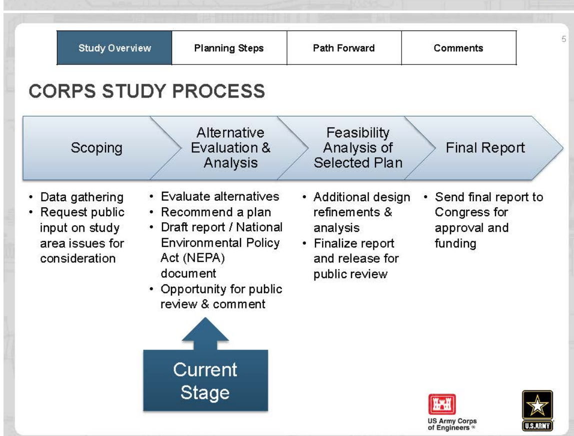
3.3.1.3 PHOTOS FROM MEETING

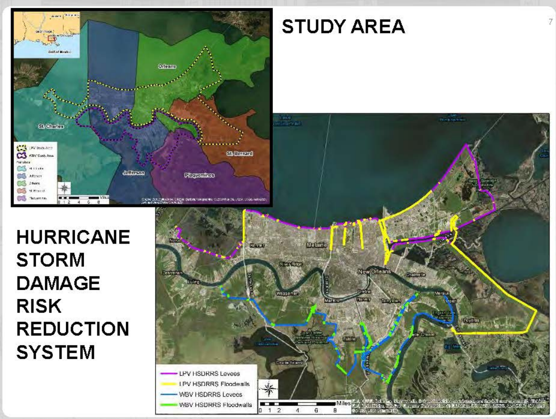

Lake Pontchartrain & Vicinity
General Reevaluation Report

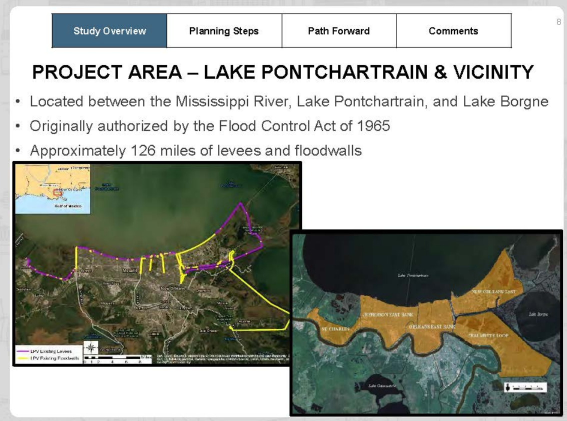
3.3.1.4 PRESENTATION SLIDES








STUDY AREA
HURRICANE STORM DAMAGE RISK REDUCTION SYSTEM
LPV HSDRRS Levees
LPV HSDRRS Floodwalls
WBV HSDRRS Levees
WBV HSDRRS Floodwalls
7


Study Overview
Planning Steps
Path Forward
Comments
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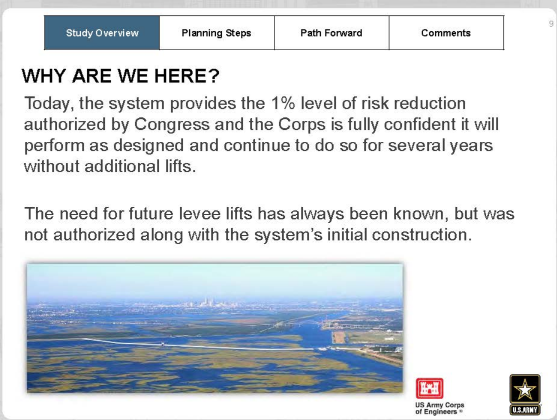
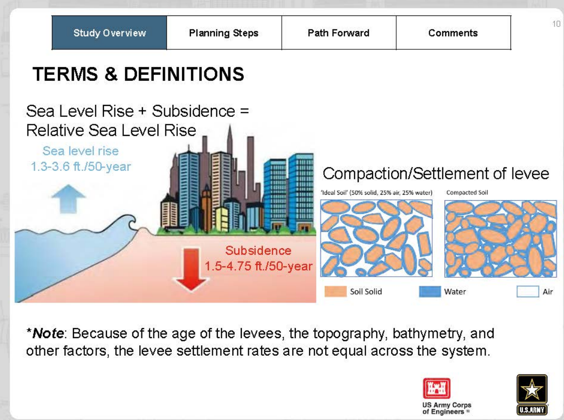
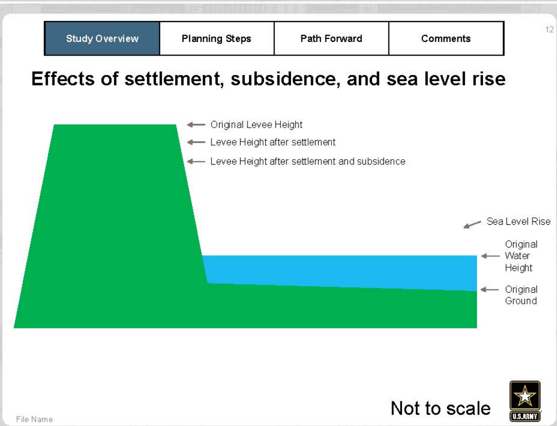
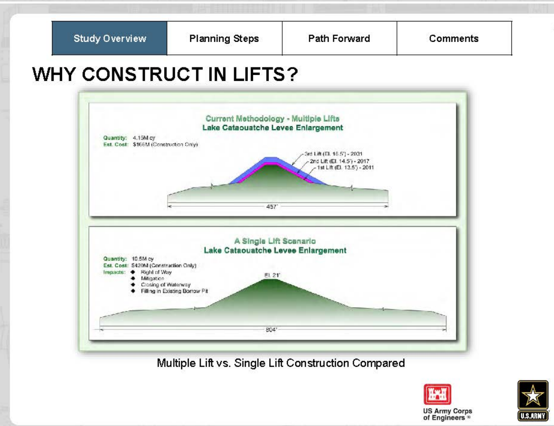
PROJECT AREA – LAKE PONTCHARTRAIN & VICINITY
• Located between the Mississippi River, Lake Pontchartrain, and Lake Borgne
• Originally authorized by the Flood Control Act of 1965
• Approximately 126 miles of levees and floodwalls


Study Overview
Planning Steps
Path Forward
Comments
9
WHY ARE WE HERE?
Today, the system provides the 1% level of risk reduction authorized by Congress and the Corps is fully confident it will perform as designed and continue to do so for several years without additional lifts.
The need for future levee lifts has always been known, but was not authorized along with the system's initial construction.
US Army Corps of Engineers
U.S.ARMY


Study Overview
Planning Steps
Path Forward
Comments
10
TERMS & DEFINITIONS
Sea Level Rise + Subsidence = Relative Sea Level Rise
Sea level rise 1.3-3.6 ft./50-year
Subsidence 1.5-4.75 ft./50-year
Compaction/Settlement of levee
'Ideal Soil' (50% solid, 25% air, 25% water)
Compacted Soil
Soil Solid
Water
Air
*Note: Because of the age of the levees, the topography, bathymetry, and other factors, the levee settlement rates are not equal across the system.
US Army Corps of Engineers
U.S.ARMY


Study Overview
Planning Steps
Path Forward
Comments
12
Effects of settlement, subsidence, and sea level rise
Original Levee Height
Levee Height after settlement
Levee Height after settlement and subsidence
Sea Level Rise
Original Water Height
Original Ground
Not to scale
File Name
U.S.ARMY


Study Overview
Planning Steps
Path Forward
Comments
14
WHY CONSTRUCT IN LIFTS?
Current Methodology - Multiple Lifts
Lake Catouatche Levee Enlargement
A Single Lift Scenario
Lake Catouatche Levee Enlargement
Multiple Lift vs. Single Lift Construction Compared
US Army Corps of Engineers
U.S.ARMY

Study Overview | Planning Steps | Path Forward | Comments

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Study Purpose

- The study will reevaluate the performance of the LPV project given the combined effects of consolidation, settlement, subsidence, sea level rise, and new datum over time.

Study Area Problems

- Increased risk of overtopping of LPV levees during hurricane and tropical storm events.
- Increased risk to life safety and storm-related economic damages.

Study Objectives

- Reduce economic damages and risk of life loss due to hurricane and tropical storm damage.

US Army Corps of Engineers | U.S. ARMY

Study Overview | Planning Steps | Path Forward | Comments

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PLAN FORMULATION PROCESS

Measure Identification

- Utilized existing infrastructure, existing reports, and subject matter expertise
- Structural, Non-Structural, Natural and Nature Based Solutions

Measure Screening

- 13 measures identified
- Evaluated using professional judgment, existing data, cost/benefit, meets objectives
- 4 measures screened from further analysis

Alternative Formulation

- 6 formulation strategies
- 4 screened from further analysis

Final Array

2 Final

US Army Corps of Engineers | U.S. ARMY

Study Overview | Planning Steps | Path Forward | Comments

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MEASURES

Structural

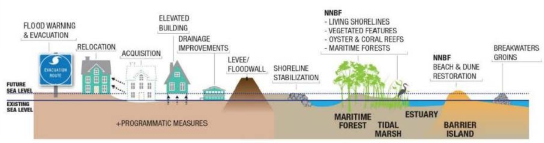
- Levee lift
- Surge Barrier
- New floodwalls
- Breakwaters
- Interior drainage improvements
- Add armoring at the flood side
- Wave berms

Non-Structural

- Risk Communication
- Buyouts
- Flood-proofing
- Elevated buildings

Nature-Based

- Marshes
- Dunes/Beaches
- Living Shoreline



Study Overview | Planning Steps | Path Forward | Comments

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ALTERNATIVES CONSIDERED

- **No Action Alternative**
- **Alternative 1:** System Levee Lifts to the Projected 1% AEP Event at 2057
- **Alternative 2:** System Levee Lifts to the Projected 1% AEP Event at 2073
- **Alternative 3:** System Levee Lifts at 2073 that Maximize Benefits
- **Alternative 4:** Selective Levee Lifts
- **Alternative 5:** Non-Structural
- **Alternative 6:** Sponsor Plan

US Army Corps of Engineers | U.S. ARMY

Study Overview | Planning Steps | Path Forward | Comments

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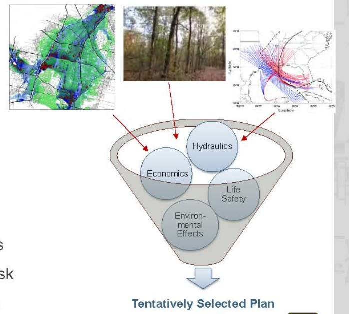
EVALUATION OF ALTERNATIVES

- ✓ Hydrology & hydraulics modeling
- ✓ Cost estimates
- ✓ Economic benefits (damages reduced)
- ✓ Environmental impacts (mitigation)
- ✓ Real estate considerations
- ✓ Reductions in life safety risk
- ✓ Reduction in risk to critical infrastructure



US Army Corps of Engineers | U.S. ARMY

Study Overview | Planning Steps | Path Forward | Comments

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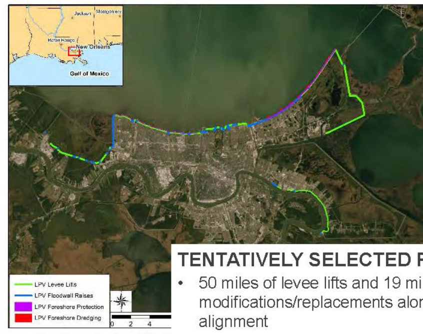

TENTATIVELY SELECTED PLAN

- 50 miles of levee lifts and 19 miles of floodwall modifications/replacements along existing LPV alignment
- Estimated total cost: ~$2.6 billion

Study Overview | Planning Steps | Path Forward | Comments

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NEXT STEPS

Final General Reevaluation Report
- Response to public comments included
- Refined design based on additional analysis
- Final plan sent to Congress

Congressional Authorization & Appropriation
- Congress approves construction through a Water Resources Development Act
- Funding occurs separately through federal and state budgeting processes

Design Phase
- Additional survey and data collection to support design refinement

Construction (Phased)
- Construction contracts awarded and managed by the Corps

US Army Corps of Engineers | U.S. ARMY

Study Overview | Planning Steps | Path Forward | Comments

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HOW TO COMMENT

Send your comments by February 7, 2020

Mail:
U.S. Army Corps of Engineers, New Orleans District
C/O Mr. Bradley Drouant, P.E.
CEMVN-PMO-L, Room 361
7400 Leake Avenue
New Orleans, LA 70118

Email:
CEMVN-LPVGRR@usace.army.mil

A Court Reporter is available tonight to accept verbal comments

US Army Corps of Engineers | U.S. ARMY

3.4 COMMENTS RECEIVED

3.4.1 SCOPING COMMENTS RECEIVED & RESPONSES (APRIL 2019)

The following comments were directed to CEMVN Public Affairs Officer (PAO) and CEMVN PAO and PM responses back to the Times Picayune newspaper are provided in red.

Is there a document/documents that have already been completed that outline where things stand for both? No.

Has there been any memo issued outlining the limitations to be required for these two studies?

There is implementation guidance.

Were these two studies requested by CPRA? Regional levee authorities? Are there documents for that?

No, they were authorized by Congress in WRRDA 2014 Sec 3017 and received appropriations from BBA18.

Were these first covered in a HSDRRS study? Since they are a re-evaluation what was the first evaluation?

There was not a HSDRRS study, because Congress authorized and appropriated funds without a report or requiring a benefit/cost analysis.

In 2015, I wrote a story about a corps presentation to the east bank authority that seemed to be about this study for the east bank, at least, and tagged the cost of the study at $10-20 million, and said it should be finished by 2018 in order to give public, FEMA time to review it, etc, in advance of 2023 recertification.

Do you expect the reviews announced in these notices will include all the provisions discussed in that meeting?

No, the items discussed in that article largely involve re-running the ADCIRC model which does not fit within the smart planning $3M budget and 3 year schedule of the GRRs. They will utilize the existing ADCIRC models with some modifications. Recertification is a responsibility of the non-Federal Sponsor and is also not part of this effort.

With the language in the notice saying the study may show parts of the system will no longer meet 1 percent requirements by 2023, is it your belief that there will be enough time between its completion and the recertification deadline to address low areas in the system?

The 2023 date is an estimate based on existing data and previous settlement curves. The study is gathering new levee elevation data (to include some work done by the NFS) that may extend the timeline the levees remain above the 1% design elevations. Even if a portion of a levee reach were to fall below the 1% design elevation engineering analysis would be required to determine whether or not the system continued to provide the 1% level of risk reduction.

Are each of the levee systems expecting that present lift efforts associated with armoring will meet that goal? Do you already know other things that need to be done? Or are you expecting this new study to identify those issues and address them as future Corps projects?

The non-Federal sponsor has taken actions to raise some of the levees previously expected to be the first requiring future lifts. No new settlement curves have been generated by USACE at this time to determine how long those reaches will remain above the 1% design heights. Additional alternatives to sustain the 1% elevation may be identified by the study.

And, Matt, can I get a copy of the engineering analysis that the corps cites in its notice as showing the 1 percent standard might not be met by 2023?

Smart planning relies on the use of existing data to complete studies in a timely and cost efficient matter. The 2023 date is an estimate based on available data at the time the NOI was published.

And if the EIS/study finds additional work must be done, would that be sent to Congress as a proposed project in a chief's report, assuming it's given a positive benefit/cost analysis? And if so, how quickly could work be started/completed to meet flood insurance requirements?

WRRDA 2014 Sec 3017 provides construction authorization provided that the project is found to be technically feasible, environmentally acceptable, and economically justified through 10 June 2024. Potential implementation would be subject to appropriations and the authority's termination date.

Comments Received from private citizen and CEMVN Responses (in red)

As you will be aware, the State of Louisiana is currently in the process of putting out to bid for the Mid-Barataria and Mid-Breton sediment diversion projects. I was wondering whether the Corps will be taking the effects that these structures will undoubtedly have on river flow and volume into account when designing the levee lifts. Further, might these structures function in a similar way to the Bonnet Carre spillway when the river is high, providing additional flood control mechanisms?

The LPV and WBV GRR studies are authorized to consider alternatives related to Hurricane and Storm Damage Risk Reduction. I can't speak to what the State may or may not utilize the diversion structures for, but riverine flooding falls under a different Federal project the Mississippi River and Tributaries (MR&T) project (i.e. river levees). The diversions are unlikely to be impacted by this study as they are outside our project area. I would not anticipate the diversions would be used during hurricanes, the details of how they are operated will be reviewed as part of the State's 408 permit request to the Corps seeking to modify the MR&T project.

Back in 2013, architects Waggoner and Ball released The Greater New Orleans Urban Water Plan, which the City of New Orleans adopted in its most recent Master Plan. The plan recommends a significant overhaul of the system of drainage canals that the Sewerage and Water Board currently operates and maintains. Again, will the Corps be taking the Urban Water Plan into account and coordinating with the City to ensure that the plan matches the Corps own objectives?

I have downloaded the Waggoner and Ball reports and shared them with the team for consideration. If in reviewing alternatives with the highest benefits it appears work on the canals may be required we would certainly consult with the S&WB and City of New Orleans, but work on the canals themselves is unlikely to provide the additional benefits that would be required to justify the expense of altering the existing floodwalls.

Additional Information: It should be noted, the interior drainage analysis was performed to determine if interior drainage function was impacted by HSDRRS construction efforts. Analysis results indicate that each basin performs independently of external water levels. Secondly, HSDRRS construction has no significant impact on interior water levels or drainage during an event that does not overtop the system.

3.4.2 PUBLIC REVIEW OF DRAFT REPORT (9 DEC 2019 – 7 FEB 2020)

3.4.2.1 MEDIA COVERAGE

3.4.2.1.1 9 DECEMBER 2019 TIMES PICAYUNE NEWSPAPER ARTICLE

Available online at:

https://www.nola.com/news/environment/article_a160ff42-1ace-11ea-bd3b-cbcf2a74b089.html

What it'll take to raise New Orleans-area levees: $3.2 billion, 50-year plan, Corps says

BY MARK SCHLEIFSTEIN | Staff writer

The Army Corps of Engineers has recommended a $3.2 billion, 50-year plan to elevate both the hurricane-protection levee systems on either side of the Mississippi River and several miles of river levees to keep pace with sinking soils and rising sea level.

In dual reports released Monday, the Corps said its plan, if pursued, would keep levees and floodwalls high enough to reduce flooding caused by storm surges resulting from hurricanes with a 1 percent chance of occurring in any year.

Protection from these so-called 100-year storms was the baseline standard the federal government agreed to provide in building New Orleans' new levee system after Hurricane Katrina.

Keeping the levees that high will guarantee that properties behind the levees would continue to be eligible for flood insurance in the future.

The system must be recertified as meeting those height requirements in 2023, and in announcing it was beginning the study earlier this year, Corps officials said some levees might already be below the 100-year required height by then.

When the study was announced, the Corps initially discounted a more expensive proposal to increase heights of the levee system to protect from a 0.5 percent surge event — a "250-year storm" — as "less efficient" and more costly to build and maintain.

The study was authorized by 2014 congressional legislation aimed at allowing the federal government to pay a portion of the levee lifts if they were found to benefit the national economy. The state will still have to pay 35 percent of the construction costs and all of the costs of operating and maintaining the levee improvements when complete.

When the post-Katrina levee system was built, at a cost of $14.6 billion, Congress did not include authorization of federal-state cost sharing for elevating the levees to keep up with subsidence and sea level rise.

The east bank and West Bank levee improvement plans are available at the Corps' New Orleans District web site. The agency will schedule public meetings in January to distribute information about the plans and provide opportunities for comments.

According to the Corps, the state Coastal Protection and Restoration Authority will act as the local sponsor for both the east and west bank projects, but construction costs will be shared by the Southeast Louisiana Flood Protection Authorities on the east and west banks; the Pontchartrain Levee District; Jefferson, Plaquemines, Orleans, St. Bernard and St. Charles parishes; and the New Orleans Sewerage & Water Board.

The biggest chunk of improvements would be aimed at levees overseen by the east bank levee authority. That work would cost $2.6 billion and would reduce estimated annual storm surge flooding damage to $30 million, compared to $230 million a year without the improvements. That would result in a benefit-to-cost ratio of 2.6 to 1, according to the Corps report. That ratio is likely to help in getting congressional approval of the construction plan, and, more important, congressional funding.

The damage estimates are based on the potential effects of hurricane surge water overtopping levees and floodwalls for a 100-year storm. However, the damage estimates would likely increase for surges created by larger storms, which would result in more water deposited within the levee system.

For comparison, Hurricane Katrina was considered a 250-year event for the surge it pushed into St. Bernard Parish and a 150-year event for its surge heights along Lake Pontchartrain.

The report pointed out that while the improvements would also result in a significant net safety increase, storms larger than the 100-year event would still pose a high risk to life “due to the extensive population protected by the levee system, even with good evacuation procedures.”

The east bank improvements would include 50 miles of levee lifts and 19 miles of floodwall modifications and replacements.

Not requiring additional elevation, according to the report, are the new combined levees and floodwalls along Lake Borgne in St. Bernard Parish, or the Lake Borgne Surge Barrier. But several miles of levees and floodwalls along the Mississippi River in St. Bernard would be elevated, as the study concludes that rising sea levels will increase water heights farther upstream during hurricanes than previously believed.

Part of that stretch of river levee already is considered below the 100-year level of risk reduction.

The Corps estimated that east and west bank bank earthen levee lifts and floodwall height elevations of between 2 feet and 5.1 feet will be required over 50 years, between 2023 and 2073, which is considered the lifespan of the project. That includes between 0.2 feet and 3.3 feet to account for sinking soils, plus an "intermediate" estimate of 1.8 feet for sea level rise, which includes the effects of human-induced global warming.

The Corps chose the intermediate level for sea rise, rather than a worst-case rise of 3.4 feet, which includes the effects of more potential melting of polar ice caps and glaciers around the world. But the estimate could be revisited during the life of the project.

The east bank work will take place in a series of lifts that would occur by decade, with 11 lifts between 2023 and 2033, four lifts between 2034 and 2043, 15 lifts between 2044 and 2053, and three lifts between 2045 and 2065.

On the West Bank, the elevation work will cost $613 million, which should reduce estimated annual damages from surge-related flooding to $8 million, compared to the estimated average $78 million a year damage cost without the improvements. That damage reduction results in a benefit to cost ratio of 2.4 to 1.

The West Bank levees would require seven lifts totaling 16 miles between 2023 and 2033, 11 lifts for 22 miles between 2034 and 2043, four lifts totaling 14 miles between 2044 and 2053, 13 lifts totaling 27 miles between 2054 and 2064, and two lifts totaling 3 miles between 2065 and 2073.

The West Bank work also would include extending upriver the segment of the Mississippi River in Plaquemines Parish and Algiers that would be elevated to deal with potential storm surges. The Algiers Canal levees also would be raised.

The Corps considered six alternatives in determining its final plan. It dismissed doing nothing as too expensive; including a no-action scenario is a requirement of Corps studies.

It held open an alternative if the state wanted to come up with its own plan, but the state declined to do so. Coastal authority officials did not respond to a request for comment on the Corps plan on Monday.

Also rejected was a proposal to consider only “non-structural” alternatives – such as elevating buildings or relocating businesses or homes. The corps found it was not cost-effective, though some buildings within the two levee systems may still become eligible for such programs in the future to reduce damage costs.

A proposal to simply elevate the system to deal with potential surge height increases through the present life of the levee system, 2056, was rejected as less effective than building to 2073 water height requirements.

Also rejected was a proposal to simply elevate portions of the levee system that seemed most likely to be overtopped in 2073. The report said that would leave a levee system with differing height levels that would be more difficult to manage. Indeed, that would be a throwback to the way the regional levee system was designed and built before Katrina, which a Corps-sponsored forensic investigation said was “a system in name only” that was destined for failure.

A final proposal looked at how to improve the levee system to protect against more dangerous storms. The Corps used the 0.5 percent/250-year surge height alternative to determine whether that alternative would be more cost-effective. The alternative would have increased the construction cost on the east bank by $348 million and reduced annual damages by $4 million a year, to $26 million. But the resulting benefit to cost ratio was less than the 1 percent alternative.

3.4.2.1.2 10 DECEMBER 2019 4WWL-TV

Available online: https://www.wwltv.com/article/news/local/orleans/army-corps-recommends-32-billion-levee-protection-plan-for-new-orleans/289-6b19c0c8-2365-411b-bfa6-f97d7a9176db

Army Corps recommends $3.2 billion levee protection plan for New Orleans: The Army Corps of Engineers' 50-year plan will help New Orleans levees keep pace with rising sea levels and sinking soil.

Author: Paul Murphy / Eyewitness News
Published: 6:18 PM CST December 10, 2019
Updated: 6:19 PM CST December 10, 2019

NEW ORLEANS — In New Orleans, residents just wrapped up the first hurricane season where the Army Corps of Engineers could not guarantee the level of risk reduction it promised in 2007.

This despite the fact that the Corps just completed an 11-year, $14.6 billion project to repair and restore regional flood protection following Hurricane Katrina.

Of primary concern are the earthen levees. They form the backbone of the 350-mile maze of protection that includes concrete floodwalls, pump stations and gated structures.

Sea-level rise and Southeast Louisiana's soft, subsiding soils have caused earthen levees to sink faster than expected.

The fear is soon the levee system won't be able to protect against a 100-year storm, which it is now designed to do.

The Corps of Engineers has released a draft study showing the need to spend $3.2 billion to raise the level of the levees on both sides of the Mississippi River over the next 50 years.

The east bank improvements would include 50 miles of levee lifts and 19 miles of floodwall modifications and replacements.

Several miles of levees and floodwalls along the Mississippi River in St. Bernard Parish would also be elevated.

The west bank improvements consist of 66 miles of levee lifts and about a mile of floodwall improvements.

State and local governments would have to pick up 35-percent of the cost of construction.

The corps is now in the process of collecting public comments on the plan.

3.4.2.1.3 10 DECEMBER 2019 WDSU-NEWS

Available online at: https://www.wdsu.com/article/corps-to-ask-feds-to-fund-billions-in-new-louisiana-flood-protection-projects/30189330#

Corps to ask feds to fund billions in new Louisiana flood protection projects: Studies in public hearing phase

Updated: 8:22 PM CST Dec 10, 2019

Reporter: Jennifer Crockett

According to the Army Corps of Engineers New Orleans district, the risk of flooding in Louisiana is going up as levees are going down. The Corps is conducting a series of five studies in the region to reduce the flood risk.

Across metro New Orleans, the Corps says levees are sinking as the sea level is rising. It is studying the feasibility of lifting the levees in phases over the next 50 years at an estimated cost of $3.2 billion. The Corps said the work would maintain protection against a 100-year-flood and meet the requirements for national flood insurance coverage.

“Right now, the levee authorities on the east and west banks are paying for levee lifts out of local tax payer dollars, and what the studies are looking at is – is there an economic justification for the federal government to participate in that going forward,” said Bradley Drouant, with the Corps’ New Orleans district. “The good news is, it looks like there is an economic justification for that work.”

But the work doesn’t stop in New Orleans. The Corps district is spending $15 million on a series of five studies in our region right now -- all to fight flooding with federal investments.

In St. Charles Parish, the Corps wants to build a new $500 million levee to extend an existing levee another 18 miles. If approved and funded, the Upper Barataria construction would run from Hahnville to Raceland, across Bayou Des Allemands. The Corps says the new levee would protect 800,000 people from Gulf storm surge in a 50-year storm.

Along the south-central coast of Louisiana, in St. Martinville, St. Mary and Morgan City, another $1.4 billion is on the table to raise homes and buffer businesses. The Corps said it would protect about 3,400 structures from flooding.

The Corps is currently hosting public hearings on the potential projects. For more information, click here.

The studies are expected to be complete and presented to Congress as early as 2021.

3.4.3 COMMENTS RECEIVED & RESPONSES ON DRAFT REPORT

3.4.3.1 COURT REPORTER COMMENTS RECEIVED AT PUBLIC MEETINGS 22 JAN 2020

1

LAKE PONTCHARTRAIN & VICINITY

GENERAL REEVALUATION REPORT

Public Information Meeting for the Draft Report

New Orleans District

Lake Vista Community Center

6500 Spanish Fort Boulevard

New Orleans, Louisiana 70124

Wednesday, January 22, 2020

6:00 pm - 8:00 pm

Public Comments

COMMENTS

MS. JENNIFER BLANCHARD:

All right, let's start with number one: Where do levee overtoppings result in the loss of life during Hurricane Katrina? Number two: Please identify on a map where levees and/or flood walls were overtopped in Hurricane Katrina. Number three: Why spend 3.2 billion adding sediment to the tops of levees rather than spend the funding to repair and maintain Morganza, the old river control structure to relieve Mississippi River flood stage or hydraulic pressure on the downstream levees?

Number four: Where is the highest percentage of lifts located? Number five: Is the highest percentage of lifts located on the river or lake? Six: Where was the location of the highest percentage of overtopping of levees/flood walls during Katrina? Number seven: Where did the highest percent of loss of life occur during Hurricane Katrina?

Number eight: Was the loss of life a result of overtopping? Number nine: Did the levee/flood wall breach in the lower ninth ward as a result of overtopping? Number ten: Where did overtopping occur on the levee flood wall in the lower ninth ward? Number 11: If overtopping was not the cause of loss of life during Katrina, why is the Corps using it as a justification for this project? Number 12: How will levee lifts inhibit or prevent levee flood wall breaches caused by hydraulic lifting leading to lateral instability?

Number 13: Why did you change the format of the public meeting to prevent oral public comments from being shared and heard during the meeting? Number 14: Was the subsidence rate and sea-level rise rate included in the proposal for the HSDRRS post-Katrina when the 14 billion was requested and authorized? Number 15: If so, what was the justification for not including lifts as part of the levee flood wall continuing repair and maintenance plan?

Number 16: When you state that the lifts will be federally funded, where will these federal funds be sourced? Number 17: Is federally funded synonymous with taxpayer dollars? Will these funds be sourced from tax revenue? That's kind of the same.

Number 18: When did you file the need for levee lifts with the national register? Number 19: If subsidence and sea-level rise are the cause leading to the need for levee lifts, why was this not identified prior to 2018 when it was filed with the national register? 20: Are you certain that the material under armored levees is clay? 21: What will happen if you remove the armor and the levee is not constructed of clay? What will happen to the un-armored levees if a Mississippi River flood or storm surge from a hurricane happen while the construction is in progress?

Let's see. Hold on, let me just make sure I got everything. Okay. I guess I have to ask these questions too. So I'm going to ask kind of a new set.

In Katrina, where does overtopping over the levees lead to loss of life? What is the amount of property damages in Katrina that resulted from overtopping of the levee system? Please provide the number of people who died in Katrina as a result of overtopping of the levee system. Please provide the number of people that died in the lower ninth ward as a result of the north breach and the south breach on Jordan Avenue. Number five: When did the north breach and the south breach fully develop, what time? When was -- what time was storm surge at its maximum height?

(CONTACT: Ms. Jennifer Blanchard| 504-729-0991|510 Slidell Street, New Orleans, LA 70114| jennifer@nolapotter.com)

*   *   *   *

MR. STEVE BARNES:

I have a suggestion for where to get some fill. It's the unused levees along Bayou Saint John between Robert E. Lee and the new flood gates they put up which makes the rest of the levees on both sides of the Bayou not needed and it would be nice to, I thought, save some money to use existing levee material to do -- because it's right there where you are doing levees. And then it would also open up the Bayou and make it more a recreational and a better ability and hopefully encourage people to get together to try and restore Spanish Fort which levees run through part of anyone. So that's my comment.

(CONTACT: Mr. Steve Barnes|53 Egret Street, New Orleans, LA 70124|504-319-8134| thesteve4@yahoo.com)

----end of comments

C-E-R-T-I-F-I-C-A-T-E

This certification is valid only for a transcript accomplished by my original signature and original required stamp on this page.

I, TAMMY LeBLANC JOSEPH, CCR, in and for the State of Louisiana, as the officer before whom these comments were taken, do hereby certify that comment was made as hereinbefore set forth in the forgoing pages; that these comments were reported by me in the stenograph writing method, was prepared, transcribed by me or under my personal direction and supervision; that the transcript has been prepared in compliance with the transcript format guidelines required by statute or by rules of the board, as described on the website of the board; that I have acted in compliance with the prohibition on contractual relationships, as defined by LA Code of Civil Procedure, Art 1434, and in the rules and advisory opinions of the board; that I am not related to counsel or to the parties herein, nor am I otherwise interested in the outcome of this matter.

Tammy LeBlanc Joseph, CCR
State of Louisiana

3.4.3.2 USACE RESPONSES TO COMMENTS RECEIVED AT PUBLIC MEETING ON 22 JANUARY 2020 (TRANSCRIBED BY COURT REPORTER)

Jennifer Blanchard Number 1: Many levees in both New Orleans east and St. Bernard Parish were overtopped causing erosion on the protected side that resulted in their failure. Additional information on the location of Hurricane Katrina levee overtoppings can be found in the Interagency Performance Evaluation Taskforce Report located at https://biotech.law.lsu.edu/katrina/ipet/ipet.html.

Jennifer Blanchard Number 2, 6, 8, 9, 10 and response to questions in last paragraph: Information on the performance of the project during and after Hurricane Katrina can be found in the Interagency Performance Evaluation Taskforce Report located at https://biotech.law.lsu.edu/katrina/ipet/ipet.html.

Jennifer Blanchard Number 3: The Corps has been directed by Congress to specifically evaluate the LPV and WBV systems in these studies. The Congressional authority and appropriations for this Study found in WRRDA 2014 Section 3017 and Bipartisan Budget Act of 2018 only apply to LPV and WBV, so the Corps is not authorized or funded to evaluate or construct repairs for other projects in the region through the LPV/WBV authority. The structures you mention fall under the Mississippi River and Tributaries project, which is a separate authority. Additional information about the Morganza to the Gulf of Mexico Project is located at https://www.mvn.usace.army.mil/About/Projects/Morganza-to-the-Gulf/.

Jennifer Blanchard Number 4: This information is available in Appendix A, Enclosure 1 and 2.

Jennifer Blanchard Number 5: Overall, the highest percentage of lifts is located along Lake Pontchartrain.

Jennifer Blanchard Number 7: USACE does not have information regarding the number of deaths as a result of Hurricane Katrina by location. The LPV and WBV studies themselves include a life safety component that assesses life safety risk within each polder of the project area.

Jennifer Blanchard Number 11: The study's authority and USACE planning policy require us to select a coastal storm risk management alternative with positive net economic benefits compared to costs. The evaluation of alternatives and selection of a recommended plan is informed by a risk analysis which includes a life safety component.

Jennifer Blanchard Number 12: All levees and floodwalls in the LPV and WBV projects were reviewed and completed, improved or replaced as necessary to meet the new design criteria that were developed post-Katrina. Those designs and design criteria were subject to a third party Independent External Peer Review (IEPR). The work proposed in this study would offset the ongoing effects of subsidence, sea level rise, consolidation, and datum change to sustain the 1% level of risk reduction through 2073. A copy of the IEPR performed on the design criteria can be found at:

https://www.mvn.usace.army.mil/About/Offices/Programs-Project-Management/Project-Review-Plans/

https://www.mvn.usace.army.mil/Portals/56/docs/PAO/Matt/Final%20IEPR%20Report.pdf

https://www.mvn.usace.army.mil/Portals/56/docs/PAO/Matt/USACE%20IEPR%20Response%20Report.pdf

Jennifer Blanchard Number 13: Broadcasting oral comments to all attendees during the public meeting is not a requirement of NEPA. A court reporter was present to take official comments on the draft report and EIS and USACE personnel were available to answer questions one-on-one following the presentation. Your comments were recorded by the court reporter. A record of all comments and responses will be included as an Appendix of the Final GRR/EIS.

Jennifer Blanchard Number 14: Yes, a relative sea level rise rate (which includes both subsidence and sea level rise estimates) of 1 ft between 2007 and 2057 was included in the floodwalls design and constructed under the supplemental appropriations.

Jennifer Blanchard Number 15: The authority in PL 109-234 did not provide authorization for future levee lifts. Maintenance is a non-Federal responsibility but, in this particular situation, did not include future levee lifts. An excerpt of the authorizing language in PL 109-234 follows:

> …to raise levee heights where necessary and otherwise enhance the existing Lake Pontchartrain and Vicinity project and the existing West Bank and Vicinity project to provide the levels of protection necessary to achieve the certification required for participation in the National Flood Insurance Program under the base flood elevations current <u>at the time of this construction</u>. (emphasis added)

Jennifer Blanchard Number 16: The work proposed in this study would be cost shared 65% Federal and 35% by the local sponsor subject to future Congressional authority and appropriations. Congress generally funds the civil works activities of USACE in annual Energy and Water Development appropriations acts.

Jennifer Blanchard Number 17: Federally-funded refers to the portion of the project that would be paid for with Federal funds as opposed to local or State funds. Congress generally funds the civil works activities of USACE in annual Energy and Water Development appropriations acts. USACE does not have specific information regarding the sources of federal or state funds; taxes are one source of revenue. See, e.g., https://datalab.usaspending.gov/americas-finance-guide/revenue/categories/ **Jennifer Blanchard Number 18:** The Notice of Intent was published in the Federal Register on April 2, 2019.

Jennifer Blanchard Number 19: Due to subsidence and other factors affecting levee heights over time, the need for future levee lifts has been known since work began in 2007; however, authorization and appropriations to begin the study were not provided until late 2018 which lead to the Notice of Intent issued April 2, 2019.

Steve Barnes Number 1: All embankment used in construction of the levees must meet geotechnical specification requirements to be considered appropriate clay material for levee construction.

Steve Barnes Number 2: USACE is experienced with constructing levees both during Hurricane season and high river flows. USACE contract requirements include provisions for sealing levees with steel rollers and taking other actions to ensure their integrity is maintained should a storm approach or the river rise during construction.

3.4.3.3 USEPA 27 JANUARY 2020

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1201 ELM STREET, SUITE 500
DALLAS, TEXAS 75270-2102

January 27, 2020

Mr. Bradley Drouant, P.E.
Project Manager
U.S. Army Corps of Engineers
New Orleans District (CEMVN-PMO-L)
7400 Leake Avenue, Room 361
New Orleans, LA 70118

Dear Mr. Drouant:

Pursuant to the National Environmental Policy Act (NEPA), Council on Environmental Quality (CEQ) regulations (40 CFR Parts 1500 – 1508), and our NEPA review authority under Section 309 of the Clean Air Act, the U.S. Environmental Protection Agency (EPA) has reviewed the Lake Pontchartrain and Vicinity General Re-evaluation Report with Integrated Environmental Impact Statement (CEQ No. 20190293).

In the Draft Environmental Impact Statement (Draft EIS), the U.S. Army Corps of Engineers evaluates the Lake Pontchartrain and Vicinity coastal storm risk management system in St. Charles, Jefferson, Orleans, and St. Bernard Parishes, Louisiana. The Draft EIS analyzes environmental impacts for the alternatives considered.

On page 52 in Appendix G Section 4 Air Quality Conformity Analysis, the Draft EIS correctly identifies sulfur dioxide (SO_2) as the pollutant of concern for St. Bernard Parish, however, Tables 3 and 6 of this section are titled "Annual VOC and NOx Emissions Totals". As appropriate, EPA recommends the title of the Tables reflect content.

We appreciate the opportunity to review the Draft EIS. We look forward to the receipt of the Final EIS. If you have any questions, please contact Kimeka Price of my staff at (214) 665-7438 or by e-mail at price.kimeka@epa.gov.

Sincerely,

Arturo J. Blanco
Director
Office of Communities, Tribes and Environmental Assessment

Corps Response: Tables updated to reflect content.

3.4.3.4 LOUISANA DEPARTMENT OF WILDLIFE AND FISHERIES

JOHN BEL EDWARDS
GOVERNOR

JACK MONTOUCET
SECRETARY

PO BOX 98000 | BATON ROUGE LA | 70898

January 23, 2020

Charles Reulet, Administrator
Louisiana Department of Natural Resources
Office of Coastal Management
P.O. Box 44487
Baton Rouge, LA 70804-4487

RE: *Application Number: ~~C20180178~~* C20190215
Applicant: U.S. Army Corps of Engineers-New Orleans District
Notice Date: December 11, 2019

Dear Mr. Reulet:

The professional staff of the Louisiana Department of Wildlife and Fisheries (LDWF) has reviewed the above referenced notice for the proposed Lake Pontchartrain and Vicinity (LPV) Levee Project and West Bank and Vicinity (WBV) Levee Project. For the LPV levee project, 27 acres of bottomland hardwood are anticipated to be impacted. For the WBV levee project, 63 acres of bottomland hardwood wetlands are anticipated to be impacted. For both levee projects, the applicant proposes to mitigate for these impacts. The following recommendations have been provided by the appropriate biologist(s):

Ecological Studies:
Scenic Rivers Program
These projects are located in the vicinity of several Louisiana designated Natural and Scenic Rivers. The applicant must obtain authorization from LDWF Scenic Rivers Program prior to initiating any of the proposed activities within or adjacent to the banks of any Scenic River. Scenic Rivers Coordinator Chris Davis can be contacted at 225-765-2642 regarding this issue. For information on the Scenic Rivers Program, you can visit our website at: http://www.wlf.louisiana.gov/scenic-rivers.

Compensatory Mitigation
LDWF concurs with the applicant's proposed plans for compensatory mitigation to offset wetland impacts associated with these projects.

Wildlife Diversity Program:
Manatee
Manatee (*Trichechus manatus*) may occur in the surrounding water bodies of the Lake Pontchartrain & Vicinity and West Bank & Vicinity project areas. Manatees are large mammals inhabiting both fresh and salt water. Although most manatees are year round residents of Florida or Central America, they have been known to migrate to areas along the Atlantic and Gulf coast during the summer months. Manatee is a threatened species protected under the Endangered Species Act of 1973 and the Federal Marine Mammal Protection Act of 1972. In Louisiana, taking or harassment of a manatee is in violation of state and federal law. Critical habitat for manatee includes marine submergent vascular vegetation (sea-grass

2000 QUAIL DRIVE | BATON ROUGE, LA 70808 | 225-765-2800 | WLF.LOUISIANA.GOV

beds). Areas with sea-grass beds should be avoided during project activities if possible. Report all manatee sightings to LDWF at 337-735-8676 or 1-800-442-2511.

Nesting Birds

Our database indicates the presence of bird nesting colonies within one mile of the Lake Pontchartrain & Vicinity and West Bank & Vicinity project areas. **Please be aware that entry into or disturbance of active breeding colonies is prohibited by LDWF. In addition, LDWF prohibits work within a certain radius of an active nesting colony.**

Nesting colonies can move from year to year and no current information is available on the status of these colonies. If work for the proposed project will commence during the nesting season, conduct a field visit to the worksite to look for evidence of nesting colonies. This field visit should take place no more than two weeks before the project begins. If no nesting colonies are found within 1000 feet (2000 feet for Brown Pelicans) of the proposed project, no further consultation with LDWF will be necessary. If active nesting colonies are found within the previously stated distances of the proposed project, further consultation with LDWF will be required. In addition, colonies should be surveyed by a qualified biologist to document species present and the extent of colonies. Provide LDWF with a survey report which is to include the following information:

1. qualifications of survey personnel;
2. survey methodology including dates, site characteristics, and size of survey area;
3. species of birds present, activity, estimates of number of nests present, and general vegetation type including digital photographs representing the site; and
4. topographic maps and ArcView shapefiles projected in UTM NAD83 Zone 15 to illustrate the location and extent of the colony.

Please mail survey reports on CD to: Wildlife Diversity Program
La. Dept. of Wildlife & Fisheries
P.O. Box 98000
Baton Rouge, LA 70898-9000

To minimize disturbance to colonial nesting birds, the following restrictions on activity should be observed:

- For colonies containing nesting wading birds (i.e., herons, egrets, night-herons, ibis, Roseate Spoonbills, Anhingas, or cormorants), all project activity occurring within 1000 feet of an active nesting colony should be restricted to the non-nesting period (i.e., September 1 through February 15).

- For colonies containing nesting gulls, terns, or Black Skimmers, all project activity occurring within 650 feet (2000 feet for Brown Pelicans) of an active nesting colony should be restricted to the non-nesting period (i.e., September 16 through April 1).

Bald Eagle

Our records indicate that the Lake Pontchartrain & Vicinity portion of the proposed project may impact nesting Bald Eagles (*Haliaeetus leucocephalus*). This species is protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c) and the Migratory Bird Treaty Act (16 U.S.C. 703-712) and is protected by the State of Louisiana. This proposed project is less than 1,000 ft. away from the Bald Eagle nest(s) of concern. All Bald Eagle nests (active, inactive or seemingly abandoned) should be protected, and no large trees should be removed. No major activities should occur within the nesting period and no large trees should be removed. No major activities should occur within the nesting period (September 1 – June 1). Please refer to the U.S. Fish and Wildlife Service Bald Eagle Management Guidelines for more information on avoiding impacts to this species including suggested buffer distances: http://www.fws.gov/southeast/es/baldeagle/ & https://www.fws.gov/southeast/our-services/eagle-technical-assistance/

Gulf Sturgeon
The Lake Pontchartrain & Vicinity portion of the proposed project may impact the gulf sturgeon (*Acipenser oxyrhynchus desotoi*) and its designated critical habitat. The gulf sturgeon is listed as threatened on both the federal and state species list. Major population limiting factors are thought to include barriers to spawning habitats and habitat loss associated with the construction of water control structures, including dams and sills. Other threats identified include modification to habitat associated with dredged material disposal and poor water quality associated with contamination.

Pallid Sturgeon
The pallid sturgeon (*Scaphirhychus albus*) may occur in water bodies near the West Bank & Vicinity project area. The pallid sturgeon is listed as endangered under the Endangered Species Act (16 U.S.C. 1531-1544) and occur in the Mississippi and Atchafalaya rivers in southern Louisiana, and the Red River. This species requires large, turbid, free-flowing riverine habitat and is adapted to living close to the bottom of large rivers with sand and gravel bars. Pallid sturgeon typically spawn from May-August, but successful reproduction has been severely reduced due to habitat modification. This includes the loss of habitat through the construction of dams that have modified flows, reduced turbidity and lowered water temperatures. We advise you to take the necessary measures to avoid the breeding season and any degradation of water quality in the Mississippi and Atchafalaya rivers. If you have any questions, please contact Keri Lejeune 337-735-8676.

Blue Sucker
Our records also indicate Blue sucker (*Cycleptus elongatus*) may occur in water bodies within the West Bank & Vicinity project area. This species is considered rare in Louisiana with an S3 state rank. Blue sucker is a fresh water fish found in channels and flowing pools with moderate currents and is occasionally found in impoundments. Cited causes of decline include depletion of surface water, poor water quality stemming from sewage effluent and agricultural runoff, interruption of migrations by dams, and stranding in irrigation canals. If you have any questions, please contact Keri Lejeune 337-735-8676.

Live Oak Forest
The database indicates that Live Oak Forest record is located within and adjacent to the West Bank & Vicinity project area. This community is considered critically imperiled in Louisiana with an S1 state rank. In southeast Louisiana, this forest type can form on ridges of stranded deltaic sediments deposited by the (formerly) constantly shifting Mississippi River. These ridges are composed primarily of sand and shell and are approximately 4 to 5 feet above sea level. This forest type is an important storm barrier, limits salt water intrusion, and acts as a critical staging and stopover site for Neotropical migratory birds. We advise you to take the necessary measures to avoid any impacts to this ecological community.

General Comment
No other impacts to rare, threatened or endangered species or critical habitats are anticipated from the proposed project. The Wildlife Diversity Program (WDP) reports summarize the existing information known at the time of the request regarding the location in question. WDP reports should not be considered final statements on the biological elements or areas being considered, nor should they be substituted for

Page 4
Application Number: C20180178
January 23, 2020

on-site surveys required for environmental assessments. If at any time WDP tracked species are encountered within the project area, please contact our biologist at 225-765-2643.

The Louisiana Department of Wildlife and Fisheries appreciates the opportunity to review and provide recommendations to you regarding this proposed activity. Please do not hesitate to contact LDWF Permits Coordinator Dave Butler at 225-763-3595 should you need further assistance.

Sincerely,

Randell S. Myers
Assistant Secretary

eb/cd/cm/bh

3.4.3.5 USACE RESPONSES

- No impacts to state-designated scenic rivers are anticipated.

- USACE will comply with notification and avoidance requirements regarding manatees, nesting birds, bald eagles, Gulf sturgeon, pallid sturgeon, blue suckers, and live oak forest as requested to the maximum extent practicable.

3.4.3.6 LOUSIANA DEPARTMENT OF NATURAL RESOURCES 24 JANUARY 2020

From: McCain, Kathryn N CIV USARMY CEMVP (USA)
To: jeff.harris (jeff.harris@la.gov)
Cc: Runyon, Kip R CIV USARMY CEMVP (USA); McCain, Kathryn N CIV USARMY CEMVP (USA)
Subject: C20190215 LPV levee lift and mitigation plan (UNCLASSIFIED)
Date: Tuesday, February 4, 2020 7:24:55 AM
Attachments: LPVMRL6 BLH WVA v1.2.pdf

Jeff,

View in rich text. Below in the blue are the responses for LPV. Attached is the preliminary WVA model spreadsheet too.

Let me know if you need anything else.

Thanks you
Kat

-----Original Message-----
From: Jeff Harris [mailto:Jeff.Harris@LA.GOV]
Sent: Friday, January 24, 2020 2:20 PM
To: Runyon, Kip R CIV USARMY CEMVP (USA) <Kip.R.Runyon@usace.army.mil>; McCain, Kathryn N CIV USARMY CEMVP (USA) <Kathryn.Mccain@usace.army.mil>
Subject: [Non-DoD Source] C20190215 LPV levee lift and mitigation plan

Kip, Kat--

I've completed an initial review of the consistency determination for the Lake Pontchartrain and Vicinity General Re-Evaluation Report, and there are a few questions and clarifications that need to be addressed.

Please provide:

- Locations and dimensions of borrow sites within and outside of Lake Pontchartrain

Specific borrow sites have not yet been identified. Section 7.1.4 of the EIS provides a generalized description of how borrow sites will be identified in the future in the vicinity of the study area.

From the draft EIS:

1.1.1 GENERALIZED BORROW AREA IMPACT ANALYSIS

Extended construction windows throughout the 50-year period of analysis would be required for implementation of the multiple levee lifts associated with the project. Borrow areas available for use now may not be available when future levee lifts are needed. Accordingly, an analysis of borrow area impacts has been conducted on a "typical" borrow pit that could be chosen for use. Anticipated impacts of excavation and use of such "typical" borrow areas for the action alternatives were evaluated using the below assumptions. The assumptions are based on extensive borrow area impact assessments performed for HSDRRS implementation. The quantities of borrow that would be needed for each lift are estimates. Specific borrow areas would be identified during pre-construction engineering and design for each segment of project construction. Borrow area acquisition requirements will continue to be evaluated during feasibility design to determine whether temporary or permanent easements are most advantageous to the Government. Additional NEPA documentation and associated public review would be conducted, as necessary, to address impacts associated with those borrow areas. Additionally, if a proposed borrow area contains upland bottomland hardwood forests or another significant resource that requires mitigation, a mitigation plan would be prepared in compliance with WRDA 1986, Section 906 (33 U.S.C. §2283). See Appendix A for construction schedule and estimated borrow quantity for each levee lift.

Table 7-4. Borrow Area Assumptions and Requirements Incorporated into Borrow Area Analysis

Resource	Assumptions and Requirements
Locations	Borrow sites would be located within one or more of the following parishes: • Orleans Parish • Plaquemines Parish • Jefferson Parish • St. Charles Parish • Lafourche Parish • St. John the Baptist Parish
Socioeconomics	Borrow sites with potential EJ impacts or potential impacts to sensitive receptors would be avoided.
Soils	Based on the estimated 8.3 million cubic yards of material needed for construction and based on an assumed 20-ft depth of borrow areas, Alternative 2 would require approximately 320.9 acres of borrow area. Based on the estimated 9.3 million cubic yards of material needed for construction, Alternative 3 would require approximately 361.5 acres of borrow area. Suitable clay material would meet the following requirements: • Soils classified as fat or lean clays are allowed • Soils with organic content greater than 9% 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% sand content Significant impacts to prime farmland soils would be anticipated given the strong correlation between suitable borrow soils and prime farmland soils.
Transportation	The same transportation corridors used during HSDRRS would be used, as described in *Transportation Report for the Construction of the 100-year Hurricane and Storm Damage Risk Reduction System* prepared in 2009 and incorporated by reference (USACE, 2009)[1].
Jurisdictional Wetlands	Suitable borrow areas that avoid jurisdictional wetland impacts would be used.
Non-Jurisdictional (i.e. upland) Bottomland	Suitable borrow areas that avoid non-jurisdictional bottomland hardwood (BLH-dry) impacts would be used.

Hardwoods	
Water Quality	Water quality impacts would be minimized through the use of Best Management Practices (BMPs).
Fisheries/Essential Fish Habitat	No impacts to fisheries or EFH would be anticipated due to the use of inland sites
Wildlife	Some permanent impacts to wildlife would be anticipated due to permanent removal of habitat.
Threatened and Endangered Species	No impacts to T&E species would be anticipated as no T&E species are present in upland areas in the target parishes.
Cultural Resources	Cultural resource surveys would be conducted on potential borrow sites; sites with cultural resources would be avoided; no impacts to cultural resources would be anticipated.
Recreational Resources	No impacts to recreational resources would be anticipated as borrow sites would likely be located on private property away from recreational areas
Aesthetics	Minor impacts to aesthetics would be anticipated due to conversion of habitat.
Air Quality	Minor impacts during construction would be anticipated, dissipating upon completion; borrow areas would avoid non-attainment areas
Noise	Minor impacts during construction would be anticipated and minimized through compliance with local noise ordinances; temporary impacts to wildlife in adjacent habitat would be anticipated during construction; avoidance of construction areas may cause carrying capacity of adjacent habitats to be temporarily exceeded.
HTRW	HTRW surveys would be conducted on potential borrow sites; sites with HTRW would be avoided; no impacts would be anticipated.

During scoping, the USFWS provided a recommended protocol for identifying borrow sources. The recommendations in descending order of priority are:

1. *Permitted commercial sources, authorized borrow sources for which environmental clearance and mitigation have been completed, or non-functional levees after newly constructed adjacent levees are providing equal protection.*
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., Chinese tallow-trees) or non-forested wetlands(e.g., wet pastures), excluding marshes;*
    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., Chinese tallow-trees) or non-forested wetlands(e.g., wet pastures), excluding marshes;*
    c. *disturbed wetlands (e.g., hydrologically altered, artificially impounded).*

Notwithstanding this protocol, the location, size, and configuration of borrow sites within the landscape is also critically important. Coastal ridges, natural levee flanks, and other geographic features that provide forested/wetland habitats and/or potential barriers to hurricane surges should not be utilized as borrow sources, especially where such uses would diminish the natural functions and values of those landscape *features*.

USACE would follow this recommended protocol to the extent practicable during borrow area selection. In addition, USACE will select borrow areas in the parishes listed in Table 7-4 that fall within the areas provided by USFWS that contain suitable soils and avoid potential mitigation (see Figure 7-2). Once borrow areas are identified, additional NEPA and environmental coordination for those sites would occur and, if necessary, a mitigation plan would be prepared to compensate for any significant resources existing on those borrow sites.

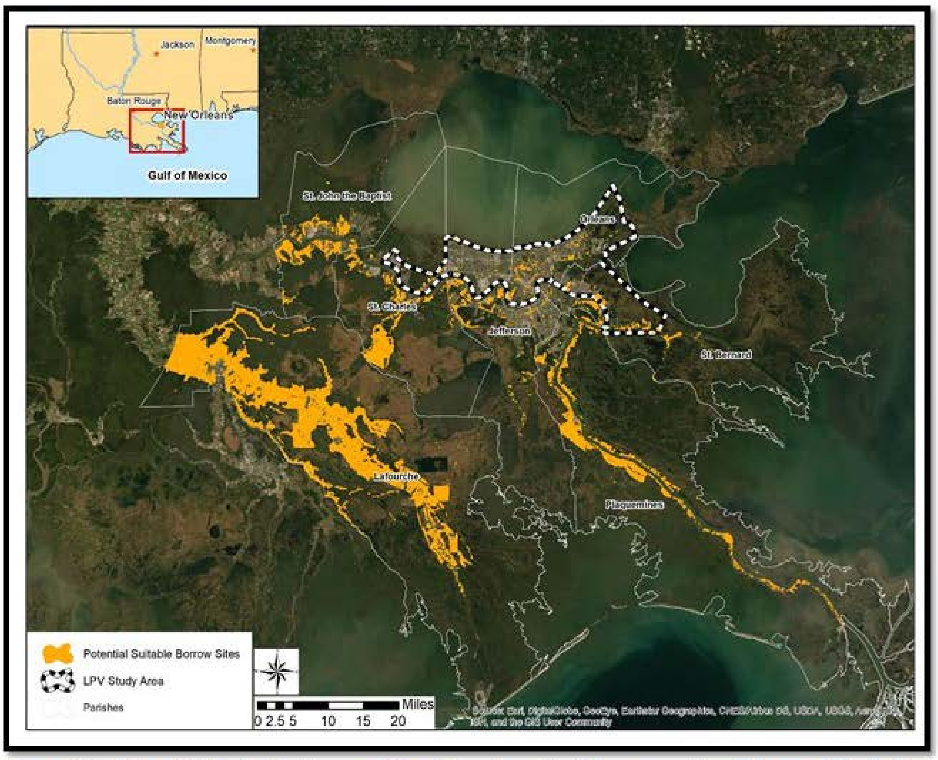


Figure 7-2. Potential Suitable Borrow Sites Based on Soil Types and Avoidance of Potential Mitigation

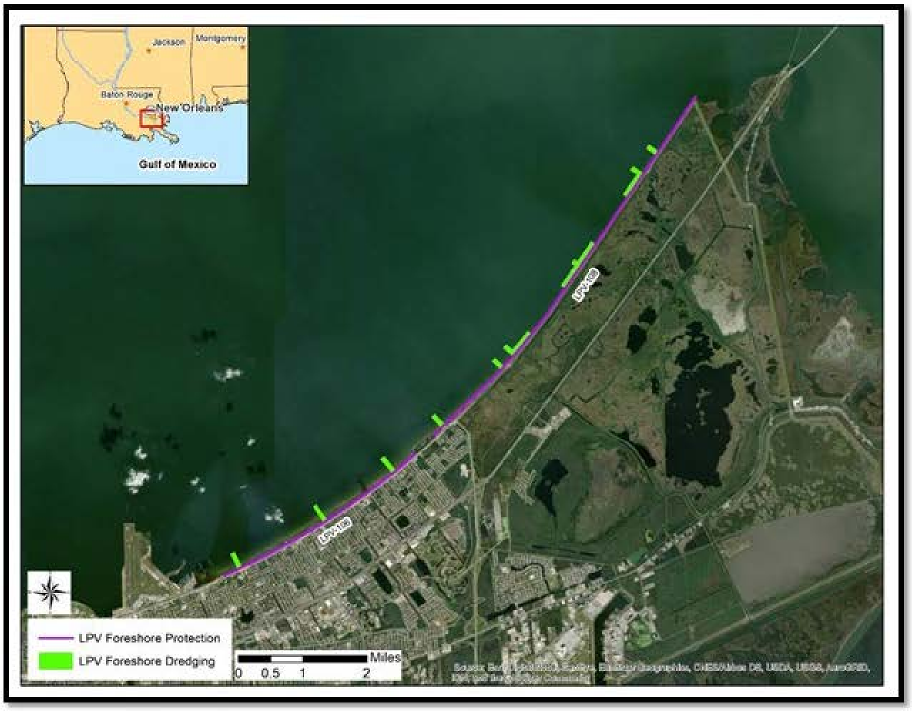
(data provided by USFWS, 2019; based on 2016 National Land Cover Database and National Resources Conservation Service (NRCS) soil surveys)

- Volume of material to be dredged

2.4 Million Cubic yards of material would be dredged in Lake Pontchartrain for construction access.

- Locations and dimensions of all access routes and staging and laydown areas

Material would be dredged from the bed of Lake Pontchartrain to provide construction access channels. Construction access channels would consist of parallel channels at the shoreline in areas where rock would be placed as well as perpendicular access channels to allow access to the shoreline channels (see Figure 2 and Figure 3). The dimensions required for barge access channels would be approximately -7 feet depth with 100-foot bottom width. Perpendicular access channels would begin at the elevation -7 ft contour of the lake and extend 400 to 1600 ft. Adjacent dredged material stockpile sites would be 150 ft wide. The total acreage of lake bottom impacted by dredging temporary construction access channels and associated temporary stockpiling would be 213 acres. A maximum of 2.4 million cubic yards of material would be dredged for construction access.



- Please clarify whether compensatory mitigation, as described in Appendix K, is or is not part of the proposed action (it is not included in the Description of the Proposed Action)
BLH-Wet mitigation is part of the proposed action.

- Please confirm that the eligibility requirements for mitigation banks will include provisions that the banks are OCM approved, and are within the same CWPPRA-defined hydrologic basin as the impacts, or an adjacent basin
Confirmed. If bank credits are purchased they will be from in-basin mitigation banks. If credits are purchased from a mitigation bank, the mitigation bank must be in compliance with the requirements of the USACE Regulatory Program and its MBI, which specifies the management, monitoring, and reporting required to be performed by the bank. The following text has been added to the mitigation appendix:
The solicitation for mitigation bank bids will include requirements that the banks are OCM-approved, and within the same or adjacent CWPPRA-defined hydrologic basin as the impacts.

Also, please review the attached comment letter from the Louisiana Department of Wildlife and Fisheries, and confirm that the Corps of Engineers will:

- Obtain authorization from the LDWF Scenic Rivers Program for any activities adjacent to any Scenic River
Concur. Shouldn't be any issues

- Comply with LDWF notification and avoidance requirements regarding Manatees, Nesting Birds, Bald Eagles, Gulf Sturgeon,

Pallid Sturgeon, Blue Suckers, and Live Oak forest

Concur.

In a broader sense, it does not appear that the plans for this project are mature enough to completely describe all of the work, and potential coastal impacts, at this time. For example, the need for future lifts is mentioned. OCM may be able to concur that the project, at this phase of development, is consistent with our coastal management program, but we'll need to arrive at some statement that additional CZM review will be obtained as the project is finalized.
Agreed. Feasibility level of design will be ongoing for the next year or so and will continue to coordinate as final feasibility designs are developed.

And last, our Mitigation staff is still reviewing the proposed mitigation. I'm hoping to get their comments by the end of next week.

Please let me know if there are any questions.

--Jeff

Jeff Harris

Consistency Section

Office of Coastal Management

Louisiana Department of Natural Resources

(225) 342-7949

PS- you will shortly be receiving an identical message regarding the review of the West Bank and Vicinity project

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[1] Available online in Appendix F at https://www.mvn.usace.army.mil/Portals/56/Users/194/42/2242/CED%20Volume%20II%20Compiled.pdf; accessed 4 December 2019

3.4.3.7 DEPARTMENT OF INTERIOR 3 FEBRUARY 2020

United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
1001 Indian School Road NW, Suite 348
Albuquerque, New Mexico 87104

ER-19/0578

February 3, 2020

Mr. Bradley Drouant, P.E.
CEMVN-PMO-L, Room 361
U.S. Army Corps of Engineers
7400 Leake Avenue
New Orleans, LA 70118

Re: Review of the Draft Integrated Feasibility Study and Draft Environmental Impact Statements (DEIS) for the Lake Pontchartrain and Vicinity General Hurricane Storm Damage and Risk Reduction Re-Evaluation Report, Louisiana

Dear Mr. Drouant:

The U.S. Department of the Interior (Department) has reviewed the DEIS by the U.S. Army Corps of Engineers for the Lake Pontchartrain and Vicinity General Re-Evaluation Report, Louisiana, and offers the comments in this letter for your consideration in preparing the final EIS. This re-evaluation addresses levee lifts to offset expected consolidation, subsidence, and sea level rise, including impacts to fish and wildlife resources and public lands.
At the current stage of planning USACE has completed preliminary studies to identify alternatives to be carried forward in the study process and has identified a tentatively selected plan.

This letter has been prepared under the authority of and in accordance with provisions of the National Environmental Policy Act (NEPA) of 1969 (42 USC 4321 et seq.), the National Historic Preservation Act of 1966, as amended (54 USC 300101 et seq.), , the Migratory Bird Treaty Act (MBTA, as amended; 16 USC 703 et seq.), the Bald and Golden Eagle Protection Act (BGEPA) (16 USC 668a-d), Fish and Wildlife Coordination Act (16 USC 661-667), and the Endangered Species Act (ESA) of 1973, as amended (16 USC 1531 et seq.), and other authorities mandating the Department's concern for environmental and historic preservation values. Comments from the National Park Service (NPS) and the U.S. Fish and Wildlife Service (FWS) are provided below.

National Park Service

The scope of the proposed action is assumed to include elevation of the I-wall on the levee within NPS lands of the Jean Lafitte National Historical Park and Preserve (Chalmette Battlefield and Chalmette National Cemetery unit). If this is not the case, then it should be stated as outside the scope of the action. If it is the case, the Battlefield and Cemetery should be acknowledged as part of the Affected Environment discussion in Section 4.11, Cultural and Historical Resources; and Section 4.13, Recreational Resources; as well as in the Environmental Effects chapter, Sections 7.11 and Section 7.13, respectively, including the potential temporal or physical impacts to visitor use or the Cemetery and Battlefield. NPS requests that USACE consult with them regarding the latter; data on visitor use for your assessment can then be provided.

U.S. Fish and Wildlife Service

Page 188, Section 7.22, Compliance with Environmental Statutes, Table 7-10. In the fourth column please remove the word "nongame" from the phrase, "Conserve and promote conservation of non-game fish and wildlife and their habitats," as the Fish and Wildlife Coordination Act applies to both game and nongame species.

Page 189, Section 7.22, Fish and Wildlife Coordination Act. FWS appreciates the USACE's incorporation of the recommendations provided in our October 9, 2019, draft Fish and Wildlife Coordination Act Report. However, in achieving compliance with the FWCA, Engineer Regulation (ER) 1105-2-100 (page G-50, section J(c)) states that each FWS recommendation should be specifically addressed and reasons should be provided for adoption or non-adoption.

Appendix K, Page 19, Mitigation Plan. For variable V5, planted trees should be not be classified as forest until they are 20 years old, rather than the 10 years stated in text; this should be changed within the main document as well.

Page 29, Table 1C, Preliminary Planting List BLH-Wet Habitat – Midstory Species. FWS recommends the removal from this table of the following species: saltbush, rough leaf dogwood, honey locust, and dwarf palmetto. Our recommendation for removal is due to factors such as site suitability, likelihood of natural regeneration, value to wildlife, and commercial availability of seedlings.

Concluding Remarks

The Department appreciates the opportunity to assist in the development of this project and to provide comments and recommendations to the DEIS. Should you have any questions about NPS comments, please contact Guy Hughes (504.589.3882 x 128), guy_hughes@nps.gov, and for FWS comments, Hannah Sprinkle (337.291.3121), hannah_sprinkle@fws.gov.

Sincerely,

Susan King
Regional Environmental Officer
Albuquerque, New Mexico
Interior Regions 6 and 7

3.4.3.8 USACE RESPONSES

- Information on the Chalmette Battlefield and Cemetery has been added as requested to Sections 4.11, 4.13, 7.11, and 7.13.
- “Non-game” has been removed from Table 7-10 as requested.
- Section 7.22 has been updated with responses to each Service recommendation as requested.
- Information on variable V5 has been updated in the mitigation plan as requested.
- Table 1C in the mitigation plan has been updated as requested.

3.4.3.9 SE LOUISIANA FLOOD PROTECTION AUTHORITY 6 FEBRUARY 2020

Brad
On behalf of the Southeast Louisiana Flood Protection Authority -East, please see below (same comments are attached in a word document) the SLFPAE official comments on the draft LPV GRR. Note I have sent them to you directly as well as the official LVPGRR USACE email. Please let me know if you have any questions, or if there are any other actions I need to take for our official comments to be submitted.

Thank you,

Derek

The Southeast Louisiana Flood Protection Authority – East (FPA) is responsible for the Operations and Maintenance of the Lake Ponchartrain & Vicinity (LPV) project and the Mississippi River Levee (MRL) project in East Jefferson, Orleans and St. Bernard Parishes. Together these systems protect over 570,000 people and over $79 Billion of infrastructure from hurricane and riverine flooding.

The FPA appreciates the Corps of Engineers' efforts to study flood protection in the greater New Orleans area, and provide a plan for long-term risk reduction. As the local sponsor likely to be required to pay the sponsor share of future work, the FPA has the following comments:

- The FPA's locally preferred plan is Alternative 3: System Levee Lifts at 2073 That Maximizes Benefits.
- Alternative 3 indicates significantly positive net economic benefit at only slightly greater cost than Alternative 2, along with similarly positive safety risk levels.
- The Total Project First Cost for Alternative 3 is only 9.6% greater than Alternative 2 for a 200 - year level of risk reduction compared to 100 Year Level for Alternative 2.
- We note that there exists some level of uncertainty in predicted rates of sea level rise, subsidence and settlement and that the evaluation incorporated the Intermediate Value of Average Relative Sea Level Rise of 1.8 feet. Greater rates may be realized which could make levee and floodwall design elevations in Alternative 2 at risk of being deficient for the 100 - year risk reduction level which is the minimum required to maintain FEMA Accreditation. Alternative 3 reduces the consequences of underestimated relative sea level rise and greater assurance of not falling below a 100-year level of risk reduction.
- We also note that the damages reduced (benefits) are similar for both Alternative 2 and 3 with the reduction only $4M greater for Alternative 3. Considering the floodwall heights for Alternative 3 would be up to 3 feet higher than Alternative 2 the increase in benefit for Alternative 3 appears understated.
- We believe the Corps should further evaluate the benefits provided by Alternative 3.
- We note that the General Footprint is the same for both Alternative 2 and 3 with the primary difference between Alternative 2 and 3 being the height of the levees and floodwalls to be lifted and the amount of co-located levee to be added to the project.
- If Alternative 3 is not the final recommended plan, then the FPA supports Alternative 2.

The Southeast Louisiana Flood Protection Authority - East commends the USACE on this study and supports the findings of the Draft Re-Evaluation Report, subject to our comments and preference for Alternative 3.

Derek E. Boese
Chief Administrative Officer
Southeast Louisiana Flood Protection Authority – East

Email: dboese@floodauthority.org
Office: 504-286-3100
Please be advised any information provided to the Southeast Louisiana Flood Protection Authority-East, or its member districts (Orleans Levee District, East Jefferson Levee District and Lake Borgne Basin Levee District) may be subject to disclosure under the Louisiana Public Records Law. Information contained in any correspondence, regardless of its source, may be a public record subject to public inspection and reproduction in accordance with the Louisiana Public Records Law, La. Rev. Stat. 44:1 et seq. If you have received this electronic mail transmission in error, please delete it from your system without copying it, and notify the sender by reply e-mail, so that our address record can be corrected.

Derek,

Thanks, nothing more you need to do to have it in the record. Are ya'll coordinating with CPRA on the topic of LPP? As the sponsor the request has to come through them to be official, though the attached will be recorded in the report's public comments.

Bradley Drouant, P.E.
Senior Project Manager
CEMVN-PMO-L
New Orleans District

3.4.3.10 EXECUTIVE DIRECTOR OF PONTCHARTRAIN LEVEE DISTRICT 6 FEBRUARY 2020

-----Original Message-----
From: Monica Salins Gorman [mailto:mgorman@leveedistrict.org]
Sent: Thursday, February 6, 2020 4:49 PM
To: Drouant, Bradley W CIV USARMY CEMVN (USA) <Bradley.W.Drouant@usace.army.mil>
Subject: [Non-DoD Source] RE: Lake Pontchartrain and Vicinity Draft Report Available

PLD would prefer Alternative 3.

Monica Salins Gorman, Executive Director Pontchartrain Levee District~ Comprised of 6 East Bank Parishes Mailing Address~ P.O. Box 426~Lutcher~ LA~70071 Office 225-869-9721~Fax 225-869-9723~Direct line 225-258-4369

Please be advised any information provided to the Pontchartrain Levee District may be subject to disclosure under the Louisiana Public Records Law. Information contained in any correspondence, regardless of its source, may be a public record subject to public inspection and reproduction in accordance with the Louisiana Public Records Law, La. Rev. Stat. 44:1 et seq. If you have received this electronic mail transmission in error, please delete it from your system without copying it, and notify the sender by reply e-mail, so that our address record can be corrected.

-----Original Message-----
From: Drouant, Bradley W CIV USARMY CEMVN (USA) <Bradley.W.Drouant@usace.army.mil>
Sent: Monday, December 09, 2019 1:53 PM
To: Monica Salins Gorman <mgorman@leveedistrict.org>
Subject: FW: Lake Pontchartrain and Vicinity Draft Report Available

Monica,

You should have gotten this email already, but I wanted to make sure you saw that the draft report for future levee lifts is out.

Bradley Drouant, P.E.
Senior Project Manager
CEMVN-PMO-L
New Orleans District
504-862-1516

3.4.3.11 CHOCTAW NATION 31 JANUARY 2020

[Non-DoD Source] RE: Lake Pontchartrain and Vicinity General Re-Evaluation Report and Integrated Draft EIS (LPV GRR-DEIS)

LB Lindsey Bilyeu <lbilyeu@choctawnation.com>
Fri 1/31, 10:09 AM
LPV GRR

Reply all

Good Morning,

The Choctaw Nation of Oklahoma thanks the USACE, New Orleans District, for the correspondence regarding the above referenced project. This project lies in our area of historic interest. The Choctaw Nation Historic Preservation Department has no comments regarding the document at this time. However, we request to be consulted under the Section 106 process.

If you have any questions, please contact me.

Thank you,
Lindsey D. Bilyeu, MS
Senior Compliance Review Officer
Historic Preservation Department
Choctaw Nation of Oklahoma
P.O. Box 1210
Durant, OK 74702
580-924-8280 ext. 2631

Choctaw Nation
Faith•Family•Culture

3.4.3.12 GENERAL PUBLIC

22 January 2020

[Non-DoD Source] Integrated General Re-evaluation Report and Environmental Impact Statement (DGRR-EIS)

LG LPV GRR
Thomas, Thank you for your request and I will get you added to our distribution list. Today, 1:52 PM

TT Thomas Thompson [redacted]
Today, 12:18 PM
LPV GRR

Reply all

Request that I be added to the mailing list for the Integrated General Re-evaluation Report and Environmental Impact Statement (DGRR-EIS) for the Lake Pontchartrain and Vicinity Coastal Storm Risk Management Project.

Thank You,

Thomas Nolan Thompson
[redacted]

22 January 2020, 11:18 AM
LPV GRR
It was not immediately obvious to me that the ACE was accounting for climate change (more storms) and projected relative sea level rise during the NEXT 50 years or simply catching up on the problem of sinking levees since the improvements implemented post Katrina. Could you please clarify how you have accounted for the changing climate in your projections and plans.

Thank you,

Julie S. Denslow
Adjunct Professor
Department of Ecology and Evolutionary Biology
Tulane University

RESPONSE:
Ms. Denslow,

Thank you for your comment. It has been documented. Please see Appendix C, Hydraulics for information on the 152 simulated synthetic storm scenarios used and RLSR for forecasting to year 2073.

thank you

Good evening. My name is Herbert Miller and I am the President of the Board of Commissioners of the Southeast Louisiana Flood Protection Authority-East. The FPA has responsibility for operating and maintaining the levees and flood control structures on the East Bank of Jefferson and Orleans Parishes and the Lake Borne Basin Levee District.

First, let me thank the Corps of Engineers for their work to date on this master plan for flood protection covering the next 50 years. I and senior staff members of the Authority met with Colonel Murphy and his key staff at the Corps a few weeks ago to discuss this report, and the meeting was very successful. We requested a few additional pieces of information be included in the final version, all of which were minor, yet we felt would add to a more complete report. The Corps was receptive to our comments.

We are pleased that the Corps is taking a hard look at the two most promising alternatives, the 1 percent and 0.5 percent alternatives, commonly referred to as the 100 and 200-year levels of protection. We noted that the benefit: cost ratios of these two alternatives were quite close. While the preliminary analysis indicated that the 100-year alternative had a slightly higher benefit: cost ratio, we understand that the Corps is doing a more detailed analysis than initially performed of both costs and benefits to determine if the 200-year level of protection may actually have a greater benefit: cost ratio upon a more detailed analysis, and thus become the recommended plan.

I have been on the Board of Commissioners now for about 3.5 years. During that time, I have been impressed by the close working relationship established between our agency and Corps. Whenever we have an issue that involves both agencies, it is always handled amicably and professionally by both parties. It is a pleasure working with the Corps staff. We are looking forward to the final report.

Thank you.

4 PROJECT DELIVERY TEAM MEETINGS

The Project Delivery Team (PDT) consists of USACE team members and team members from the non-federal sponsor (CPRA) and federal cooperating agencies (U.S. Fish and Wildlife Service and National Marine Fisheries Service). Below is a list of key PDT meetings . The PDT met weekly. Only key meetings are summarized below. Full meeting minutes are documented in the project file and available upon request.

Date	Summary
10-14 September 2018	Initial PDT Kick-Off Meeting, Rapid Iteration #1, Site Visits
20 September 2018	Environmental PDT CEMVS & CEMVN: Call to discuss GRR NEPA documentation considerations moving forward
4 October 2018	Environmental, Tribal & OC PDT CEMVS & CEMVN: Call to discuss cooperating agency and coordinating with agency partners.
5-8 November 2018	Rapid Iteration #2, Site Visits
14 February 2019	Alternatives Milestone Meeting: MSC Planning and Policy Chief affirmed the PDT's preliminary analysis of the Federal Interest, and problems, opportunities, objectives, constraints, existing and future without project conditions, status of environmental compliance and initial array of alternatives for evaluation.
30 April 2019	PDT meeting to discuss plan formulation and screen measures
3 October 2019	Environmental and USFWS – Initial Wetland Value Assessment Discussion; Discussion with CEMVN Environmental on Mitigation Planning
9 October 2019	Tentatively Selected Plan Milestone Meeting: MSC Planning and Policy Chief affirmed the PDT's recommendation of the TSP
10 December 2019	Agency Technical Review Kick-off Meeting: District team and technical review team met to discuss the charge for reviewers and answer any questions.
11 December 2019	Independent External Peer Review (IEPR) Kick-off Meeting: District team and the IEPR team met to discuss the charge to reviewers and answer any questions.

5 DISTRIBUTION LIST

5.1 DRAFT REPORT PUBLIC REVIEW DISTRIBUTION LIST 9 DECEMBER 2019

The District sent emails to elected officials, state and Federal agencies, interested citizens and parties announcing the project report's availability. The District sent out a press release to the New Orleans and regional media before the public review period and public meetings. Additionally, information about the public review and meetings was posted on the District's Facebook and Twitter accounts. 178 letters were sent to interested parties who have requested to be in the CEMVN District stakeholder and NEPA mailing lists notifying them where to download the draft report and information on the public meetings. This mailing list is maintained as a database and contains personal information, and therefore not provided here.

U.S. Elected Officials

Senator John Kennedy	U.S. Senator
Senator "Bill" Cassidy	U.S. Senator
Steve Scalise	U. S. Representative - 1st Congressional District
Cedric Richmond	U. S. Representative – 2nd Congressional District
Clay Higgins	U. S. Representative – 3rd Congressional District
"Mike" Johnson	U. S. Representative – 4th Congressional District
Ralph Abraham	U. S. Representative – 5th Congressional District
Garret Graves	U. S. Representative – 6th Congressional District

State Elected Officials

Senator Sharon Hewitt	Dist 1
Senator Jean-Paul J. Morrell	Dist 3
Senator Wesley Bishop	Dist 4
Senator Karen Carter Peterson	Dist 5
Senator Mack White, Jr.	Dist 6
Senator Troy Carter	Dist 7
Senator John A. Alario, Jr.	Dist 8
Senator Conrad Appel	Dist 9
Senator Daniel “Danny” Martiny	Dist 10
Senator Jack Donahue, Jr.	Dist 11
Senator Gary Smith	Dist 19
Rep Jerry Gisclair	Dist 54
Rep Gregory A Miller	Dist 56
Rep Kirk Talbot	Dist 78
Rep Julie Stokes	Dist 79
Rep Polly Thomas	Dist 80
Rep J. Cameron Henry, Jr.	Dist 82
Rep Robert E Billiot	Dist 83
Rep Patrick Connick	Dist 84
Rep Joseph Marino III	Dist 85
Rep Rodney Lyons	Dist 87
Rep Reid Falconer	Dist 89
Rep Walt Leger, III	Dist 91
Rep Joseph Stagni	Dist 92
Rep Royce Duplessis	Dist 93

Rep Stephanie Hilferty	Dist 94
Rep Terry Landry	Dist 96
Rep Joseph Bouie	Dist 97
Rep Neil Abramson	Dist 98
Rep Jimmy Harris	Dist 99
Rep John Bagneris	Dist 100
Rep Gary Carter	Dist 102
Rep Raymond Garofalo	Dist 103
Rep Paul Hollis	Dist 104
Rep Christopher Leopold	Dist 105

Local Elected Officials

Mayor, City of Kenner
Mayor, City of Jean Lafitte
Mayor, City of Westwego
Mayor, City of New Orleans
Mayor, City of Harahan
Mayor, Town of Grand Isle

Mayor, City of Gretna

President and Council, St. Bernard Parish
President and Council, Orleans Parish
President and Council, Jefferson Parish
President and Council, St. Charles Parish

Federal Agencies

Joe Ranson	US Fish and Wildlife Service
David Walther	US Fish and Wildlife Service
Hannah Sprinkle	US Fish and Wildlife Service
Cathy Breaux	U.S. Fish and Wildlife Service
John Boatman	Natural Resources Conservation Service
Kevin Norton	Natural Resources Conservation Service
David Bernhardt	NOAA – National Marine Fisheries Service
Patrick Williams	NOAA – National Marine Fisheries Service
Craig Gothreaux	NOAA - National Marine Fisheries Service
Noah Silverman	NOAA - National Marine Fisheries Service
Kelly Shotts	NOAA - National Marine Fisheries Service
Joe Heublein	NOAA – National Marine Fisheries Service
Raul Gutierrez	U.S. Environmental Protection Agency Reg 6
Robert Houston	U.S. Environmental Protection Agency Reg 6
Guy Hughes	National Park Service
Jami Hammond	National Park Service
Kelly Altenhofen	National Park Service
Tomma Barnes	US Geological Survey
Ann Hijuelos	US Geological Survey
Michelle Meyers	US Geological Survey
Gary Zimmerer	FEMA, Region VI

State Agencies

Jack Montoucet	Louisiana Department of Wildlife and Fisheries
Dave Butler	Louisiana Department of Wildlife and Fisheries
Barry Hebert	Louisiana Department of Wildlife and Fisheries
Elizabeth Barron	Louisiana Department of Wildlife and Fisheries
Mathew Weigel	Louisiana Department of Wildlife and Fisheries
Kyle Balkum	Louisiana Department of Wildlife and Fisheries

Charles Reulet	Louisiana Department of Natural Resources
Jeff Harris	Louisiana Department of Natural Resources
Mark Hogan	Louisiana Department of Natural Resources
Sara Krupa	Louisiana Department of Natural Resources
Hannah Pitts	Louisiana Department of Natural Resources
Bren Haase	Louisiana Department of Natural Resources
James Bondy	Louisiana Department of Natural Resources
Don Haydel	Louisiana Department of natural Resources
Kyle R "Chip" Kline, Jr.	Coastal Protection and Restoration Authority
Michael Ellison	Coastal Protection and Restoration Authority
Alexis Rixner	Coastal Protection and Restoration Authority
Wes Leblanc	Coastal Protection and Restoration Authority
Justin Merrifield	Coastal Protection and Restoration Authority
Jonathan Bridgeman	Coastal Protection and Restoration Authority
James Waskom	Governor's Office of Homeland Security and Emergency Preparedness
Casey Tingle	Governor's Office of Homeland Security and Emergency Preparedness
Scott Guilliams	Louisiana Department of Environmental Quality – Water Permit Division
Diane Hewitt	Louisiana Department of Environmental Quality
Mr. Kristin P. Sanders	Louisiana State Historic Preservation Officer Office of Cultural Development

Interested Parties

The Nature Conservancy of Louisiana
Avoyelles Parish Library
Jefferson Parish Library
River Parishes Guide
Times Picayune
Evans and Associates
Stantec
Ford Construction Company
Ducks Unlimited
Luhr Bros Inc
Alberici
Massaman Construction Company
Kansas City Southern Railway Company
St. Charles Grain Elevator
Circle, Inc.
Crescent River Port Pilots Association
Plaq Port Harbor and Terminal District
Plaquemines Newspaper
Entergy
Crucial, Inc.
Union Carbide/Dow Chemical
Kenner Star
C&M Contractors, Inc
West Jefferson Levee District
Lafourche Basin Levee District
Lake Borne Basin Levee District
Grand Isle Independent Levee District
Orleans Levee District
Associated Press
Bonnet Carre' Rod and Gun Club
WDSU-TV
WNOE-AM-FM
WQUE-FM
WWL-TV, Channel 4
WVUE-TV
WWOZ
WCKW-AM
Port of New Orleans
Pontchartrain Material Corp
J H Menge & Co.
AUX LLC
Berry Brothers Gen Contractors Inc
Grand Isle Shipyard Inc
Plaisance Dragline & Dredging Co Inc
South Central Planning & Development
Lafourche Telephone Co Inc
Diamon Services Corporation
Journal of Commerce
WHC Inc
CF Bean Corporation
CI Jack Stelly & Associates Inc
White Castle Times

Port of Greater Baton Rouge
CB&I
Hydro Consultants Inc
Nicholls State University
Port Aggregates, Inc
Louisiana State University
State-Times/Morning Advocate
State Library of Louisiana
DHH-OPH
Terracon
The Waterways Journal
SOL Engineering, LLC
Louisiana Audubon Council
Tulane University Library
Coalition to Restore
Earl K. Long Library
Gulf Restoration Network
Coalition of Coastal Parishes

Tribal Distribution List

Alabama-Coushatta Tribe of Texas
Caddo Nation
Chitimacha Tribe of Louisiana
Choctaw Nation of Oklahoma
Coushatta Tribe of Louisiana
Jena Band of Choctaw Indians
Mississippi Band of Choctaw Indians
Muscogee (Creek) Nation
Seminole Nation of Oklahoma
Seminole Tribe of Florida
Tunica-Biloxi Tribe of Louisiana

5.2 DRAFT REPORT PUBLIC REVIEW LETTER 9 DECEMBER 2019 – Sent to Distribution List provided in Section 5.1 above

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
7400 LEAKE AVENUE
NEW ORLEANS, LOUISIANA 70118

REPLY TO
ATTENTION OF

December 9, 2019

Regional Planning and Environment
Division South

Dear Sir or Madam:

The U.S. Army Corps of Engineers, New Orleans District, has prepared a draft report entitled "Lake Pontchartrain and Vicinity General Re-Evaluation Report with Integrated Draft Environmental Impact Statement (LPV GRR-DEIS)." You are receiving this letter because you may be interested in this project. The draft report and appendices are available online for your review and comment at the below website:

https://www.mvn.usace.army.mil/About/Projects/BBA-2018/studies/LPV-GRR/

This GRR-DEIS will reevaluate the performance of the LPV system given the combined effects of consolidation, settlement, subsidence, sea level rise, and new datum over time, and determine if additional actions are recommended to address the economic and life safety risks associated with flooding due to hurricanes and coastal storms.

The U.S. Army Corps of Engineers is using this DEIS to initiate consultation for Section 106 of the National Historic Preservation Act (NHPA), with the State Historic Preservation Officer (SHPO) and with Federally-recognized Tribes. No determination of effect under the NHPA is being made at this time. Consultation will follow the standard Section 106 process. The determination of effect and any conditions will be documented in the Final Record of Decision (ROD) before it is signed.

Please review the documents at the link above and provide comments by February 7, 2020. A public open house will be held the week of January 20th and details will be posted on the New Orleans District website: https://www.mvn.usace.army.mil/Media/Public-Meetings/

Interested parties may express their views on the proposed action. All comments postmarked on or before the expiration of the comment period will be considered and addressed as appropriate in the final report.

Comments should be mailed to the attention of Mr. Bradley Drouant; U.S. Army Corps of Engineers; New District; CEMVN-PMO-L; Room 361; 7400 Leake Avenue, New Orleans, Louisiana 70118. Comments may also be provided by email to CEMVN-LPVGRR@usace.army.mil. Mr. Drouant may be contacted at (504) 862-1516 if questions arise.

HARPER.MARSHALL.KEVIN.1536114358 Digitally signed by HARPER.MARSHALL.KEVIN.1536114358 Date: 2019.12.04 12:32:48 -06'00'

Marshall K. Harper
Chief, Environmental Planning Branch
Regional Planning and Environment
Division South

5.3 DRAFT REPORT TRIBAL/SHPO REVIEW LETTERS

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
7400 LEAKE AVENUE
NEW ORLEANS, LOUISIANA 70118

REPLY TO
ATTENTION OF

December 9, 2019

Regional Planning and
Environment Division South

Cecilia Flores, Tribal Council Chairperson
Alabama-Coushatta Tribe of Texas
571 State Park Rd 56
Livingston, TX 77351

The U.S. Army Corps of Engineers, New Orleans District, has prepared a draft report entitled "Lake Pontchartrain and Vicinity General Re-Evaluation Report with Integrated Draft Environmental Impact Statement (LPV GRR-DEIS)." This GRR-DEIS reevaluates the performance of the LPV system given the combined effects of consolidation, settlement, subsidence, sea level rise, and new datum over time, and determine if additional actions are recommended to address the economic and life safety risks associated with flooding due to hurricanes and coastal storms.

The draft report and appendices are available online for your review and comment at the below website:

https://www.mvn.usace.army.mil/About/Projects/BBA-2018/studies/LPV-GRR/

The USACE is initiating consultation for Section 106 of the National Historic Preservation Act (NHPA), with the State Historic Preservation Officer (SHPO) and with Federally-recognized Tribes with this letter for the referenced project. No determination of effect under the NHPA is being made at this time. Consultation will follow the standard Section 106 process.

NHPA consultation will address the Area of Potential Effects for portions of the project that are outside of the undertakings previously reviewed under Individual Environmental Reviews (IER) and Comprehensive Environmental Documents available at (https://www.mvn.usace.army.mil/Missions/Environmental/NEPA-Compliance-Documents/HSDRRS-Projects/). The LPV study includes the actions described in IERs #1, #2, #3, #4, #5, #6, #7, #8, #9, #10, #11, and #27. The Section 106 consultation will provide the results of any Phase I Cultural Resources Survey (if necessary), and USACE's determination of effect to historic properties. This will provide an opportunity to for consulting parties to review NHPA specific documentation, per 36 CFR 800.11. The determination of effect and any conditions will be documented in the Final Record of Decision (ROD) before it is signed.

For purposes of understanding the undertaking, please review the documents at the link above. Should your tribe or agency want to provide comments upon the NEPA document, please provide comments by February 7, 2020. All comments postmarked on or before the expiration of the comment period will be considered and addressed as appropriate in the final report. A public open house will be held the week of January 20th and details will be posted on the New Orleans District website: https://www.mvn.usace.army.mil/Media/Public-Meetings/

Comments should be mailed to the attention of Mr. Bradley Drouant; U.S. Army Corps of Engineers; New District; CEMVN-PMO-L; Room 361; 7400 Leake Avenue, New Orleans, Louisiana 70118. Comments may also be provided by email to CEMVN-LPVGRR@usace.army.mil. Mr. Drouant may be contacted at (504) 862-1516 if questions arise.

HARPER.MARSHALL.KEVIN.1536114358
Digitally signed by HARPER.MARSHALL.KEVIN.1536114358
Date: 2019.12.05 15:56:24 -06'00'

Marshall K. Harper
Chief, Environmental Planning Branch

CC: An electronic copy of this letter with enclosures will be provided to Mr. Bryant J. Celestine, Historic Preservation Officer, Alabama Coushatta Tribe of Texas, celestine.bryant@actribe.org.

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
7400 LEAKE AVENUE
NEW ORLEANS, LOUISIANA 70118

REPLY TO
ATTENTION OF

December 9, 2019

Regional Planning and
Environment Division South

Tamara Francis-Fourkiller, Chairman
Caddo Nation of Oklahoma
117 Memorial Lane
P.O. Box 487
Binger, OK 73009

The U.S. Army Corps of Engineers, New Orleans District, has prepared a draft report entitled "Lake Pontchartrain and Vicinity General Re-Evaluation Report with Integrated Draft Environmental Impact Statement (LPV GRR-DEIS)." This GRR-DEIS reevaluates the performance of the LPV system given the combined effects of consolidation, settlement, subsidence, sea level rise, and new datum over time, and determine if additional actions are recommended to address the economic and life safety risks associated with flooding due to hurricanes and coastal storms.

The draft report and appendices are available online for your review and comment at the below website:

https://www.mvn.usace.army.mil/About/Projects/BBA-2018/studies/LPV-GRR/

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Comments should be mailed to the attention of Mr. Bradley Drouant; U.S. Army Corps of Engineers; New District; CEMVN-PMO-L; Room 361; 7400 Leake Avenue, New Orleans, Louisiana 70118. Comments may also be provided by email to CEMVN-LPVGRR@usace.army.mil. Mr. Drouant may be contacted at (504) 862-1516 if questions arise.

HARPER.MARSHALL.KEVIN.1536114358
Digitally signed by HARPER.MARSHALL.KEVIN.1536114358
Date: 2019.12.05 15:57:01 -06'00'

Marshall K. Harper
Chief, Environmental Planning Branch

CC: An electronic copy of this letter will be provided to Mr. Derrick Hill, THPO, Caddo Nation of Oklahoma, dhill@caddo.xyz

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
7400 LEAKE AVENUE
NEW ORLEANS, LOUISIANA 70118

REPLY TO
ATTENTION OF

December 9, 2019

Regional Planning and
Environment Division South

Gary Batton, Chief
Choctaw Nation of Oklahoma
Attn: Choctaw Nation Historic Preservation Department
P.O. Box 1210
Durant, OK 74702-1210

The U.S. Army Corps of Engineers, New Orleans District, has prepared a draft report entitled "Lake Pontchartrain and Vicinity General Re-Evaluation Report with Integrated Draft Environmental Impact Statement (LPV GRR-DEIS)." This GRR-DEIS reevaluates the performance of the LPV system given the combined effects of consolidation, settlement, subsidence, sea level rise, and new datum over time, and determine if additional actions are recommended to address the economic and life safety risks associated with flooding due to hurricanes and coastal storms.

The draft report and appendices are available online for your review and comment at the below website:

https://www.mvn.usace.army.mil/About/Projects/BBA-2018/studies/LPV-GRR/

The USACE is initiating consultation for Section 106 of the National Historic Preservation Act (NHPA), with the State Historic Preservation Officer (SHPO) and with Federally-recognized Tribes with this letter for the referenced project. No determination of effect under the NHPA is being made at this time. Consultation will follow the standard Section 106 process.

NHPA consultation will address the Area of Potential Effects for portions of the project that are outside of the undertakings previously reviewed under Individual Environmental Reviews (IER) and Comprehensive Environmental Documents available at (https://www.mvn.usace.army.mil/Missions/Environmental/NEPA-Compliance-Documents/HSDRRS-Projects/). The LPV study includes the actions described in IERs #1, #2, #3, #4, #5, #6, #7, #8, #9, #10, #11, and #27. The Section 106 consultation will provide the results of any Phase I Cultural Resources Survey (if necessary), and USACE's determination of effect to historic properties. This will provide an opportunity to for consulting parties to review NHPA specific documentation, per 36 CFR 800.11. The determination of effect and any conditions will be documented in the Final Record of Decision (ROD) before it is signed.

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HARPER.MARSHALL.KEVIN.1536114358
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Date: 2019.12.05 15:57:40 -06'00'

Marshall K. Harper
Chief, Environmental Planning Branch

CC: An electronic copy of this letter with enclosures will be provided to Dr. Ian Thompson, Director/Tribal Historic Preservation Officer, Choctaw Nation of Oklahoma, ithompson@choctawnation.com and Ms. Lindsey Bilyeu, NHPA Section 106 Reviewer, Choctaw Nation of Oklahoma, lbilyeu@choctawnation.com.

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
7400 LEAKE AVENUE
NEW ORLEANS, LOUISIANA 70118

REPLY TO
ATTENTION OF

December 9, 2019

Regional Planning and
Environment Division South

David Sickey, Chairman
Coushatta Tribe of Louisiana
P.O. Box 818
Elton, LA 70532

The U.S. Army Corps of Engineers, New Orleans District, has prepared a draft report entitled “Lake Pontchartrain and Vicinity General Re-Evaluation Report with Integrated Draft Environmental Impact Statement (LPV GRR-DEIS).” This GRR-DEIS reevaluates the performance of the LPV system given the combined effects of consolidation, settlement, subsidence, sea level rise, and new datum over time, and determine if additional actions are recommended to address the economic and life safety risks associated with flooding due to hurricanes and coastal storms.

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https://www.mvn.usace.army.mil/About/Projects/BBA-2018/studies/LPV-GRR/

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Comments should be mailed to the attention of Mr. Bradley Drouant; U.S. Army Corps of Engineers; New District; CEMVN-PMO-L; Room 361; 7400 Leake Avenue, New Orleans, Louisiana 70118. Comments may also be provided by email to CEMVN-LPVGRR@usace.army.mil. Mr. Drouant may be contacted at (504) 862-1516 if questions arise.

HARPER.MARSHALL.KEVIN.1536114358 Digitally signed by HARPER.MARSHALL.KEVIN.1536114358 Date: 2019.12.05 15:58:18 -06'00'

Marshall K. Harper
Chief, Environmental Planning Branch

CC: An electronic copy of this letter with enclosures will be provided to Dr. Linda Langley, Tribal Historic Preservation Officer, Coushatta Tribe of Louisiana, llangley@coushattatribela.org.

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
7400 LEAKE AVENUE
NEW ORLEANS, LOUISIANA 70118

REPLY TO
ATTENTION OF

December 9, 2019

Regional Planning and
Environment Division South

Melissa Darden, Chairman
Chitimacha Tribe of Louisiana
P.O. Box 661
Charenton, LA 70523

The U.S. Army Corps of Engineers, New Orleans District, has prepared a draft report entitled "Lake Pontchartrain and Vicinity General Re-Evaluation Report with Integrated Draft Environmental Impact Statement (LPV GRR-DEIS)." This GRR-DEIS reevaluates the performance of the LPV system given the combined effects of consolidation, settlement, subsidence, sea level rise, and new datum over time, and determine if additional actions are recommended to address the economic and life safety risks associated with flooding due to hurricanes and coastal storms.

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https://www.mvn.usace.army.mil/About/Projects/BBA-2018/studies/LPV-GRR/

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HARPER.MARSHALL.KEVIN.1536114358 Digitally signed by HARPER.MARSHALL.KEVIN.1536114358 Date: 2019.12.05 15:59:03 -06'00'

Marshall K. Harper
Chief, Environmental Planning Branch

CC: An electronic copy of this letter with enclosures will be provided to Mrs. Kimberly Walden, M. Ed., Cultural Director/Tribal Historic Preservation Officer, Chitimacha Tribe of Louisiana, kim@chitimacha.gov.

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
7400 LEAKE AVENUE
NEW ORLEANS, LOUISIANA 70118

REPLY TO
ATTENTION OF

December 9, 2019

Regional Planning and
Environment Division South

B. Cheryl Smith, Principal Chief
Jena Band of Choctaw Indians
P.O. Box 14
Jena, LA 71342

The U.S. Army Corps of Engineers, New Orleans District, has prepared a draft report entitled "Lake Pontchartrain and Vicinity General Re-Evaluation Report with Integrated Draft Environmental Impact Statement (LPV GRR-DEIS)." This GRR-DEIS reevaluates the performance of the LPV system given the combined effects of consolidation, settlement, subsidence, sea level rise, and new datum over time, and determine if additional actions are recommended to address the economic and life safety risks associated with flooding due to hurricanes and coastal storms.

The draft report and appendices are available online for your review and comment at the below website:

https://www.mvn.usace.army.mil/About/Projects/BBA-2018/studies/LPV-GRR/

The USACE is initiating consultation for Section 106 of the National Historic Preservation Act (NHPA), with the State Historic Preservation Officer (SHPO) and with Federally-recognized Tribes with this letter for the referenced project. No determination of effect under the NHPA is being made at this time. Consultation will follow the standard Section 106 process.

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Comments should be mailed to the attention of Mr. Bradley Drouant; U.S. Army Corps of Engineers; New District; CEMVN-PMO-L; Room 361; 7400 Leake Avenue, New Orleans, Louisiana 70118. Comments may also be provided by email to CEMVN-LPVGRR@usace.army.mil. Mr. Drouant may be contacted at (504) 862-1516 if questions arise.

HARPER.MARSHALL.KEVIN.1536114358 Digitally signed by HARPER.MARSHALL.KEVIN.1536114358 Date: 2019.12.05 16:01:38 -06'00'

Marshall K. Harper
Chief, Environmental Planning Branch

CC: An electronic copy of this letter with enclosures will be provided to Mrs. Alina Shively, Tribal Historic Preservation Officer, Jena Band of Choctaw Indians, ashively@jenachoctaw.org.

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
7400 LEAKE AVENUE
NEW ORLEANS, LOUISIANA 70118

REPLY TO
ATTENTION OF

December 9, 2019

Regional Planning and
Environment Division South

Cyrus Ben, Chief
Mississippi Band of Choctaw Indians
P.O. Box 6257
Choctaw, MS 39350

The U.S. Army Corps of Engineers, New Orleans District, has prepared a draft report entitled "Lake Pontchartrain and Vicinity General Re-Evaluation Report with Integrated Draft Environmental Impact Statement (LPV GRR-DEIS)." This GRR-DEIS reevaluates the performance of the LPV system given the combined effects of consolidation, settlement, subsidence, sea level rise, and new datum over time, and determine if additional actions are recommended to address the economic and life safety risks associated with flooding due to hurricanes and coastal storms.

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HARPER.MARSHALL.KEVIN.1536114358
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Date: 2019.12.05 16:02:36 -06'00'

Marshall K. Harper
Chief, Environmental Planning Branch

CC: An electronic copy of this letter with enclosures will be provided to Mr. Kenneth H. Carleton, Tribal Historic Preservation Officer/Archaeologist, Mississippi Band of Choctaw Indians, kcarleton@choctaw.org.

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
7400 LEAKE AVENUE
NEW ORLEANS, LOUISIANA 70118

REPLY TO
ATTENTION OF

December 9, 2019

Regional Planning and
Environment Division South

Mr. James Floyd, Principal Chief
Muscogee (Creek) Nation
Attn: Historic and Cultural Preservation Office
P.O. Box 580
Okmulgee, OK 74447

The U.S. Army Corps of Engineers, New Orleans District, has prepared a draft report entitled "Lake Pontchartrain and Vicinity General Re-Evaluation Report with Integrated Draft Environmental Impact Statement (LPV GRR-DEIS)." This GRR-DEIS reevaluates the performance of the LPV system given the combined effects of consolidation, settlement, subsidence, sea level rise, and new datum over time, and determine if additional actions are recommended to address the economic and life safety risks associated with flooding due to hurricanes and coastal storms.

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HARPER.MARSHALL.KEVIN.1536114358 Digitally signed by HARPER.MARSHALL.KEVIN.1536114358 Date: 2019.12.05 16:03:44 -06'00'

Marshall K. Harper
Chief, Environmental Planning Branch

CC: An electronic copy of this letter with enclosures will be provided to Ms. Corain Lowe-Zepeda, Tribal Historic Preservation Officer, Muscogee (Creek) Nation, section106@mcn-nsn.gov.

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
7400 LEAKE AVENUE
NEW ORLEANS, LOUISIANA 70118

REPLY TO
ATTENTION OF

December 9, 2019

Regional Planning and
Environment Division South

Greg Chilcoat, Principal Chief
Seminole Nation of Oklahoma
P.O. Box 1498
Wewoka, OK 74884

The U.S. Army Corps of Engineers, New Orleans District, has prepared a draft report entitled "Lake Pontchartrain and Vicinity General Re-Evaluation Report with Integrated Draft Environmental Impact Statement (LPV GRR-DEIS)." This GRR-DEIS reevaluates the performance of the LPV system given the combined effects of consolidation, settlement, subsidence, sea level rise, and new datum over time, and determine if additional actions are recommended to address the economic and life safety risks associated with flooding due to hurricanes and coastal storms.

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HARPER.MARSHALL.KEVIN.1536114358 Digitally signed by HARPER.MARSHALL.KEVIN.1536114358 Date: 2019.12.05 16:06:29 -06'00'

Marshall K. Harper
Chief, Environmental Planning Branch

CC: An electronic copy of this letter with enclosures will be provided to Mr. Theodore Isham, Tribal Historic Preservation Officer, Seminole Nation of Oklahoma, isham.t@sno-nsn.gov.

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
7400 LEAKE AVENUE
NEW ORLEANS, LOUISIANA 70118

REPLY TO
ATTENTION OF

December 9, 2019

Regional Planning and
Environment Division South

Marcellus W. Osceola, Chairman
Seminole Tribe of Florida
6300 Sterling Road
Hollywood, FL 33024

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HARPER.MARSHALL.KEVIN.1536114358 Digitally signed by HARPER.MARSHALL.KEVIN.1536114358 Date: 2019.12.05 16:09:40 -06'00'

Marshall K. Harper
Chief, Environmental Planning Branch

CC: An electronic copy of this letter with enclosures will be provided to Dr. Paul N. Backhouse, Tribal Historic Preservation Officer, Seminole Tribe of Florida, THPOCompliance@semtribe.com.

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
7400 LEAKE AVENUE
NEW ORLEANS, LOUISIANA 70118

REPLY TO
ATTENTION OF

December 9, 2019

Regional Planning and
Environment Division South

Joey Barbry, Chairman
Tunica-Biloxi Tribe of Louisiana
P.O. Box 1589
Marksville, LA 71351

The U.S. Army Corps of Engineers, New Orleans District, has prepared a draft report entitled "Lake Pontchartrain and Vicinity General Re-Evaluation Report with Integrated Draft Environmental Impact Statement (LPV GRR-DEIS)." This GRR-DEIS reevaluates the performance of the LPV system given the combined effects of consolidation, settlement, subsidence, sea level rise, and new datum over time, and determine if additional actions are recommended to address the economic and life safety risks associated with flooding due to hurricanes and coastal storms.

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HARPER.MARSHALL.KEVIN.1536114358
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Date: 2019.12.05 16:10:38 -06'00'

Marshall K. Harper
Chief, Environmental Planning Branch

CC: An electronic copy of this letter with enclosures will be provided to Mr. Earl J. Barbry, Jr., Cultural Director, Tunica-Biloxi Tribe of Louisiana, earlii@tunica.org.

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
7400 LEAKE AVENUE
NEW ORLEANS, LOUISIANA 70118

REPLY TO
ATTENTION OF

December 9, 2019

Regional Planning and
Environment Division South

Kristin Sanders, SHPO
LA State Historic Preservation Officer
P.O. Box 44247
Baton Rouge, LA 70804-4241

The U.S. Army Corps of Engineers, New Orleans District, has prepared a draft report entitled "Lake Pontchartrain and Vicinity General Re-Evaluation Report with Integrated Draft Environmental Impact Statement (LPV GRR-DEIS)." This GRR-DEIS reevaluates the performance of the LPV system given the combined effects of consolidation, settlement, subsidence, sea level rise, and new datum over time, and determine if additional actions are recommended to address the economic and life safety risks associated with flooding due to hurricanes and coastal storms.

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HARPER.MARSHALL.KEVIN.1536114358
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Date: 2019.12.05 16:05:22 -06'00'

Marshall K. Harper
Chief, Environmental Planning Branch

CC: An electronic copy of this letter with enclosures will be provided to the Section 106 Inbox, section106@crt.la.gov.

MISSISSIPPI DEPARTMENT *of* ARCHIVES AND HISTORY

MDAH

HISTORIC PRESERVATION DIVISION
P. O. BOX 571
Jackson, MS 39205-0571
Phone 601-576-6940 Fax 601-576-6955
Website: mdah.ms.gov

December 14, 2020

Mr. John Thron
U.S. Army Corps of Engineers, Vicksburg District
4155 Clay Street
Vicksburg, MS 39183-3435

RE: The Final Supplement II (Final SEIS II) to the 1976 Environmental Impact Statement (FEIS), Mississippi River and Tributaries (MR&T) Project, Mississippi River Mainline Levees (MRL) (MDAH Project Log 11-065-20)

Dear Mr. Thron:

We have reviewed the Final Supplement II (SEIS) for the above referenced project, in accordance with our responsibilities under Section 106 of the National Historic Preservation Act and 36 CFR Part 800. After review of the information provided, MDAH concurs that the proposed undertaking will have an impact on historic resources. MDAH has been a participant in the negotiations for the *Programmatic Agreement Among the U.S. Army Corps of Engineers (USACE), Memphis, New Orleans, and Vicksburg Districts, the Chickasaw Nation; the Choctaw Nation of Oklahoma; the Osage Nation; the Quapaw Nation; the Arkansas State Historic Preservation Officer; the Illinois State Historic Preservation Officer; the Kentucky State Historic Preservation Officer; the Louisiana State Historic Preservation Officer; the Mississippi State Historic Preservation Officer; the Missouri State Historic Preservation Officer; the Tennessee State Historic Preservation Officer; and the Advisory Council on Historic Preservation Regarding the Mississippi River and Tributaries Project: Mississippi River Levee Features.* MDAH anticipates signing the agreement once the execution document is sent out for signature. Thus, MDAH has no further comment at this time.

If there are any changes to the scope of work, or should unexpected cultural materials be encountered during the project, MDAH requests that our office be notified so that we can provide comment in accordance with 36 CFR 800.13.

If you have any questions, please contact us at (601) 576-6945.

Sincerely,

Barry White

Barry White
Deputy State Historic Preservation Officer

FOR: Katie Blount
State Historic Preservation Officer