



St. Tammany Parish, Louisiana Feasibility Study



Final Integrated Feasibility Report and Environmental Impact Statement

May 2024

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Cover Page

St. Tammany Parish, Louisiana Feasibility Study
Final Integrated Feasibility Report and Environmental Impact Statement

Counties/Parishes: St. Tammany Parish, Louisiana

Lead Agency: U.S. Army Corps of Engineers, New Orleans District

Cooperating Agencies: U.S. Fish and Wildlife Service; National Marine Fisheries Service; Louisiana State Historic Preservation Office; Louisiana Department of Wildlife and Fisheries; City of Mandeville, LA; City of Slidell, LA; Choctaw Nation of Oklahoma.

Abstract: The St. Tammany Parish, Louisiana Feasibility Study (study) for flood damage risk reduction in St. Tammany Parish, Louisiana (study area), is authorized by Subtitle B, Section 1201 (14) of the Water Resources Development Act of 2016, as included in the Water Infrastructure Improvements for the Nation Act, and is funded by the Bipartisan Budget Act of 2018, Division B, Subdivision 1, Title IV. The study area includes all of St. Tammany Parish in southeastern Louisiana. The Final Integrated Feasibility Report and Environmental Impact Statement contains, among other things, sections on plan formulation, analysis of potential environmental impacts and consequences, alternatives analysis, mitigation, and a description of the Recommended Plan (RP). The RP (also the National Economic Development Plan) includes a levee and floodwall system in Slidell, LA, that includes 8 pump stations, 13 culverts/sluice gates/lift gates, 18 vehicular floodgates, 1 pedestrian floodgate, 1 railroad floodgate, and 6 road ramps. The I-10 road surface would be raised to a construction elevation of 22.0 feet in order to ramp over the new levee and remain above the hydraulic design elevation for the year 2082. The RP also includes nonstructural (NS) home elevations for 5,583 preliminarily eligible residences, and floodproofing for 827 eligible non-residential structures in the study area, for a combined total of 6410 structures that are preliminarily eligible for participation in the NS portion of the RP. The RP would reduce flood risk to approximately 26,350 structures and approximately 70,000 residents. The RP will produce an estimated \$145,331,000 in net benefits, has a benefit to cost ratio of 1.6, and is consistent with USACE policies, laws, and regulations. The RP will decrease annual damages from \$537,780,000 (without-out project condition) to \$165,289,000 under the “with project” condition.

For further Information, please visit the study website at: <https://www.mvn.usace.army.mil/About/Projects/BBA-2018/studies/St-Tammany/> or contact:

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Executive Summary

INTRODUCTION

The United States Army Corps of Engineers (USACE), Mississippi Valley Division (MVD), New Orleans District (CEMVN), Regional Planning and Environment Division South (RPEDS), prepared this Final Integrated Feasibility Report and Environmental Impact Statement (FIFR-EIS) (report) for the St. Tammany Parish, Louisiana Feasibility Study (study). This FIFR-EIS documents the analysis conducted to identify and evaluate Flood Risk Management (FRM) and Coastal Storm Risk Management (CSRМ) solutions to flooding in St. Tammany Parish, Louisiana. The non-federal sponsor (NFS) is the State of Louisiana, acting by and through, the Coastal Protection and Restoration Authority Board of Louisiana (CPRAB). The study is authorized by Subtitle B, Section 1201 (14) of the Water Resources Development Act of 2016, as included in the Water Infrastructure Improvements for the Nation Act, and is funded by the Bipartisan Budget Act of 2018 (P.L. 115-123), Division B, Subdivision 1, Title IV.

PURPOSE AND NEED

The study area encompasses all of St. Tammany Parish, which is approximately 1,124 square miles and is located in southeastern Louisiana (see Figure ES-1). The study area has experienced repeated, widespread flooding from both rainfall and coastal storm flood events (i.e., riverine bank overtopping, drainage, and storm surge) including historic flood impacts during Hurricane Katrina (August 2005) and the flood of August 2016. The flood events caused major disruptions, damages, and adverse economic impacts to the parish. The sources of flooding vary across the parish and drainage subbasins. Figure ES-2 shows repetitive loss areas, flood zones, and frequently flooded roads and also the areas that experience coastal flooding and/or riverine flooding. The purpose of the study is to identify risk reduction measures that contribute to the National Economic Development (NED) in a manner that is consistent with protecting the Nation's environment, and that is in compliance with National Environmental Policy Act (NEPA), and other environmental laws and regulations, applicable Executive Orders (EOs), and other federal planning requirements.

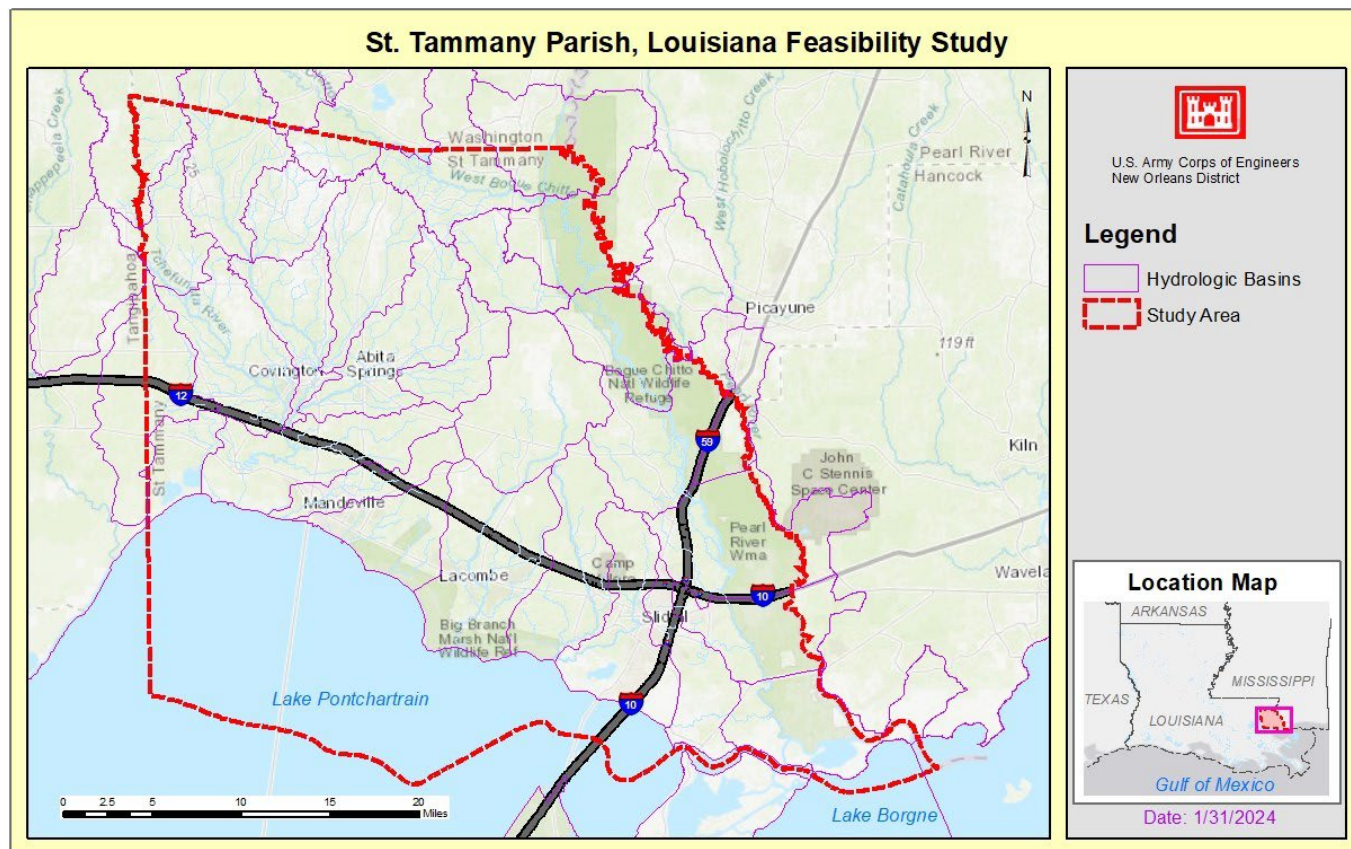


Figure ES-1. St. Tammany Parish- Study Area

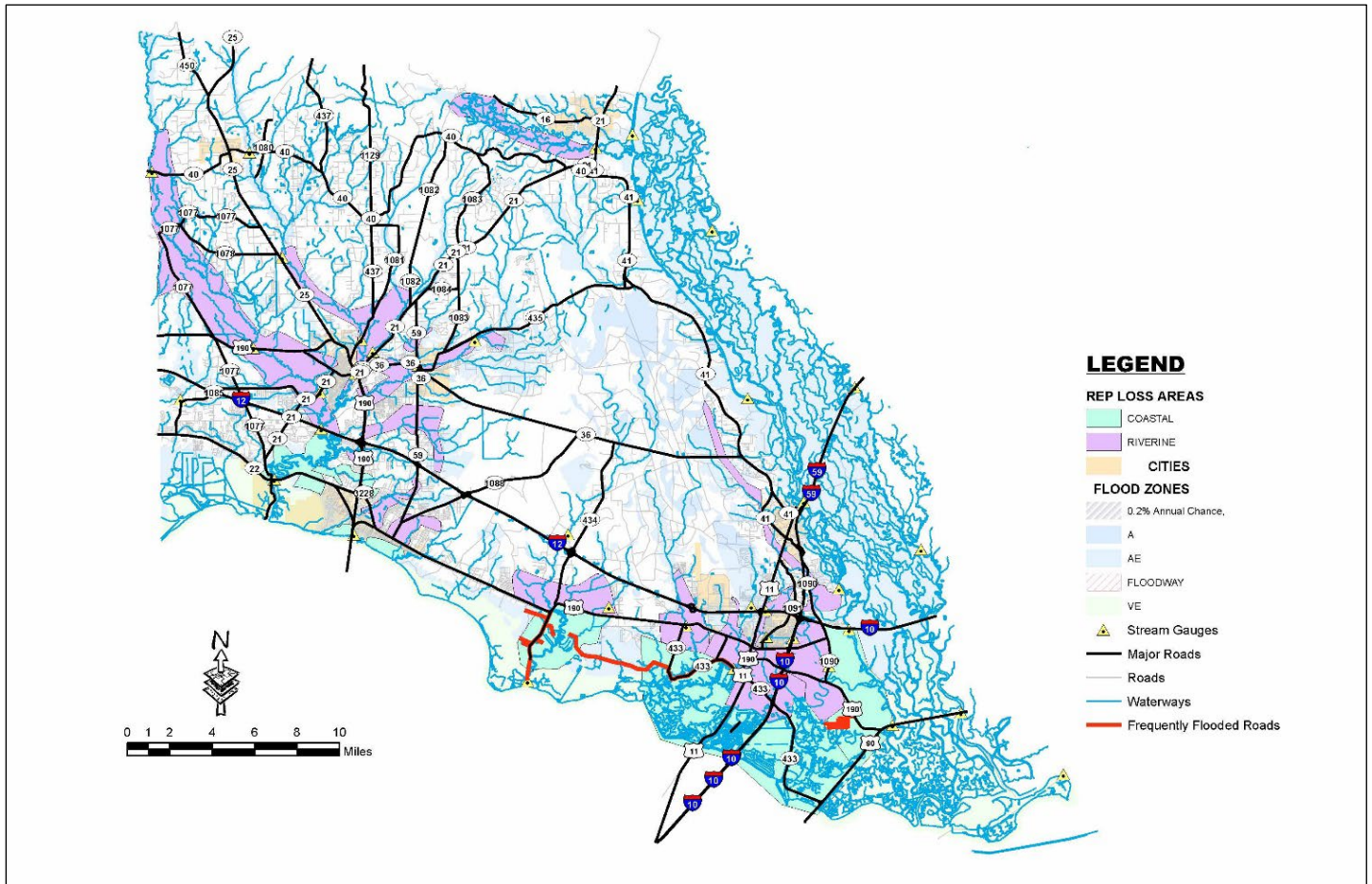


Figure ES-2. St. Tammany Parish- Repetitive Loss Areas, Flood Zones, and Frequently Flooded Roads. (Source STPG 2020)

PLAN FORMULATION

The USACE's planning process was followed, which included identifying problems and opportunities, inventorying, and forecasting conditions, identifying measures, creating alternatives, and continually reevaluating and screening through the Initial Array of Alternatives, the Focused Array of Alternatives, the Final Array of Alternatives (Final Array), the Draft Tentatively Selected Plan (TSP), the Optimized TSP, and ultimately the identification of the Recommended Plan (RP).

A total of 208 site-specific management measures were identified and screened to an Initial Array of 13 alternatives and 62 measures. The measures in the Initial Array were evaluated, compared, and screened to reach a Focused Array of Alternatives which consisted of 11 alternatives and 43 management measures, including the No Action alternative. Based on analysis and evaluations, the best performing alternatives and measures were identified to formulate the Final Array of Alternatives which consisted of 8 alternatives and 27 measures. The measures in the Final Array of Alternatives that were economically justified were combined to form the Draft Tentatively

Selected Plan (Draft TSP), which included a combination of structural and nonstructural (NS) measures for both FRM and CSRM.

A Draft Integrated Feasibility Report and Environmental Impact Statement (DIFR-EIS) containing the Draft TSP was released in June 2021 for a concurrent public, Agency Technical Review (ATR), Independent External Peer Review (IEPR), and legal and policy review. Subsequent to the release of the DIFR-EIS, additional engineering, economic, and environmental investigations were conducted on the separate measures of the Draft TSP. The information gathered through these additional investigations, together with the comments received on the DIFR-EIS were used to refine and optimize the Draft TSP. On 21 July 2023, a Revised Draft Integrated Feasibility Report and Environmental Impact Statement (RDIFR-EIS) that contained an Optimized TSP, was released for a public review concurrent with ATR and MVD Policy review.

After review of the comments received on the RDIFR-EIS, additional analysis was conducted on the measures in the Optimized TSP, which included the Mile Branch Channel Improvements (structural FRM) Measure. As a result of this analysis, the cost estimate for this measure was revised. The new implementation cost for the Mile Branch Channel Improvements Measure exceeded the amount of damage reduction and was not economically justified. Consequently, the Mile Branch Channel Improvements Measure was screened and not carried forward into the Recommended Plan (RP).

FINAL ARRAY OF ALTERNATIVES

Alternative 1. No Action - Future without project condition (FWOP): Under the No Action Alternative, no Federal FRM or CSRM measures would be implemented and the study area would continue to experience damages from riverine, rainfall, storm surge, and coastal storm related flooding. Consideration of a No Action Alternative is a requirement of the National Environmental Policy Act (NEPA) and forms the basis against which all other alternatives plans are measured. During analysis of the Final Array, the project delivery team (PDT) determined that Alternative 1 does not address the planning objectives. Consequently, Alternative 1 was screened out based on completeness since it would not alleviate problems or provide flood risk reduction benefits.

Alternative 2. Nonstructural: Alternative 2 initially consisted of a standalone NS measure with no structural measures at all. During the analysis of the Final Array, the standalone NS alternative was screened out in favor of a combined structural and NS alternative, which would provide more net benefits. The NS measures were evaluated using an aggregation method based on the Annual Exceedance Probability (AEP) floodplain. The standalone NS alternative (no structural measures) was screened, but a combined structural and NS measure was retained.

Alternative 4. Lacombe: Alternative 4 included variations of a levee system to reduce coastal storm flooding in the area of Lacombe, Louisiana (Variations 4a and 4a.1). A longer levee, extending from Lacombe to the West Slidell area, was also considered (Variation 4b). Although Alternative 4 met the planning objectives and was complete and effective, none of the levee variations (Variations 4a, 4a.1 and 4b) had a positive benefit to cost ratio (BCR) and therefore, Alternative 4 was screened out based on lack of efficiency.

Alternative 5. Bayou Liberty/ Bayou Vincent/Bayou Bonfouca: Alternative 5 included measures to address riverine, rainfall, and coastal storm flooding in the areas of Bayou Liberty, Bayou Vincent, and Bayou Bonfouca. Channel improvements on Bayou Liberty and Bayou Patassat were considered along with a West Slidell levee (with floodgates and pump stations). During analysis of the Final Array, the Bayou Bonfouca Detention Pond and Bayou Liberty Channel improvements were screened based on lack of efficiency due to a negative BCR. Ultimately, the West Slidell Levee was incorporated into Alternative 6c. Bayou Patassat was initially retained, but was ultimately screened due to a negative BCR.

Alternative 6. South Slidell Storm Surge: Alternative 6 included a levee and floodwall system in South Slidell (6a). Variation (6b) incorporated the Eden Isle community into the South Slidell levee system. A combination of the 6a measures and the West Slidell levee from Alternative 5 above, was created to form Variation 6c. Variations 6a and 6b were screened based on lack of efficiency due to a negative BCR.

Alternative 7. Eastern Slidell: Alternative 7 included a diversion at Gum Bayou, Poor Boy Canal Improvements, channel improvements on Doubloon Bayou, and a levee to prevent riverine flooding from the Pearl River. During analysis of the Final Array, the Pearl River Levee, Doubloon Bayou channel improvements, Gum Bayou Diversion, and Poor Boy Canal improvements were all screened out based on lack of efficiency due to a negative BCR.

Alternative 8. Upper Tchefuncte/Covington: Alternative 8 included channel improvements and the enlargement of the lower 2 miles of Mile Branch and Lateral "A." During analysis of the Final Array, the Lateral "A" channel improvements were screened out based on lack of efficiency resulting in a negative BCR. The Mile Branch Channel Improvements Measure was optimized after the release of the RDIFR-EIS, but was ultimately screened out based on a negative BCR.

Alternative 9. Mandeville Lakefront: Alternative 9 included multiple variations to replace and raise the existing Lake Pontchartrain seawall, together with related improvements, such as floodwalls, floodgates and or pumps to address tidal and storm surge flooding in Mandeville, Louisiana. All variations in the measures that made up Alternative 9 were screened out based on lack of efficiency due to a negative BCR. See Section 4 and Appendix B: Plan Formulation, for more information regarding the alternatives and measures.

PLAN EVALUATION, COMPARISON AND SELECTION

Throughout the planning process, each Alternative was evaluated to determine its effects, benefits, costs, and impacts and existing data was used to model the physical, economic, and environmental conditions, along with measuring how well each Alternative performed in meeting the study objectives and avoiding the study constraints. Each Alternative and measures within the Alternatives were compared to the No Action Alternative.

Measures and alternatives were evaluated across multiple benefit and impact categories, which included economic (national and regional), environmental (national and regional), and social considerations, which were captured under the following accounts: National Economic

Development (NED), Regional Economic Development (RED), Other Social Effects (OSE), and Environmental Quality (EQ).

The decisions on the selection of the Draft TSP, Optimized TSP, and ultimately the RP, were informed by, among other things, hydraulic (H&H) modeling (Advanced CIRCulation (ADCIRC) and Hydrologic Engineering Center – River Analysis System (HEC-RAS)), USACE cost estimates, engineering, design, environmental impacts and compensatory mitigation, risk assessments and potential life safety concerns, and economic modeling (Hydrologic Engineering Center Flood Damage Analysis (HEC-FDA)).

RECOMMENDED PLAN

The Recommended Plan (RP) (also the National Economic Development Plan) is a comprehensive plan to address flooding parish-wide and includes structural and NS measures.

The **Structural Component** of the RP consists of the construction of a 15-mile (97,700 feet) levee and 3.5 mile (18,200 feet) floodwall system in South and West Slidell (West and South Slidell Levee and Floodwall System) that includes 8 pump stations, 13 culverts/sluice gates/lift gates, 18 vehicular floodgates, 1 pedestrian floodgate, 1 railroad floodgate, and 6 road ramps. The construction of the floodwall and levee system would be based on a 1 percent probability storm level of risk reduction with 2.7 feet of RSLR, based on a 2082 intermediate RSLR scenario projection. The levee alignment would impact approximately 102 acres of staging area and 483 acres of permanent right-of-way. The levee alignment would require approximately 7,239,000 cubic yards of fill for construction (includes 30 percent contingency). The I-10 road surface would be raised to a construction elevation of 22.0 feet in order to ramp over the new levee and remain above the hydraulic design elevation for year 2082.

Approximately 110 acres of the Big Branch Marsh National Wildlife Refuge (BBMNWR), generally along the south side of Bayou Bonfouca westward of the Norfolk Southern Railroad tracks, is required from the USFWS for the West and South Slidell Levee and Floodwall System feature of the RP. The USFWS is authorized to exchange property with the NFS. Accordingly, property determined to be suitable and desirable by USFWS in a location where it is authorized to acquire property for the BBMNWR would be identified by USFWS, then the identified property may be acquired by the NFS and exchanged with USFWS for the LERRDs required within the Refuge. The exchange of BBMNWR is authorized under the National Wildlife Refuge System Administration Act administered by the National Wildlife Refuge System. In the case of an exchange, an Exchange Agreement is to be executed between the NFS and USFWS during implementation of the project.

The only features of the RP that need borrow material is the West and South Slidell Levee and Floodwall System. Borrow material for construction will come from sites estimated to be within no more than 17 miles of the levee and floodwall system. A total of 3,000,000 cubic yards of soil is needed for initial construction and a grand total of 7,239,000 cubic yards is needed over the entire authorized 50-year period to sustain the 1 percent AEP design elevations out to year 2082. All levee and floodwall features (the West and South Slidell Levee and Floodwall System) are based on the design standards developed by USACE for the post-Hurricane Katrina Hurricane and

Storm Damage Risk Reduction System (HSDRRS) for the greater New Orleans area which includes St. Tammany Parish.

The construction of the West and South Slidell Levee and Floodwall System and related components) would occur from 2025-2076. Additional levee lifts would occur three times post initial construction at 5-7 years, 15-20 years, and 30 years. Upon completion of construction of the project, or functional portions thereof, the NFS would be fully responsible for Operation Maintenance Repair Replacement & Rehabilitation (OMRR&R).

The **Nonstructural Component** of the RP includes all of St. Tammany Parish and consists of the elevation of approximately 5,583 eligible residential structures to the future 100-year flood stage (not to exceed 13 feet above the existing grade), and the floodproofing of 827 eligible nonresidential structures up to 3 feet, including approximately 80 critical infrastructure facilities. The combined total number of structures (residential and nonresidential) that are preliminarily eligible for participation in the NS portion of the RP is 6,410 structures. The cost estimate for the NS component of the RP assumes 100 percent participation by the owners of eligible residential structures, so the overall total project cost is inherently conservative. The construction of the NS component would be implemented over a period of 12 years from 2025-2037.

Dry floodproofing consists of sealing all areas of a structure up to a maximum of approximately 3 feet above grade level to reduce damage caused by coastal storm surge inundation by making walls, doors, windows, and other openings resistant to penetration by water. Eligible structures must have a first-floor elevation (FFE) at or below the 25, 50 or 100 -year storm surge floodplain (depending on location within the study area), based on hydrologic conditions predicted to occur in 2032 (the beginning of the 50-year period of analysis).

The NS measures are anticipated to reduce annual damages by approximately 40 percent relative to the without project condition. The NS plan (1%, 2% and 4% AEP) was efficient and incrementally justified because it provided the most net benefits to reduce flood damages. The NS plan also had positive NED, Regional Economic Development and Other Social Effects benefits and the least Environmental Quality impacts of any alternative in the Final Array of Alternatives.

Nonstructural addresses structures impacted by FRM and CSRM flooding. The riverine portion of the NS plan includes 3,762 structures, and the coastal portion of the NS plan includes 2,648 structures. There is a difference in performance and adaptive capacity and sensitivity to sea level change based on if the structure is impacted by FRM or CSRM flooding. An analysis was conducted on the structures impacted by coastal flooding. The NS plan's projected benefits and project performance would remain through the 50-year period of analysis and is not potentially impacted by sea level rise until 70-130 years in the future based on the actual level of sea level rise encountered.

The RP will not reduce all flood risk within St Tammany Parish, but rather is intended to provide benefits in concert with other ongoing efforts, programs and projects by other federal agencies, state and local government and community efforts. The residual risk, along with the potential consequences, has been communicated to the NFS and will become a requirement of any communication and evacuation plan.

The **Structural and Nonstructural components** of the RP would reduce flood risk to approximately 26,350 structures and approximately 70,000 residents. The RP will produce an estimated \$145,331,000 in net benefits, has a benefit to cost ratio of 1.6, and is consistent with USACE policies, laws, and regulations. The RP will decrease annual damages from \$537,780,000 (without-out project condition) to \$165,289,000 under the “with project” condition.

With respect to Environmental Justice and compliance with the Justice40 Initiative, the PDT used its best efforts to comply with the Interim Implementation Guidance for the Justice40 Initiative, dated 20 July, 2021; and MEMORANDUM FOR COMMANDING GENERAL, U.S. ARMY CORPS OF ENGINEERS SUBJECT: Implementation of Environmental Justice and the Justice40 Initiative (Justice40 Interim Guidance) dated 15 March 2022. This Guidance established a goal that 40 percent of the overall benefits of certain federal investments, flow to disadvantaged communities that are marginalized, underserved, and overburdened by pollution. Forty-six percent of the benefits provided by the West and South Slidell Levee and Floodwall System will accrue to disadvantaged communities. Four percent of the benefits provided by the NS plan will accrue to disadvantaged communities. The low percentage of benefits provided under the NS plan to disadvantaged communities is primarily due to community locations (i.e., rural communities and/or areas not subject to frequent flooding, and/or areas that will receive protection from the structural measures). Overall, approximately 20 percent of the NED benefits provided by the Recommended Plan accrue to disadvantaged communities.

The estimated total Project First Cost for the RP is \$5,894,229,000 at a FY 24 price level. The Project First Cost (Current Price Level) is the cost estimate that will serve as the basis for providing the cost of the project for which authorization is sought. The fully funded total project cost includes a contingency developed utilizing the Cost and Schedule Risk Analysis, and computed contingency for the overall project as 46 percent, with a 51 percent computed contingency for the structural component (West and South Slidell Levee and Floodwall System) and 43 percent computed contingency for the NS. The cost contingencies reflect an 80 percent confidence level in estimated fully funded total project cost and are intended to cover potential cost and schedule increases associated with identified project risks and their probability of occurrence.

The estimated total Project First Cost for the Structural measure (West and South Slidell Levee and Floodwall System) is \$2,882,000. The construction of the levee and floodwall system will impact an estimated 290 private landowners and the NS measures will impact 6,410 private landowners. The total estimated real estate cost for the West and South Slidell Levee and Floodwall System, including contingencies, borrow sites and environmental mitigation costs, is estimated as \$81,476,000.

The total estimated Project First Cost for the NS measures is \$3,012,000 which includes \$1,832,345,000 for implementation of residential structure elevation measures (for 5583 eligible residential structures at \$95 per square foot and \$2,295,896,000 for implementation of the dry floodproofing measures for 827 eligible nonresidential structures at approximately \$29-\$80 per square foot (dependent on the square footage of the nonresidential structure). The total estimated real estate cost for NS measures, including contingencies is \$170,764,000. The real estate cost

estimates may require revisions during Preconstruction, Engineering and Design (PED) if the project is approved.

The RP includes a compensatory habitat Mitigation Plan to mitigate for habitat losses that will result with the implementation of the RP. The Mitigation Plan consists of a combination of mitigation bank credit purchases and USACE constructed marsh restoration and BBMNWR pine savanna restoration mitigation projects to be constructed by USACE either before or concurrent with the construction of the RP. The total cost of compensatory habitat mitigation for fish and wildlife losses under the RP is \$39,973,512, which is included in the total estimated Project First Cost. See Appendix I: Mitigation Plan.

IMPLEMENTATION OF THE RECOMMENDED PLAN

Once construction funds are appropriated, the NFS, and the Department of the Army would enter into a Project Partnership Agreement (PPA). After the signing of a PPA, the NFS would perform the relocations required for the project and acquire the lands, easements, rights-of way, disposal areas and usage rights to the borrow material sources that are needed to construct the project. Construction of the structural features of the RP would occur from 2025-2076, subject to the USACE receipt of construction funding, full environmental law and regulation compliance, and the satisfaction of the real estate obligations pertaining to construction by the non-federal sponsor (among other things). Additional levee lifts would occur three times after the initial construction at 5-7 years, 15-20 years, and 30 years. The construction of the NS component would be implemented over a period of 12 years from 2025-2037.

It is anticipated the cost share for the design and construction of the project would be 65 percent federal and 35 percent non-federal. Final, specific cost share requirements would be identified in the Project Partnership Agreement. Among other responsibilities, the NFS must provide all project Lands, Easements, Right of Ways, Relocations, and Disposals (LERRDs) required for the project. The NFS will be 100 percent responsible for the OMRR&R. For the NS component of the plan, these responsibilities include inspection of the elevations and floodproofing measures on properties to ensure compliance with the restrictions provided within the non-standard estate(s) to be acquired by the NFS for continued effectiveness of the measures. The total average OMRR&R annual cost is currently estimated at \$7,753,000. Table ES-1 provides a summary of the measures in the RP.

Table ES-1. Summary of Measures in the Recommended Plan (FY24 price level in \$1,000s)

Measure	Slidell Levee and Floodwall	Nonstructural	Total First Costs for Recommended Plan
Project First Cost	\$2,881,740	\$3,012,488	\$5,894,229
Benefits	\$159,036	\$213,455	\$372,491
Average Annual Costs	\$115,196	\$111,964	\$227,160
Net Benefits	\$43,840	\$101,491	\$145,331
B/C Ratio	1.4	1.9	1.6
Approx. # structures with flood risk reduction	20,000	6,410	26,350

RELEVANT RESOURCES AND ENVIRONMENTAL CONSIDERATIONS

A Notice of Intent (NOI) to prepare an integrated Feasibility Report and EIS for the study was published in the Federal Register (Vol. 85, No. 119) on 19 June 2020 and included a 45-day scoping public comment period.

The U.S. Fish and Wildlife Service (USFWS); National Marine Fisheries Service (NMFS); Louisiana State Historic Preservation Office (LA SHPO); Louisiana Department of Wildlife and Fisheries (LDWF); City of Mandeville, Louisiana; and City of Slidell, Louisiana are cooperating agencies and participants in the project delivery team (PDT) meetings. See Appendix C: Environmental.

A Notice of Availability (NOA) was published in the Federal Register (Vol. 86, No. 111) on Friday, 11 June 2021, announcing the release of the first DIFR-EIS for a 45-day public comment period. Refer to Section 9 for a summary discussion on public and agency involvement.

Due to the significance of the comments received on the first DIFR-EIS, the report was revised and released as a Revised Draft report (RDIFR-EIS) for second public comment period. The NOA for the second public comment period was published in the Federal Register (Vol 88 FR 47138, EIS No. 20230086) on 21 July 2023. Public hearings were held on 15 August and 16 August 2023 in Slidell and Covington, LA respectively.

The RDIFR-EIS garnered a good deal of attention with the submission of approximately 212 emails and 17 comment cards constituting 767 comments from individual citizens, non-government organizations, city, parish, state, and federal agencies. Of the 767 comments received, a majority of the individuals expressed opposition to the plan or were skeptical of risk reduction limits of the plan. The top reoccurring themes were plan formulation and support for another alternative, social effects from increased taxes, insurance, emergency services, induced flooding, or risk of increased height of flooding for those outside the system. The lack of support was in regard to being excluded from the proposed levee system and concerns for increases to their taxes, home and flood insurance.

Important resources identified in this report include: threatened and endangered species (T&E) and protected species, wetlands, aquatic resources, essential fish habitat, water quality, air quality, cultural resources, socioeconomics, environmental justice (EJ), prime and unique farmlands, recreation, aesthetics, and noise.

Efforts were taken to avoid, minimize, rectify and or reduce habitat impacts, but there are still unavoidable impacts to fish and wildlife resources associated with the implementation of the RP. Therefore, a Compensatory Mitigation Plan was developed. The goal of the Mitigation Plan is to fully compensate for the unavoidable impacts to significant fish and wildlife habitat resources that would occur with the implementation of the RP. The objectives of the Mitigation Plan are defined by the results of the habitat impact assessment model using quantified units. The Compensatory Mitigation Plan consists of a combination of mitigation bank credit purchases, marsh restoration and pine savanna (refuge) mitigation projects to be constructed by USACE either before or concurrent with the construction of the RP to mitigate for the following habitat losses that would result with the implementation of the RP:

- Loss of 48 Average Annual Habitat Units (AAHUs) of fresh and intermediate marsh wetland habitat in the Mississippi Alluvial Plain, Deltaic Coastal Marshes and Barrier Islands ecoregion within Louisiana.
- Loss of 67 AAHUs (9.7 red-cockaded woodpecker AAHU; 57 pine warbler AAHU) of Pine Savanna habitat in the Lake Pontchartrain Watershed.
- Loss of 9 AAHUs (7 red-cockaded woodpecker AAHU; 2 pine warbler AAHU) of Pine Savanna habitat on refuge land within Big Branch Marsh National Wildlife Refuge (BBMNWR) or on within other USFWS land within the Lake Pontchartrain Watershed.

The requirements of the NEPA and all applicable environmental laws and regulations have been complied with throughout the course of this study and in the process and preparation of this FIFR-EIS. Full NEPA compliance will be achieved upon execution of the Record of Decision (ROD) for this EIS. A biological assessment (BA) dated 27 April 2023, was submitted to NOAA on 01 May 2023 and a BA dated 22 June 2023, was submitted to USFWS on 3 July 2023. The BA's were submitted as part of the on-going coordination with USFWS and NOAA for listed T&E species, including the Gulf sturgeon and Gulf sturgeon critical habitat, West Indian manatee, three species of sea turtles (green, Kemp's ridley and loggerhead), Gopher tortoise, Ringed map turtle, Red-cockaded woodpecker, Louisiana quillwort, Eastern black rail, migratory shorebirds, and species of management concern (i.e. rare and very rare species) that are known to occur or are believed to occur within the area. Upon CEMVN submission of a revised BA dated 22 June 2023, NOAA concurred with CEMVN's determination in a letter dated 05 September 2023. Upon CEMVN submission of a revised BA dated 31 August 2023, USFWS concurred with CEMVN determination in a letter authorized 20 September 2023. The biological assessments and coordination documents are included in Environmental Appendix C.

NOAA submitted a letter on 05 December 2023 indicating that CEMVN has satisfied their EFH consultation under the Magnuson-Stevens Fishery Conservation Management Act requirements for the feasibility study. Further coordination with NOAA and EFH consultation would continue should the study proceed to PED. Refer to Section 9 for further discussion on the EFH consultation process.

In compliance with NHPA Section 106, CEMVN initiated Section 106 consultation for the Proposed Action (Proposed Undertaking) as described in the CEMVN correspondence dated 20 August 2020 to the LA SHPO. CEMVN developed a Programmatic Agreement (PA) establishing procedures to satisfy the CEMVN's Section 106 responsibilities pursuant to 36 CFR Part 800.14(b). The PA addresses the potential to affect historic properties that are eligible for or listed in the NRHP, including archaeological sites, districts, buildings, structures, and objects that are significant in American history, architecture, archaeology, engineering, and/or sites of religious and cultural significance on or off Tribal Lands (as defined in 36 CFR § 800.16(x)) that may be affected by this undertaking. The PA will be executed once all signatories sign and a copy of the executed agreement is submitted to the Advisory Council on Historic Preservation (ACHP). The final PA is contained in Appendix C of this FIFR-EIS.

VIEWS OF THE NFS, AGENCIES, AND STAKEHOLDERS

The non-federal sponsor (CPRAB) recognizes the importance for flood risk reduction and coastal storm risk reduction in St. Tammany Parish and similar projects to reduce risk to the study area are included in the state of Louisiana 2023 Master Plan. The NFS supports the implementation of the RP and is in basic agreement with the applicable model PPA that will be signed if the RP is approved and funded. The views of interested parties, including federal, state, and local agencies, were considered and all comments from public reviews have been addressed and incorporated into the FIFR-EIS where appropriate.

Fish and Wildlife Coordination Act: The draft CAR (DCAR) on the initial DEIS was received 28 April 2021. The revised DCAR with recommendations on the Optimized TSP was received on 15 May 2023. The final CAR (FCAR) is dated 26 September 2023. Post public review additional analysis was conducted and the Mile Branch measure was eliminated from the RP. CEMVN coordinated this change with the Resource agencies and as a result USFWS provided a subsequent FCAR version 2.0 on 22 January 2024. The FCAR version 2.0 eliminated recommendations specific to Mile Branch and included two additional recommendations at the request of NMFS from what was included in the revised DCAR. USFWS correspondence, the DCAR, FCAR and FCAR version 2.0 are included in Environmental Appendix C.

REVIEWS

In accordance with USACE policy on the review of decision documents, all technical, engineering, and scientific work underwent an open, dynamic, and rigorous review process. The comprehensive review process included District Quality Control Review, Agency Technical Review, Type I Independent External Peer Review (IEPR), Mississippi Valley Division (MVD) Policy and Legal Compliance Review, and Headquarters Policy and Legal Compliance Review to confirm the planning analyses, alternative design and safety, and the quality of decisions. Washington-level review indicates that the plan recommended by the reporting officers complies with all essential elements of the U.S. Water Resources Council's Economic and Environmental Principles, Requirements, and Guidelines for Water and Land Related Resources Implementation Studies, as well as other administrative and legislative policies and guidelines.

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SECTION 1

Introduction

The United States Army Corps of Engineers (USACE), Mississippi Valley Division (MVD), New Orleans District (CEMVN), Regional Planning and Environment Division South (RPEDS), prepared this Final Integrated Feasibility Report and Environmental Impact Statement (FIFR-EIS) (collectively, the “report”) for the St. Tammany Parish, Louisiana Feasibility Study. This FIFR-EIS documents the analysis conducted to identify and evaluate Flood Risk Management (FRM) and Coastal Storm Risk Management (CSRM) solutions to flooding in St. Tammany Parish, Louisiana. CEMVN undertook this study and analyses to confirm a federal interest in the project, identify and evaluate an array of alternative plans, and make a recommendation for action or inaction. This FIFR-EIS includes input from the non-federal sponsor (NFS), agencies, and the public. The NFS is the State of Louisiana, acting by and through, the Coastal Protection and Restoration Authority Board of Louisiana (CPRAB). The FIFR-EIS also documents the plan formulation process and presents a Recommended Plan (RP) for implementation. The selection of the RP, as described herein, is based on consideration of the associated economic benefits, environmental outputs, environmental and social impacts, costs, and residual risk.

A Draft Integrated Feasibility Report and Environmental Impact Statement (DIFR-EIS) containing a Draft TSP was released for 45-day concurrent public, Agency Technical Review (ATR), Independent External Peer Review (IEPR), and legal and policy review in June 2021. Subsequent to the release of the DIFR-EIS, additional engineering, economic, and environmental investigations was conducted on the separate measures of the Draft TSP. Information gathered through these additional investigations, together with the consideration of comments received from the public, stakeholders, the USFWS and the NMFS assisted in further refining the design of the Draft TSP during feasibility level of design. Thereafter in July 2023, a Revised Draft Integrated Feasibility Report and Environmental Impact Statement (RDIFR-EIS) was released for a second concurrent review. The RDIFR-EIS documented the refinements from the DIFR-EIS and recommended an optimized tentatively selected plan (Optimized TSP) that had been formulated based on comments received from the public, USACE ATR review and legal and policy review.

After review of the comments received on the RDIFR-EIS, an updated analysis on the measures in the Optimized TSP was conducted. The results of this analysis informed the final RP.

1.1 STUDY SCOPE

Congress authorized USACE to conduct this study to investigate both FRM and CSRM problems and solutions. In the course of the study, CEMVN considered past, current, and future management and flood resilience studies and projects by USACE, and other Federal, state, and local agencies and identified and evaluated a full range of reasonable

alternatives, including the No Action Alternative, to reduce flood damages from rainfall and storm surge events in the study area (entirety of St. Tammany Parish). Both structural and nonstructural (NS) measures were considered in the study process. The CEMVN performed these overarching efforts:

- Assess the study area's problems, opportunities, and future without project condition (FWOP) for a 50-year time period called the period of analysis. The period of analysis for this study is 2032-2082, which is the time period used to consider the benefits and impacts of an action. The time it takes to conduct the study and implement the RP is not part of the period of analysis. For planning purposes, it was assumed that the study and design and initial construction activities would not be completed until 2032.
- Evaluate the feasibility of implementing site-specific solutions, including structural, NS, and natural and nature-based measures, or possibly a combination thereof.

The FIFR-EIS was prepared in accordance with the USACE Planning Guidance Notebook (1105-2-100); Engineering Regulation (ER) 1105-2-101 "Risk Assessment for Flood Risk Management Studies" dated 15 July 2019; NEPA and Council on Environmental Quality (CEQ) and USACE NEPA regulations, and all other applicable laws, regulations, and policies. CEMVN uses a standard format for the Integrated Feasibility Report and EIS to be consistent with the CEQ NEPA regulations. In the table of contents, the specific sections for the following bulleted list are located:

- the purpose and need for the RP or proposed action (Section 2);
- the affected environment and relevant resources in the study area where the RP or proposed action would occur (Section 3);
- alternatives and the RP or proposed action (Section 4 and Section 6);
- environmental consequences of implementing an alternative (Section 5);
- public involvement including scoping, establishing cooperating agencies and public review and input during preparation of the FIFR-EIS (Section 9).

The study followed the specific, measurable, attainable, risk-informed, timely (SMART) planning process. The outcome of the planning process is the identification of the National Economic Development (NED) plan, and designation of the RP.

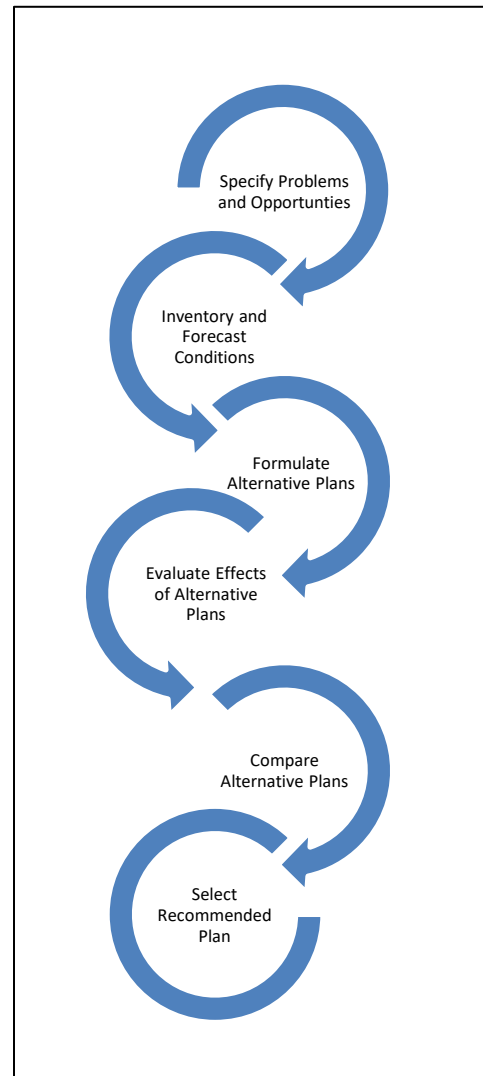


Figure 1-1. Six Step USACE Planning Process adapted from ER 1105-2-100

The study was conducted by a multi-disciplinary multi-agency project delivery team (PDT) comprised of professionals with expertise to identify the water resource problems, develop alternatives to address the problems, and recommend a plan that addresses the need to reduce flooding in St. Tammany Parish. The NFS and cooperating agencies to include, U.S. Fish and Wildlife Service; National Marine Fisheries Service; Louisiana State Historic Preservation Office; Louisiana Department of Wildlife and Fisheries; City of Mandeville, LA; City of Slidell, LA; Choctaw Nation of Oklahoma, were an integral part of the PDT. Throughout the feasibility process, the PDT also coordinated with, and integrated input from, the USACE vertical team, which includes MVD, or the Major Subordinate Command (MSC), and USACE Headquarters (HQUSACE). The PDT followed ER 1105-2-100, which describes the USACE planning process (Figure 1-1) and is also detailed in Appendix B: Plan Formulation.

1.2 STUDY AUTHORITY

This study is authorized by Subtitle B, Section 1201 (14) of the Water Resources Development Act (WRDA) of 2016, as included in the Water Infrastructure Improvements for the Nation Act (P.L. 114-322). The study is authorized in accordance with the annual reports submitted to the Congress in 2015 and 2016, pursuant to Section 7001 of the Water Resources Reform and Development Act (WRDDA) of 2014 (33 U.S.C. 2282d). The study is funded by the Bipartisan Budget Act (BBA) of 2018 (P.L. 115-123), Division B, Subdivision 1, Title IV, which appropriated supplemental funds in the Supplemental Investigations Funds for Long Term Disaster Recovery Investment Plans (LDRIPs) related to the completion, or initiation and completion, of authorized flood and storm damage risk reduction studies, including shore protection. See also 14 February 2017 MEMORANDUM FOR DISTRIBUTION; SUBJECT: Implementation Guidance for Sections 1201 and 1207 of the WRDA of 2016. The study is authorized for inclusion as a BBA 2018 study in September 2019. The 5 September 2019 Memorandum for the Deputy Commanding General for Civil and Emergency Operations; Subject: Supplemental Appropriations BBA of 2018 - LDRIP - Investigations Account. This Memorandum reflects the determination of the Office of the Deputy Commanding General for Civil and Emergency Operations, that the feasibility study for St. Tammany Parish, Louisiana, should be included as a BBA 2018 funded study in the Investigations Account LDRIP.

Notwithstanding Section 105(a) of the WRDA of 1986 (33 U.S.C. 2215(a)), which specifies the cost-sharing requirements generally applicable to feasibility studies, BBA 2018 authorizes the Government to conduct the study at full federal expense, to the extent that appropriations provided under the Investigations heading of the BBA 2018 are available and used for such purpose. The Policy Guidance Memorandum on Implementation of Supplemental Appropriations of the BBA of 2018 dated 9 August 2018, states that a new FCSA or an amendment to the existing FCSA is required to address use of Supplemental Investigations funds at 100 percent federal expense. Further, HQUSACE is authorized to develop and approve FCSAs, and amendments to existing FCSAs, for studies in the LDRIP and to delegate to the Division Commander authority to approve use of such FCSAs and amendments. In addition, authority to execute a FCSA or amendment, once approved, may be delegated to the District Commander. HQUSACE developed and approved a model

FCSA as set forth in the MEMORANDUM FOR DISTRIBUTION, SUBJECT: Bipartisan Budget Act of 2018 (BBA 2018) - Model Agreement for New Feasibility Studies dated 10 August 2018.

On 26 November 2019, the CEMVN submitted the (model) FCSA package (with no deviations) for review and approval to the MVD Commander, together with a request that the signature authority for the FCSA be delegated to the CEMVN Commander. Pursuant to the MEMORANDUM FOR Commander, New Orleans District, SUBJECT: Request for Review and Approval to Execute the Model FCSA between the Department of the Army and the State of Louisiana, acting by and through, the Coastal Protection and Restoration Authority Board of Louisiana for the St. Tammany Parish, Louisiana Feasibility Study, dated 6 January 2020, the MVD Commander approved the draft FCSA and directed the CEMVN to proceed as scheduled with processing the FCSA. The FCSA was fully executed by all parties on 14 January 2020.

Generally, feasibility studies funded by BBA 2018 are conducted for not more than \$3 million and are completed within 36 months, consistent with Section 1001 of WRRDA 2014. If an additional resource request is approved for a study, those additional costs may be funded from remaining supplemental investigations funds.

An exemption additional resource request to the Section 1001 of WRRDA 2014, requirements was approved by the Assistant Secretary of the Army for Civil Works ASA(CW) in April 2022 in order to complete the complex feasibility study and to further reduce risk and address policy and legal, public, ATR, and independent external peer review (IEPR) comments received. An additional \$1.77M and 16 months was allocated to complete critical tasks to inform the decision on the RP. As part of the additional resource request Exemption approval, the study was designated as a Mega Study and is required to follow the requirements in the Interim Guidance for Civil Works Mega Studies dated 15 October 2021.

Except as otherwise noted, studies funded by BBA 2018 are undertaken in accordance with existing civil works policies and guidance and incorporate Specific Measurable Attainable Risk-Informed Timely (SMART) planning principles. This study has been undertaken in accordance with Sections 1001 and 1002 of WRRDA 2014, applicable existing USACE civil works regulations, policies, and guidance, and has incorporated SMART planning principles. See MEMORANDUM FOR COMMANDING GENERAL, U.S. ARMY CORPS OF ENGINEERS, SUBJECT: Revised Implementation Guidance for Section 1001 of the Water Resources Reform and Development Act of 2014, Vertical Integration and Acceleration of Studies as amended by Section 1330(b) of the WRDA of 2018, dated 25 March 2019.

1.3 NON-FEDERAL SPONSOR

CPRAB is the NFS pursuant to the FCSA executed on 14 January 2020. The NFS supports the implementation of the RP and is in basic agreement with the applicable model PPA that will be signed if the RP is approved and funded.

1.4 STUDY AREA

The study area encompasses all of St. Tammany Parish, which is approximately 1,124 square miles and located in southeastern Louisiana (see Figure 1-2). St. Tammany Parish is located on the northeast shore of Lake Pontchartrain and is home to over approximately 258,110 residents and 2,500 businesses. The hydrology is complex, and communities experience repeated damages from flood events, including, but not limited to, coastal rainfall, high tide, wave action and storm surge from coastal storms, and riverine flooding from localized rainfall events. The term “study area” and “St. Tammany Parish” are used interchangeably throughout this document.

The State of Mississippi, with the Pearl River, creates the eastern boundary. Lake Pontchartrain serves as the southern boundary. Tangipahoa Parish is located along the western boundary and Washington Parish is located along the northern boundary. The study area includes 36 hydrologic sub-basins, as defined by the United States Geological Survey (USGS) 12- digit hydrologic unit delineations (WBDHUC12).

Most of the population resides along the northern edge of Lake Pontchartrain, and many residents commute into New Orleans from Mandeville, Slidell, Covington, Abita Springs, Pearl River, and Madisonville. St. Tammany Parish is the fastest-growing parish in Louisiana and is one of the fastest-growing areas in the nation. Major industries include health care and social assistance, retail trade, professional, scientific, and technical services, construction, finance, and insurance.

The Big Branch Marsh National Wildlife Refuge (BBMNWR), the Bogue Chitto National Wildlife Refuge, and the St. Tammany Wildlife Refuge are located within St. Tammany Parish. The Fontainebleau State Park is also located within the parish.

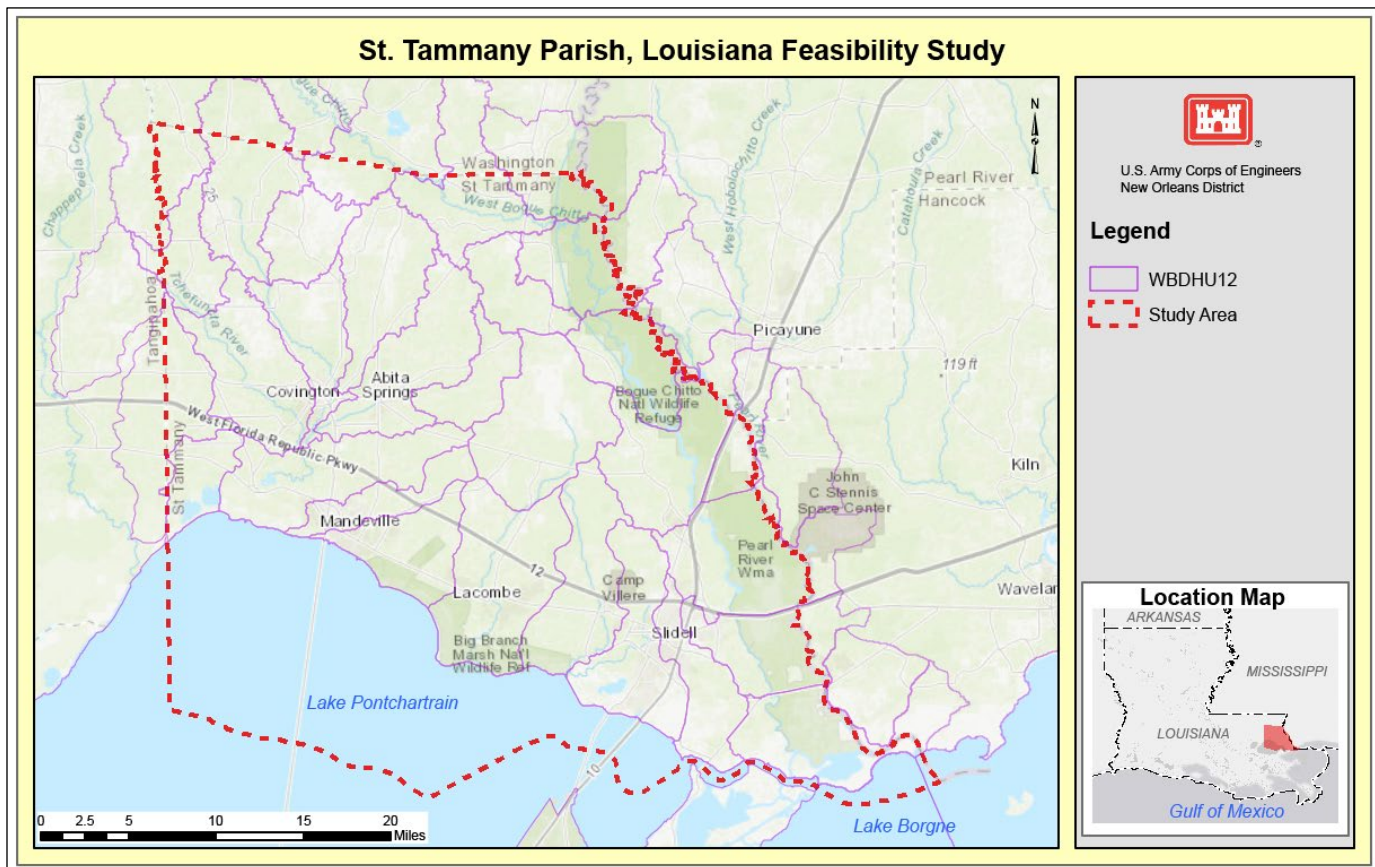


Figure 1-2. Study Area

Note: The U.S. Geological Survey Watershed Boundary Dataset (WBDHU12) was used to delineate the hydrologic sub basins with study area.

1.5 PROJECT AREA

Within the 36 sub-basins, 18 sub-basins have documented flooding, whether from coastal or riverine flooding and repetitive flood loss damages. Those 18 sub-basins comprise the project area and are listed and in bolded font in Table 1-1 and shown on Figure 1-3. The project area was examined to determine measures and alternatives that would address the needs of the area and provide opportunities to reduce risk from flooding.

Table 1-1. Hydrologic Subbasins

	Sub-Basin	Type of Flooding
1	Bayou Vincent-Bayou Bonfouca	Coastal (storm surge)/Rainfall
2	Ponchitolawa Creek-Tchefuncte River	Coastal (storm surge)/Rainfall (headwater Flooding)
3	West Pearl River-Pearl River	Rainfall (headwater and backwater)
4	Talisheek Creek	Rainfall
5	Savannah Branch-Tchefuncte River	Rainfall
6	Talleys Creek-Bogue Chitto	Rainfall
7	Upper Bogue Falaya River	Rainfall (headwater and backwater)
8	Bayou Castine-Cane Bayou	Coastal/Rainfall (headwater flooding)
9	Washley Creek	Rainfall
10	Soap and Tallow Branch-Tchefuncte River	Coastal/Rainfall (headwater flooding)
12	English Branch	Rainfall
13	Pearlington-Pearl River	Coastal/Rainfall
15	Warner Creek-Bogue Chitto	Rainfall
16	Lacombe Bayou	Rainfall (headwater flooding)
17	Middle River-Pearl River	Coastal/Rainfall
18	Big Branch Bayou-Lacombe Bayou	Coastal (storm surge)/Rainfall
19	Simalusa Creek	Rainfall
20	Bull Branch-Tchefuncte River	Rainfall
21	Pearl River Canal-Pearl River	Rainfall
22	Black River	Coastal/Rainfall
23	Salt Bayou	Coastal/Rainfall
24	Abita River	Rainfall (Headwater Flooding)
25	Rigolets-Pearl River	Coastal/Rainfall
26	Old Channel-Pearl River	Rainfall
27	Bedico Creek	Rainfall
28	Berrys Creek-Bogue Chitto	Rainfall
30	Bayou Chinchuba	Coastal/Rainfall (headwater flooding)
31	Lower Bogue Falaya River	Coastal/Rainfall
32	Second Alligator Branch-Pearl River	Rainfall
34	Wilson Slough-Pearl River	Rainfall
35	Liberty Bayou-Bayou Bonfouca	Coastal/Rainfall, (headwater and backwater flooding)
36	Little Bogue Falaya River	Rainfall

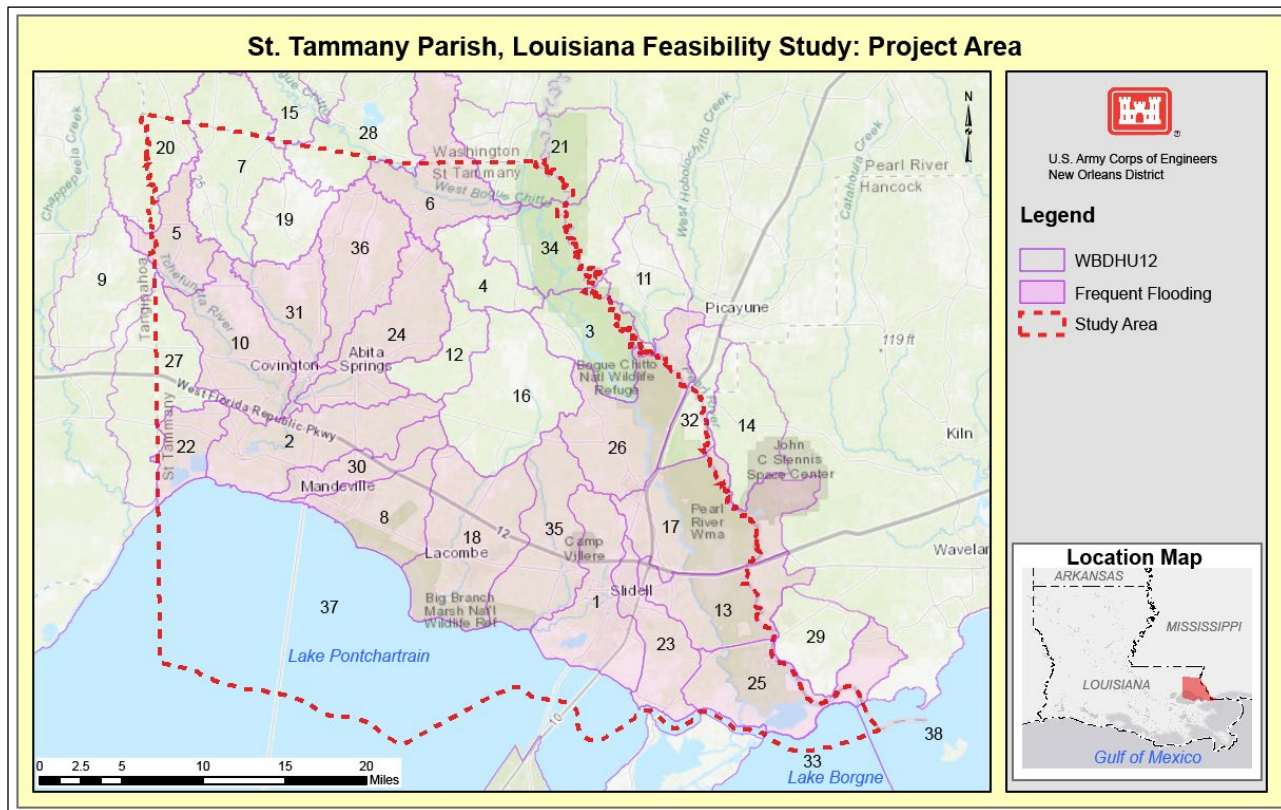


Figure 1-3. Project Area

Note: The U.S. Geological Survey Watershed Boundary Dataset (WBDHU12) (November 2019) is included to delineate the hydrologic sub basins. The highlighted WBDHU 18 sub-basins are documented areas of frequent flooding and repetitive loss.

1.6 PRIOR REPORTS, EXISTING WATER PROJECTS, AND ONGOING PROGRAMS

A number of studies and reports on water resources development have been prepared by USACE, and other federal, state, parish, and local agencies. Existing information and data collected during the plan formulation process was used in the development of problems, opportunities, management measures, and alternatives for the study.

1.6.1 Prior Reports and Existing Water Resource Development Projects

Information from existing documents listed in Table 1-2 was considered the most significant to identifying problems and formulating plans. Listed in Table 1-2, is the title of the document, date, and how the information was utilized in the study, including whether the information was used as a source of data for analysis, modeling, establishing future without project (FWOP) conditions, or included recommendations to inform the development of management measures in the study area. Existing studies and reports were reviewed to ensure consistency between the plan formulation under this study and other existing plans and reports for the area.

Table 1-2. Relevant Prior Reports and Studies

Year	Study/Report/Environmental Document Title	Data Source	Consistency	Structural Measures	Nonstructural Measures	FWOP Conditions
1958	USACE Tchefuncte River & Bogue Falaya Operations and Maintenance	×				
1986	USACE Pearl River Basin Interim Report on Flood Control	×		×		
1990	USACE Schneider Canal, Slidell, LA Hurricane Protection Reconnaissance Report	×	×	×		
1991	USACE Tangipahoa, Tchefuncte and Tickfaw Rivers Reconnaissance Report			×		
1992	St. Tammany Local Coastal Program	×				
1994	City of Slidell Master Drainage Plan		×			
1996	USACE Southeast Louisiana Flood Control Project (SELA) Includes 7 projects in St. Tammany: Schneider Canal Hurricane Levee; Mandeville Hurricane Protection; Lacombe Area Plan; Mile Branch Plan; Bayou Chinchuba Plan; and Slidell Area Plan (W-13, W-14, and W-15 Canals)		×	×	×	
1996	St. Tammany Parish, Louisiana Reconnaissance Study			×	×	
1996	USACE Southeast Louisiana Project St. Tammany Parish Technical Report	×	×	×		
1998	Coast 2050 Region 1 Strategy		×			
2003	St. Tammany Bayou Liberty Watershed Management Plan	×		×		
2004	St. Tammany Bayou Lacombe Watershed Management Plan	×				
2004	St. Tammany Bayou Tete L'Ours Watershed Management Plan	×				
2006	Comprehensive Habitat Management Plan for the Lake Pontchartrain Basin	×				
2006	St. Tammany Bayou Chinchuba Watershed Management Plan *	×				
2006	Bayou Liberty St. Tammany Parish LA	×				
2007	Louisiana Speaks Regional Plan LA		×			
2007	St. Tammany Parish Tchefuncte and Bogue Falaya Study	×				
2008	St. Tammany Analysis and Recommendations for Drainage Improvements	×				
2009	USACE Louisiana Coastal Protection and Restoration (LACPR) Final Technical Report			×		
2009	Update Natural Hazards Mitigation Plan St. Tammany Parish	×				
2010	St. Tammany Parish Hydrologic and Hydraulic Analysis of Bayou Lacombe Drainage Basin	×				
2011	Lake Pontchartrain Basin Foundation Northshore: Recommendations for Restoration and Conservation Report				×	

St. Tammany Parish, Louisiana Feasibility Study
Final Integrated Feasibility Report and Environmental Impact Statement

Year	Study/Report/Environmental Document Title	Data Source	Consistency	Structural Measures	Nonstructural Measures	FWOP Conditions
2012	Northshore Hurricane/Food Protection/Restoration Plan by G.E.C. Inc for St. Tammany and Tangipahoa Parish, CPRA Sponsor (PO-0074)	x	x	x	x	x
2012	Draft Southeast Louisiana Urban Flood Control Project W-14 Canal Improvements Section 533(D) Report Vol. 1 Vol. 2 Appendices	x	x			
2013	French Branch (W-15) and Doubloon Bayou Drainage Study for St. Tammany Parish	x		x		
2014	CPRA-St. Tammany Parish Watershed Management Study (PO-0151)	x		x	x	x
2015	Drainage Study and Cost Benefit Analysis for the Little Bayou Cistine Drainage Project	x				
2015	City of Mandeville Hazard Mitigation Plan		x			
2015	St. Tammany Parish Hazard Mitigation Plan Final		x			
2015	FEMA Little Bayou Cistine Drainage Improvements Study St. Tammany Parish	x				
2016	Flood Loss Outreach & Awareness Taskforce (FLOAT) Lake Pontchartrain, Louisiana Area Floodplain and Stormwater Management Program	x				
2016	Reducing Coastal Risk with a Lake Pontchartrain Surge Barrier	x		x		x
2016	USGS FEMA Characterization of Peak Streamflows and Flood Inundation of Selected Areas in Louisiana, Texas, Arkansas, and Mississippi from Flood of March 2016	x				x
2016	St. Tammany Parish Coastal Master Plan	x	x	x	x	x
2017	CPRA- Louisiana's Comprehensive Master Plan for a Sustainable Coast	x	x	x	x	x
2017	1077/1085 Regional Drainage Report St. Tammany Parish	x		x		x
2017	St. Tammany Parish Stormwater Management Plan (SWMP)			x		
2018	City of Covington Flood Response Plan		x			x
2018	Integrated Draft Feasibility and Environmental Impact Statement Pearl River Basin, Mississippi; Hinds and Rankin Counties, MS	x	x			
2019	St. Tammany Parish Watershed Management: Water Quality Impact Modeling Program	x				
2019	St. Tammany Parish Code of Ordinances		x			
2019	Coastal Wetlands Planning, Protection and Restoration Act	x			x	x
2020	St. Tammany Parish Coastal Protection (PO-167)	x	x	x	x	x
2020	St. Tammany Parish Multi-Jurisdictional Hazard Mitigation Plan Update 2020	x	x			
2023	CPRA- Louisiana's Comprehensive Master Plan for a Sustainable Coast	x	x	x	x	x

1.6.2 Existing Structural Flood Risk Reduction Features

The structural flood risk reduction features that are considered in the FWOP conditions are listed below and illustrated in Figure 1-4. All levees in Slidell are identified as existing levees. (Note: The only levee that is currently accredited by Federal Emergency Management Agency (FEMA) is the Lakeshore Levee, Slidell, Louisiana.) An accredited levee system is a system that FEMA has determined to meet the design, data, and documentation requirements of 44 CFR 65.10; it therefore can be shown on a Flood Insurance Rate Map as reducing the base flood hazard.

- Seawall, Mandeville, Louisiana
- Oak Harbor Levee, Slidell, Louisiana
- Kings Point East Levee, Slidell, Louisiana
- Kings Point West Levee, Slidell, Louisiana
- Lakeshore Levee Slidell, Louisiana (federally certified levee)

According to the National Levee Database (<https://levees.sec.usace.army.mil>), there are 4 existing levee systems in St. Tammany Parish:

- Oak Harbor Ring Levee (system ID 1605252002)
- Oak Harbor Ring Levee (system ID 1605252001), referred to as Lakeshore Estate in the study
- Kingspoint Ring Levees (system ID 1605252004), referred to as Kingspoint West in the study
- Voters Road Levee (system ID 300005009100), referred to as Kingspoint East in the study.

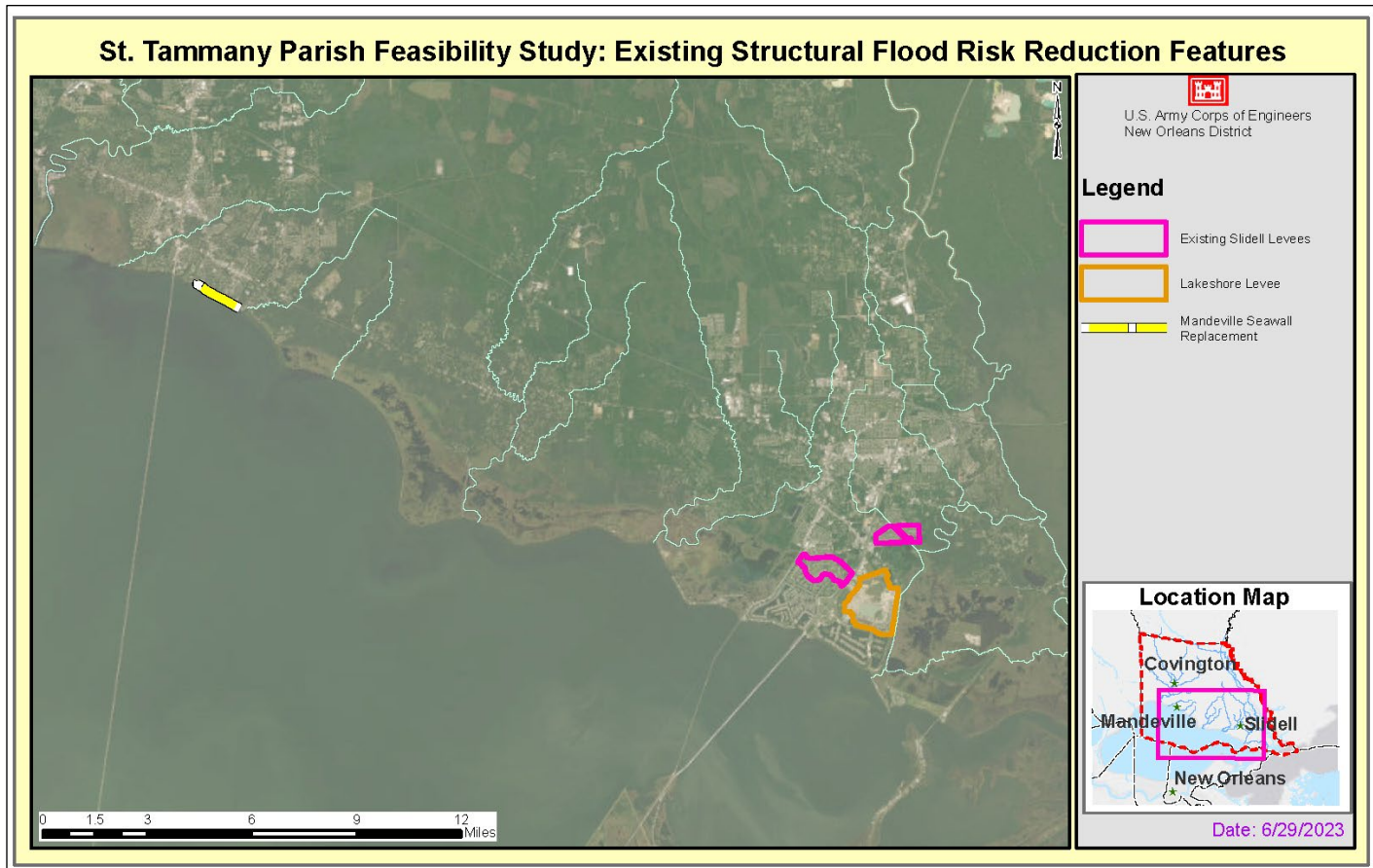


Figure 1-4. St. Tammany Parish Existing Structural Features

The St. Tammany Parish Government (STPG) has identified the following projects as having the potential to reduce flood risk in the study area:

- River Glen Drainage-in progress
- Abita River Regional Detention Pond
- Riverwood and Country Club Estates Drainage Improvements-completed
- Magnolia Drive Drainage
- Orleans Avenue Drainage
- Trinity Lane Drainage
- Lamarque St Drainage
- Little Bayou Castine Drainage Improvements
- Labarre St. Detention Pond and Channel Improvements-completed
- Chevreuil St Drainage
- Frenchmen Dr. & Lafitte Ct Drainage Improvements
- N. Pontchartrain Dr. Drainage
- Erindale Drainage
- Cypress Park Drainage Improvements-completed

- Ozone Woods Drainage Improvements-ongoing
- Oak Manor Drainage Feasibility-ongoing
- Ben Thomas Road Detention Pond
- Ben Thomas Rd. Subsurface & Sidewalk
- Robert Road Detention Pond Expansion
- Forest Brook and Quail Creek storage facilities and channel Improvements-completed
- Whisperwood pond excavation- complete
- Alton Drainage Improvement
- Graci Drive and Brier Lakes Culvert Improvements-completed.
- Northwood Village, Whisperwood & Eddins Canal
- Lake Village Drainage-completed
- Lower W-15 Area Detention Pond-complete
- Lower W-15 Widening
- Bayou Bonfouca Marsh Creation (PO-0104)-completed.
- Goose Point/Point Platte Marsh Creation (PO-0033)-completed.
- PO-51 Mandeville Aquatic Ecosystem Restoration-complete
- Tchefuncte Marsh Acquisition- Complete
- Guste Island Aquatic Ecosystem Restoration-complete
- PO-87, Madisonville Bulkhead
- West Pearl River Vegetative Plantings-complete
- Clearing and Snagging of the W-14 Canal from I-12 to Fremaux
- Canal Improvements from the downstream side of Fremaux to the upstream side of the Daney Street Bridge
- Improvements to the existing canal from the downstream side of the Daney Street Bridge to the upstream side of the I-10 Bridge.
- West Diversion Pond located on the west side of U.S. Route 11 near North Boulevard
- Louisiana Watershed Initiative project - city of Covington and Avery Estates Buyout Program

Not all of the above-listed local drainage projects are sizable enough to be captured in the engineering hydrology and hydraulic (H&H) modeling conducted for the study. Additional information regarding what was included in the H&H modeling is located in Appendix E: Hydrologic & Hydraulics.

1.6.3 Ongoing Programs and Projects

Major ongoing programs and/or projects in the state of Louisiana are described below.

Louisiana Watershed Initiative: Floodplain issues in Louisiana have historically been managed within political jurisdictions, often without the mechanisms to consider the effects on other jurisdictions or the surrounding watershed. Furthermore, agencies often operate with numerous mandates and responsibilities related to floodplain management that are outlined in codes, statutes, or federal laws. In 2018, Executive Order JBE18-16 was issued in Louisiana, creating the Council on Watershed Management comprising the Office of

Community Development, Coastal Protection and Restoration Authority, Governor's Office of Homeland Security and Emergency Preparedness, Department of Transportation and Development (LaDOTD), and the LDWF.

The State of Louisiana is developing the statewide Louisiana Watershed Initiative to address FRM with a coordinated, coherent, and long-term vision for sustainability and resilience. The Louisiana Watershed Initiative is developing computer models to better understand flood risk and help with the selection of projects best suited for investment in each watershed region as well as ongoing efforts to address compound flooding (surge and rain). The USACE has been engaged in the ongoing efforts to address compound flooding.

(<https://www.watershed.la.gov/>)

The CEMVN and Vicksburg Districts have been in coordination with the State of Louisiana Council on Watershed Management and entered into a Memorandum of Understanding between USACE and the State of Louisiana, Council on Watershed Management on 3 December 2020, to allow for USACE collaboration and technical assistance as part of the local, state, and federal agency and stakeholder effort to create a Comprehensive Statewide Watershed-Based Floodplain Management Plan. Additionally, the PDT coordinated with the Louisiana Watershed Initiative (LWI) through the NFS to ensure coordination regarding the Watershed Initiative activities in St. Tammany Parish. To date, there have been no products developed from the initiative that could be incorporated into this study, but the PDT will continue coordination efforts as the study and the LWI progress. If new data becomes timely available, it would be incorporated into the FIFR-EIS. On 23 March 2021, Governor Edwards announced that \$10 million in Community Development Block Grant Mitigation funding from the LWI would be allocated toward NS projects in St. Tammany Parish. The PDT is in coordination with the NFS regarding allocation and implementation of these NS projects and how this work supplements the efforts of this study.

USACE Southeast Louisiana Urban Flood Control Project (SELA): As a result of the extensive flooding in May 1995, Congress authorized SELA with enactment of Section 108 of the Energy and Water Development Appropriations Act for Fiscal Year 1996 (EWDAA 1996) and Section 533 of the Water Resources Development Act of 1996 (WRDA 1996), as amended, to provide for flood control and improvements to rainfall drainage systems in Jefferson, Orleans, and St. Tammany Parishes, Louisiana. Seven projects were authorized under the SELA program in St. Tammany Parish in 1996, pending a study (known as a 533d report) to confirm they are technically sound, environmentally acceptable, and economically justifiable (BCR greater than 1.0). Those projects include Schneider Canal Hurricane Protection; Mandeville Hurricane Protection; Lacombe Area Plan; Abita Area Plan; Mile Branch Plan; Bayou Chinchuba Plan; and Slidell Area Plan (W-13, W-14, and W-15 Canals). Figure 1-5 shows the seven SELA authorized projects within St. Tammany Parish.

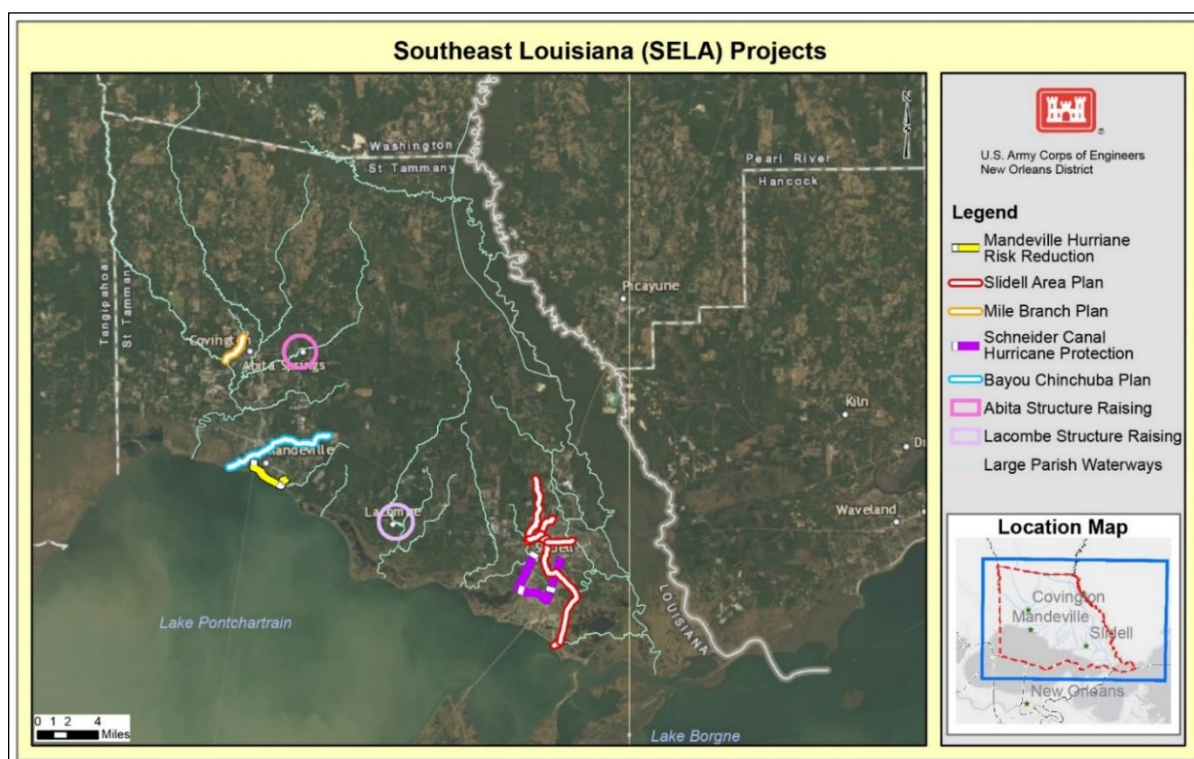


Figure 1-5. SELA Projects Map

Of the seven potentially authorized SELA Projects in St. Tammany Parish, only the W-14 SELA Project in Slidell has an approved 533(d) report from March 2012 with a recommended plan that has been found to be technically sound, environmentally acceptable, and economically justifiable. Because the W-14 project has an approved 533d report, it was excluded from plan formulation under this study. An economic update on the W-14 project is currently underway. Analysis of the other six projects were included as part of plan formulation and included as potential measures and alternatives because the original SELA projects were over 30 years old, and it was expected that conditions in the study area might have changed.

After this study was underway, efforts to develop a 533d report for the SELA Schneider Canal hurricane protection project were initiated, but there is currently no funding to proceed. There is significant overlap in the larger St. Tammany study area with the smaller SELA Schneider Canal study area. This study evaluated a comprehensive plan for the parish, whereas, the SELA Schneider Canal 533d study is much more limited in scope and study area. If funding is received, the SELA Schneider Canal study PDT would evaluate the recommended alignment included in the Schneider Canal Hurricane Protection Reconnaissance Report dated May 1990. Coordination between the two study PDTs, Office of Counsel, and leadership would continue to determine the linkages between the two studies if the SELA Schneider Canal 533d study moves forward.

Coastal Protection and Restoration Authority: Following Hurricanes Katrina and Rita in 2005, the Louisiana legislature created the Coastal Protection and Restoration Authority (CPRA) and tasked it with coordinating the local, state, and federal efforts to achieve comprehensive coastal protection and restoration. To accomplish these goals, CPRA was charged with developing a coastal master plan. <http://coastal.la.gov/> Louisiana's Comprehensive Master Plan for a Sustainable Coast (Master Plan), updated in 2023. The 2023 Master Plan sets forth a path to create a more sustainable coastal Louisiana landscape. The Master Plan includes protection and restoration goals for reducing coastal flood risk, promoting sustainable ecosystems by providing habitats for a variety of commercial and recreational activities, and support for regional and national business and industry. The 2023 Master Plan recommends a diversity of projects to build land and reduce flood risk to balance short-term needs with long-term goals. The PDT has been in contact with the CPRA Master Plan team to better ensure coordination and consistency between this study and the 2023 Master Plan.

Structural and NS projects contained in the 2023 Master Plan that are in the study area and were included in the development of management measures and alternatives are:

Lake Pontchartrain barrier (Project No. 001. HP.08)

- Construction of closure gates and weirs to an elevation of 2 feet North American Vertical Datum of 1988 (NAVD 88) across the passes at Chef Menteur and the Rigolets for storm surge risk reduction within the Lake Pontchartrain Basin.

Slidell ring levees (Project No. 001. HP.13)

- Construction and improvement of a levee to an elevation between 13 to 17 feet NAVD88 around the city of Slidell. Project features approximately 76,000 feet of earthen levee, approximately 11,000 feet of T-wall, a 30-foot barge gate, a 180-foot barge gate, a 220-foot barge gate, a 20-foot stop log gate, and a 30-foot stop log gate.

St. Tammany NS risk reduction (Project No. STT.01N)

- Project includes flood proofing non-residential properties where 100-year flood depths are 1-3 feet, elevating residential properties where 100-year

flood depths are 3-14 feet, and acquiring residential properties where 100-year flood depths are greater than 14 feet.

Tchefuncte River Reduction Restoration (ID# 318)

- Restoration of approximately 3,600 feet of historic ridge at the mouth of the Tchefuncte River to provide coastal upland habitat, restore natural hydrology, and provide wave and storm surge attenuation.

Fritchie Marsh Restoration (ID# 249)

- Creation of marsh within a footprint of approximately 4,400 acres in St. Tammany Parish along the eastern Lake Pontchartrain shoreline to create new wetland habitat, restore degraded marsh, and reduce wave erosion.

The PDT is also coordinating with other governmental entities on flood risk reduction studies in the Parish. (See e.g., Table 1-2, PO-167 St. Tammany Parish Coastal Protection).

SECTION 2

Problems and Opportunities (Purpose and Need)

2.1 PURPOSE AND NEED

The study area encompasses all of St. Tammany Parish, which is approximately 1,124 square miles and located in southeastern Louisiana (see Figure 1-2). The study area has experienced repeated, widespread flooding from both rainfall and coastal storm flood events (i.e., riverine bank overtopping, drainage, and storm surge) including historic flood impacts during Hurricane Katrina (August 2005) and the flood of August 2016. The flood events caused major disruptions, damages, and adverse economic impacts to the parish. The sources of flooding vary across the parish and drainage subbasins. Figure 2-1 shows repetitive loss areas, flood zones, and frequently flooded roads and also the areas that experience coastal flooding and/or riverine flooding. The purpose of the study is to identify flood risk reduction measures that contribute to the NED in a manner that is consistent with protecting the Nation's environment, and that complies with environmental laws and regulations, applicable Executive Orders (EOs), and other federal planning requirements.

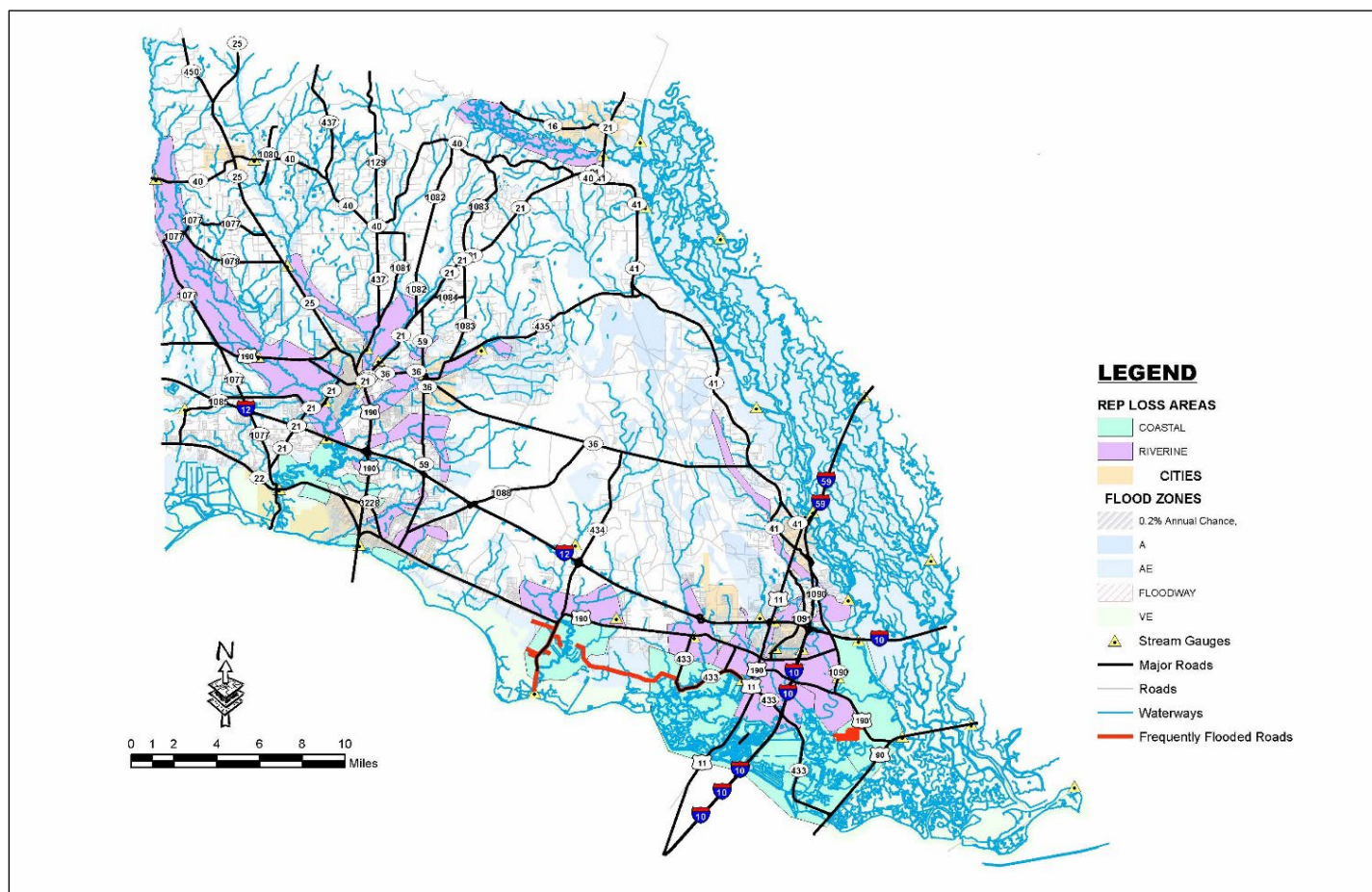


Figure 2-1. St. Tammany Parish- Repetitive Loss Areas, Flood Zones, and Frequently Flooded Roads. (Source STPG 2020)

Figure 2-1 shows the areas with repetitive loss from both coastal and riverine sources. The various flood zones are shaded and include the areas with a 0.2 percent change of annual flooding, those in a designated A zone with hazards from erosion and waves >3 feet without a Base Flood Elevation (BFE), those designated to be in an AE zone (Low-lying areas that have a high risk) with a BFE; those designed to be in a floodway, and those in a VE zone (Coastal High Hazard Area) that has additional hazards from storms and waves >3 feet. For additional information on the elevation of surface water and the flood zones please see www.FEMA.gov.

2.2 OPPORTUNITIES

Step 1 of the Planning Process: Identifying Problems and Opportunities.

The planning process begins with identifying the problems and opportunities in the study area. It was important to understand the flooding issues and what was driving those issues. Once there was an understanding of the problems in the watershed, study objectives were defined describing the potential results that a federal project could achieve and the constraints that could limit achieving potential solutions.

St. Tammany Parish has experienced repeated, widespread flooding (Figure 2-2) from rainfall and riverine bank overtopping, and storm surge, including historic impacts during Hurricane Katrina in August of 2005 and recently with the flood of August 2016. Hurricane Katrina damaged over 48,000 residential structures, causing \$1.45 billion in damages ([U.S. Department of Housing and Urban Development 2006](#)). The flood of August 2016, in St. Tammany Parish, caused flood damage to approximately 900 businesses and 8,000 employees, together with impacts to transportation along both I-10 and I-12. ([Louisiana Economic Development 2016](#)), and caused major disruptions, damages, and economic impacts to the parish.



Figure 2-2. Flooding in St. Tammany Parish

Source: St. Tammany Parish Government, Covington, LA March 2016

Flood damages from riverine flooding, rainfall, and coastal storm surge are experienced in the study area. FRM seeks to reduce flood risks from rainfall by managing the floodwaters to reduce the probability of flooding, managing the floodplains to reduce the consequences of flooding, and by making improvements to the local drainage infrastructure and systems. CSRM includes methods to reduce storm damages and sustain the Nation's coastlines. Planning for future storm systems and sea level and shoreline changes are Planning for future storm events and climate preparedness and resilience are methods to reduce the risk of flood damages caused by coastal storms, including inundation, waves, and erosion.

Table 2-1 provides a summary of the disaster declaration events in St. Tammany Parish (St. Tammany Parish Hazard Mitigation Plan 2020) caused by flooding from rainfall and/or coastal storm events. Tropical cyclones (hurricanes) are the most hazardous type of flood event, primarily due to storm surge. Flooding also frequently occurs from non-hurricane events, such as flash floods, which can cause heavy rainfall flooding (St. Tammany Parish 2020). Section 3.2.2.1.4 provides information regarding the Federal Emergency Management Agency (FEMA) flood statistics for the study area.

Table 2-1. St. Tammany Parish Flood Events and Major Disaster Declarations (2020 St. Tammany Parish Hazard Mitigation Plan Table as Updated by USACE)

Date	Event	Date	Event
Aug-65	Hurricane Betsy	Aug-02	Tropical Storm Bertha
Aug-69	Hurricane Camille	Sep-02	Hurricane Isidore
Apr- 73	Severe Storms and Flooding	Oct-02	Hurricane Lili
Apr-77	Drought and Freezing	Sep-04	Hurricane Ivan
Apr-79	Heavy Rainfall	Aug-05	Hurricane Cindy
Apr-80	Heavy Rainfall	Aug-05	Hurricane Katrina
Dec-82	Heavy Rainfall	Sept-05	Hurricane Rita
Jan-83	Heavy Rainfall	Jan-06	Heavy Rainfall
Mar-83	Heavy Rainfall	Oct-07	Heavy Rainfall
Apr-83	Heavy Rainfall	May-08	Heavy Rainfall
Aug-85	Hurricane Danny	Aug-08	Tropical Storm Fay
Nov-85	Hurricane Juan	Sep-08	Hurricane Gustav
Feb-88	Heavy Rainfall	Sep-08	Hurricane Ike
Apr-88	Heavy Rainfall	Apr-09	Heavy Rainfall
Jun-89	Heavy Rainfall	Oct-09	Heavy Rainfall
May-91	Heavy Rainfall	Nov-09	Heavy Rainfall
Aug-92	Hurricane Andrew	Nov-09	Hurricane Ida
Feb- 93	Severe Storm, Flood	Dec-09	Heavy Rainfall
Apr-95	Heavy Rainfall	Sept-11	Tropical Storm Lee
May-95	Heavy Rainfall	Aug-12	Hurricane Isaac
Oct-95	Hurricane Opal	Mar-16	Heavy Rainfall
Aug-96	Heavy Rainfall	Oct-17	Hurricane Nate
Oct-96	Coastal Flooding	Aug-19	Hurricane Barry
Jan-98	Heavy Rainfall	May-20	Heavy Rainfall
Mar-98	Heavy Rainfall	Jun -20	Tropical Storm Cristobal
Sep-98	Tropical Storm Frances	Oct-20	Hurricane Zeta
Sep-98	Hurricane Georges	July-21	Heavy Rainfall
Jun-01	Heavy Rainfall	Sept-21	Hurricane Ida
Jun-01	Tropical Storm Allison		

2.1.1 Problems within the Study Area

The study area has experienced repeated, widespread flooding from both rainfall and coastal storm flood events (i.e., riverine bank overtopping, drainage, and storm surge) including historic flood impacts during Hurricane Katrina (August 2005) and the flood of August 2016. The flood events caused major disruptions, damages, and adverse economic impacts to the parish. Different locations throughout the study area experienced different flood damages since the sources of flooding vary across the parish and drainage subbasins. Figure 2-2 shows repetitive loss areas, flood zones, and frequently flooded roads and also the areas that experience coastal flooding and/or riverine flooding. The flooding within the study area has been described in prior studies, such as the 2012 Northshore Flood Protection Plan prepared by Gulf Engineering and Consultants, as excerpted and set forth below.

Tropical storms and hurricanes produce coastal and inland flooding. Within five miles of Lake Pontchartrain, flooding occurs as a result of intense rainfall, abnormally high tides in the lake, hurricanes or lesser tropical storms, or any combination of these events. Coastal flooding is produced by storm surges from the lake, with the capacity to produce waves greater than 15 feet that inundate the extensive low-lying coastal area in the parish and the lower portions of the Pearl River floodplain.

In the areas not adjacent to the lake, flooding occurs from periodic intense rainfall causing overflow of rivers and streams. Flooding occurs when the drainage system is unable to adequately convey the water produced by rainfall events. Flooding occurs on the floodplains of the streams that comprise the major drainage basins in the parish (Tchefuncte, Bayou Chinchuba, Little Bayou Castine, Bayou Castine, Cane Bayou, Bayou Lacombe, Bayou Bonfouca, W/14/W15 and Gum Bayou Basin). Smaller watersheds flood more quickly. The larger Pearl River watershed responds more slowly to runoff, and the duration of flooding tends to be much longer. Water tends to pond in the flat areas of the parish and to run off slowly, resulting in localized flooding conditions.

Natural drainageways have been disrupted in developed areas, and impervious surfaces increase the runoff. All of these conditions are aggravated by channel obstructions. These watershed conditions mean that the parish is faced by longer-lasting overbank flooding from the larger rivers and quick or “flash” stormwater flooding in areas where the runoff overloads the drainage system. The first occurs primarily because of rain falling upstream in the watershed, and the second occurs by rain falling in the affected area. Because overbank flooding takes longer to occur, there may be advance warning time; but there is very little warning of local stormwater flooding. [2012 Northshore Flood Protection Plan](#)

Additional flood risk information is contained in the [2014 St Tammany Parish Watershed Management Plan](#).

The problems identified by the PDT for this study include:

- Increasing risk to people from catastrophic flooding events;
- Increasing risk of damage to residential and commercial property;
- Critical infrastructure is expected to become more at risk of damage from potential floods; critical infrastructure throughout the study area includes the I-10, I-12, and I-59 transportation system and evacuation routes, Government facilities, hospitals, critical infrastructure, and schools;
- Economic losses from flooding to industrial and commercial structures and businesses;
- Increasing risk to historically significant structures in the study area;
- Development has led to increased flooding;
- Degradation of local channels and banks stability contribute to upstream and downstream flooding;
- Degrading natural flood protection:
 - Diverse ecologically and important habitat within the study area is being lost and degraded due to saltwater intrusion, waves, subsidence, storm surge, and development.
 - Sea level rise and subsidence are expected to increase in the future, causing more frequent storm surge inundation and flood events.

2.1.2 Opportunities for this Study

The opportunities identified to address the afore-stated study area problems include:

- Public Safety - Decrease risk to public safety during flood events;
- Flood Damages - Reduce the flood risks and damage to public, commercial, and residential property, real estate, and infrastructure;
- Community Resilience - Improve the communities' ability to prepare for, mitigate, and recover from flood events;
- Transportation and Evacuation - Increase the reliability of the national transportation corridors (I-10, I-12, and I-59) by providing alternatives that would potentially lessen damages to roads and interstates; reduce flooding on roadways used as evacuation routes during flood events;
- Natural Resources - Protect the function and increase the resiliency of the ecosystem to reduce flood damages.

2.3 PLANNING GOALS AND OBJECTIVES

Based on the documented problems, the overall goal of the study is to reduce the severity of flood damages and associated risks to public health and safety, caused by heavy rainfall, riverine flooding, coastal storms, and hurricanes. The federal objective of water and related land resources project planning is to contribute to NED in a manner that is consistent with protecting the Nation's environment, and that is in compliance with NEPA, and other environmental laws and regulations, applicable Executive Orders (EOs), and other federal planning requirements. Planning objectives represent desired positive changes to future

conditions. See Appendix B: Plan Formulation for additional information regarding the linkages between the problems, opportunities, and planning objectives for this study.

Planning Objectives:

Objective 1: Reduce the risk to public health and safety by reducing flood impacts to structures and critical infrastructure in St. Tammany Parish.

- Metric(s) to evaluate objective: water surface elevation (WSE), structure impacts, impacts to population.

Objective 2: Reduce flood damage to structures (i.e. businesses, residential, commercial, and public structures) from flooding in St. Tammany Parish.

- Metric(s) to evaluate objective: WSE, annualized damages, structure impacts.

Objective 3: Reduce interruption, to the maximum extent practicable, to the Nation's transportation corridor and evacuation routes e.g. the I-10, I-12, and the I-59 interchange in St. Tammany Parish.

- Metric(s) to evaluate objective: road inundation.

2.4 PLANNING CONSTRAINTS

A planning constraint is a restriction that limits plan formulation or that plan formulation must work around. It is a statement of things that the alternative plans should avoid. The planning constraints identified in the study area include the following:

- Measures must meet minimum flow (800 cubic feet per second for a 10 percent chance flood) and drainage area (1.5 square. miles) requirements (ER 1165-2-21).
- Avoid direct or indirect support of floodplain development (in accordance with EO 11988), wherever there is a practicable alternative.
- Avoid locating project features on lands known to have hazardous, toxic, and radioactive waste (HTRW) and/or related concerns.

Additional considerations in the plan formulation process included:

- Avoid and minimize impacts to threatened and endangered species and their critical habitats;
- Avoid and minimize impacts to managed habitats such as essential fish habitat (EFH);

Avoid and minimize impacts to established recreational areas;

- Avoid and minimize impacts to viewshed;

- Avoid and minimize impacts to historic places and cultural resources.

SECTION 3

Inventory and Forecast Conditions Affected Environment

The President's Council on Environmental Quality (CEQ) regulations (40 CFR Part 1500 *et seq.*), promulgated to implement NEPA provides guidance for the preparation of NEPA documents. Section 1502.15 of the CEQ regulations states that Affected Environment section of an EIS shall contain data and analysis "commensurate with the importance of the impact, with less important material summarized, consolidated, or simply referenced." This Section of the report describes the existing conditions of the affected environment within the study area as well as project area. Included in this Section are descriptions of the relevant resources, among others, that may be affected by the RP such as wetlands, fisheries, essential fish habitat, threatened and endangered species, social-economic environment, and environmental justice.

3.1 EXISTING CONDITIONS

3.1.1 Geography

St. Tammany Parish (study area) is located in the southeast portion of Louisiana, on the northern shore of Lake Pontchartrain. It is bordered to the north by Washington Parish, to the west by Tangipahoa Parish, to the south by Jefferson and Orleans Parishes, and to the east by the Pearl River, which forms the natural border between southeastern Louisiana and southern Mississippi. St. Tammany Parish has a surface area of approximately 715,652 acres, of which approximately 52 percent (373,226 acres) is water or wetlands (STPS HMP, 2020). St. Tammany Parish contains eight incorporated communities: the Villages of Folsom and Sun; the towns of Abita Springs, Madisonville, and Pearl River; and the cities of Covington, Mandeville, and Slidell. Covington, the parish seat, is located in the central-eastern part of the parish and is the second most populous municipality in the parish behind the City of Slidell.

Critical infrastructure includes numerous hospitals, schools, and local government facilities. Interstates I-10 and I-12 connect the parish with the State of Mississippi and the cities of Baton Rouge and New Orleans, serving as a major transportation corridor through Louisiana. The Lake Pontchartrain Causeway (Causeway) connects the town of Mandeville directly with the greater New Orleans area in Metairie (Jefferson Parish).

3.1.2 Topography

The topography of St. Tammany Parish varies from gently rolling to low lying wetlands, with the highest elevation of 262 feet found in the northwestern portion of the parish and steadily decreases moving to the south and to the east. The lowest elevations are found along the Northshore of Lake Pontchartrain as well as south and east of Slidell, LA at a low of -22 feet.

3.1.3 Land Use

The land use of the Lake Pontchartrain Basin is both rural and urban and is the most densely populated region in Louisiana and includes metro New Orleans and the state capital, Baton Rouge. It is one of the largest estuarine systems in the Gulf of Mexico containing over 22 essential habitats. St. Tammany Parish is one of 16 parishes within the Lake Pontchartrain Basin.

3.1.4 Land Cover

Land cover within the parish varies widely based on elevation. The areas of higher elevation generally to the north contain upland habitats consisting of mixed scrub-shrub, mixed upland forests, evergreens, open fields/agricultural lands, and the lower lying areas of the parish to the south and east consist of wetlands, bottomland hardwoods, pine savanna/flatwoods. Reference Figure 3-1 for current habitat data within the parish.

St. Tammany Feasibility Study: Louisiana Habitat Data (Recommended Plan)

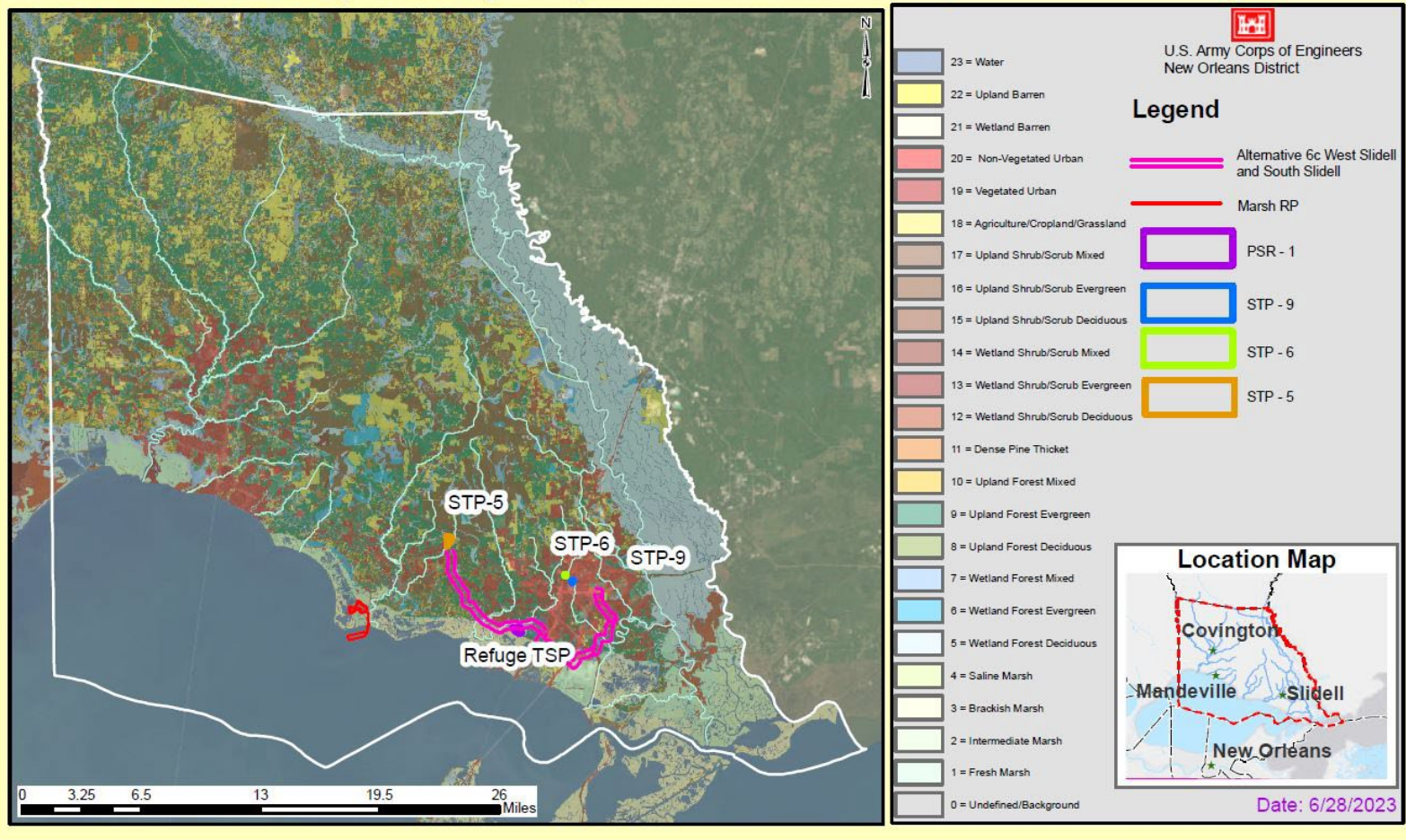


Figure 3-1. Habitat Data in St. Tammany Parish

3.1.5 Geomorphic and Physiographic Setting

The study area is located within the Mississippi Alluvial Plain of the Mississippi Alluvial and Southwest USA Coastal Plains ecoregion as defined by Omernik (1987,1995, 2004, 2014). This riverine ecoregion extends from southern Illinois at the confluence of the Ohio River with the Mississippi River, south to the Gulf of Mexico. The study area consists of four physiographic areas: the forested terrace uplands, used mainly for woodland and pastureland; the broad terraces or Gulf Coast Flatwoods, used mainly for woodland; the narrow flood plains of major streams, used for woodland and wildlife habitat; and the marshes and swamps, used mainly as habitat for wetland wildlife and for recreation.

3.1.6 Climate

The Mississippi Alluvial Plain ecoregion has a mild mid-latitude humid subtropical climate. Winters are generally mild and summers are hot and humid reflecting the subtropical nature typical for the region. Variations in daily temperature are fairly consistent throughout the

parish, although small differences can be attributed to the proximity to Lake Pontchartrain, and to a much lesser degree, the differences in elevation between the northern and southern portions of the parish. The average annual temperature for the state as a whole is 68°F. January is typically the coldest month for Louisiana, averaging approximately 51°F, while July is typically the warmest at an average of 82°F. Winter months are usually mild with cold spells of short duration. For St. Tammany Parish in particular, the summer months are usually quite warm, with an average daily maximum temperature in July and August of 92°F. Winters are typically mild, with snowfall averages less than one inch per year. Average annual rainfall for the area is 55.45 inches. St. Tammany Parish is susceptible to the normal weather dangers, but due to its location within the state and its proximity to Lake Pontchartrain and the Gulf of Mexico, the parish is extremely susceptible to tropical cyclones and storm surge inundation (National Climatic Data Center).

Projections of storm frequencies for the updated 2023 Atlantic Hurricane Season calls for a 70 percent probability for each of the following ranges of activity during the 2023 hurricane season, which officially runs from 01 June through 30 November (NOAA Climate Prediction Center)

- 14-21 named storms
- 6-11 Hurricanes
- 2-5 Major hurricanes
- Accumulated Cyclone Energy (ACE) range of 105%-200% of the median, which includes the ACE from the 5 named storms (1 of which reached hurricane strength) recorded thus far in 2023.

By 28 November 2023, the 2023 Atlantic Hurricane Season saw a total of 20 storms, 19 of which were named. Seven of the storms were hurricanes with three intensifying to major hurricanes.

Table 3-1 presents the average annual number of North Atlantic Basin tropical storms and major hurricanes (NOAA, NHC).

Table 3-1. North Atlantic Basin Tropical Storms and Major Hurricanes based on the Plausible Range of Future Tropical Storm Frequency

	1991-2020 Average
Named Storms	14
Hurricanes	7
Major Hurricanes*	3

Recent assessments (NOAA, 2023) on tropical cyclones and climate changes by scientists with NOAA, indicate that tropical cyclone intensities globally are projected to increase (*medium to high confidence*) on average (by 1 to 10% according to model

projections for a 2 degree Celsius global warming). This change would imply an even larger percentage increase in the destructive potential per storm, assuming no reduction in storm size. Storm size responses to anthropogenic warming are uncertain. The global proportion of tropical cyclones that reach very intense (Category 4 and 5) levels is projected to increase (medium to high confidence) due to anthropogenic warming during the 21st century. There is less confidence in future projections of the global number of Category 4 and 5 storms, since most modeling studies project a decrease (or little change) in the global frequency of all tropical cyclones combined.

The USACE 2021 Climate Action Plan and 2022 Climate Adaptation Plan Progress Report outlines how to develop, implement, and assess adjustments or changes in operations and decision environments to enhance resilience or reduce vulnerability of USACE projects, systems, and programs to observed or expected changes in climate. The Climate Action Plan has 5 main priority adaptation actions planned: Modernizing USACE programs and policies to support climate-resilient investments, Managing USACE lands and waters for climate preparedness and resilience, Enabling state, local, and tribal government preparedness, Providing actionable climate information, tools and projections, and Planning for climate change-related risks to USACE missions and operations. The Action and Adaptation Plans are designed to evaluate the most significant climate change related risks to, and vulnerabilities in, agency operations and mission in both the short and long term, while also addressing how USACE would address vulnerabilities.

The PDT complied with EO 13990 issued 20 January 2021 to “bolster resilience to the impacts of climate change” through consideration of climate change in the plan formulation process and in the engineering analysis. As an example, the rainfall and coastal flood risk analyses incorporated projected sea level rise. The rainfall flood risk analysis included a higher downstream boundary water level (representative of higher future sea levels in Lake Pontchartrain and the Gulf of Mexico); the coastal flood risk data used a higher starting water level that represents future sea level rise, which results in higher storm surge values in the future. For more detailed information on the Hydrologic and Hydraulic modeling see Appendix E: Hydrologic & Hydraulics.

Engineering regulation (ER) 1100-2-8162 provides guidance for incorporating direct and indirect physical effects of projected future sea level change (SLC) across the project life cycle in managing, planning, engineering, designing, constructing, operating, and maintaining USACE projects and systems of projects. Potential relative sea level change must be considered in every USACE coastal activity as far inland as the extent of estimated tidal influence. Relative sea level change (RSLC) was considered. The intermediate scenario was used in the quantitative analysis of the Final Array of Alternatives. Changes in storm surge and wave values from higher sea levels (in the form of starting water levels in the coastal model) are included. Higher starting water levels resulted in higher surge values for a given frequency.

USACE policy in ER 1100-2-8162, requires that sea level change be considered in project formulation. In particular, the policy requires that alternatives be evaluated such that an alternative that performs best across the full range of plausible future conditions should

generally be selected over an alternative that only performs well under one of the scenarios. For alternative section, the PDT should demonstrate that uncertainty over future sea level conditions does not constitute uncertainty over which alternative would perform the best in the future. Further discussion on how climate change was considered can be found in Section 6.7 and Appendix E: Hydrologic and Hydraulics.

Temperatures in Southeast Louisiana have increased approximately 0.5 degrees Fahrenheit over the past century (EPA, 2016). Climate patterns in Louisiana are forecasted to see continued warming of temperature, and a corresponding increase in severe flooding events and droughts. Increasing sea temperatures are expected to result in the increased likelihood of more intense tropical storm events, as well as accelerating land loss and decline of coastal marsh (EPA 2016).

3.1.7 Hydrology

The study area is located within the Pontchartrain Basin of southeast Louisiana (Figure 3-2). The Pontchartrain Basin is 10,000 square miles and encompasses 16 Louisiana parishes (USGS.gov) of which St. Tammany Parish is one. Three large lakes, Maurepas, Pontchartrain, and Borgne cover 55 percent of the basin. It is one of the largest estuarine systems in the Gulf of Mexico, containing over 22 important habitat types. Lakes Maurepas, Pontchartrain, and Borgne form a shallow brackish receiving basin for fresh water from the Amite, Tickfaw, Blind, Tangipahoa, Tchefuncte, and Pearl Rivers, as well as Bayous Lacombe and Bonfouca. Fresh water is also introduced through regional drainage canals while salt water enters these lakes from the Gulf of Mexico via Mississippi and Chandeleur Sounds and Chef and Rigolets Passes.



Figure 3-2. Lake Pontchartrain Basin

St. Tammany Parish is comprised of 10 major watersheds and 36 hydrologic subbasins as defined by the USGS 12-digit hydrologic unit delineations. Figure 3-3 illustrates the subbasins. The area has complex hydrology and experiences repeated damages from various types of flood events, including, but not limited to storm surge, wave action, rainfall, riverine, and high tide.

The watersheds include the Pearl River, Gum Bayou, W-14/W-15 basin, Bayou Bonfouca, Bayou Lacombe, Bayou Cane, Bayou Castine, Little Bayou Castine, Bayou Chinchuba, and the Tchefuncte River. Figure 3-3 depicts the hydrologic units (subbasins) and highlights the project areas receiving major flooding. Table 3-2 lists the subbasins and the types of flooding experienced.

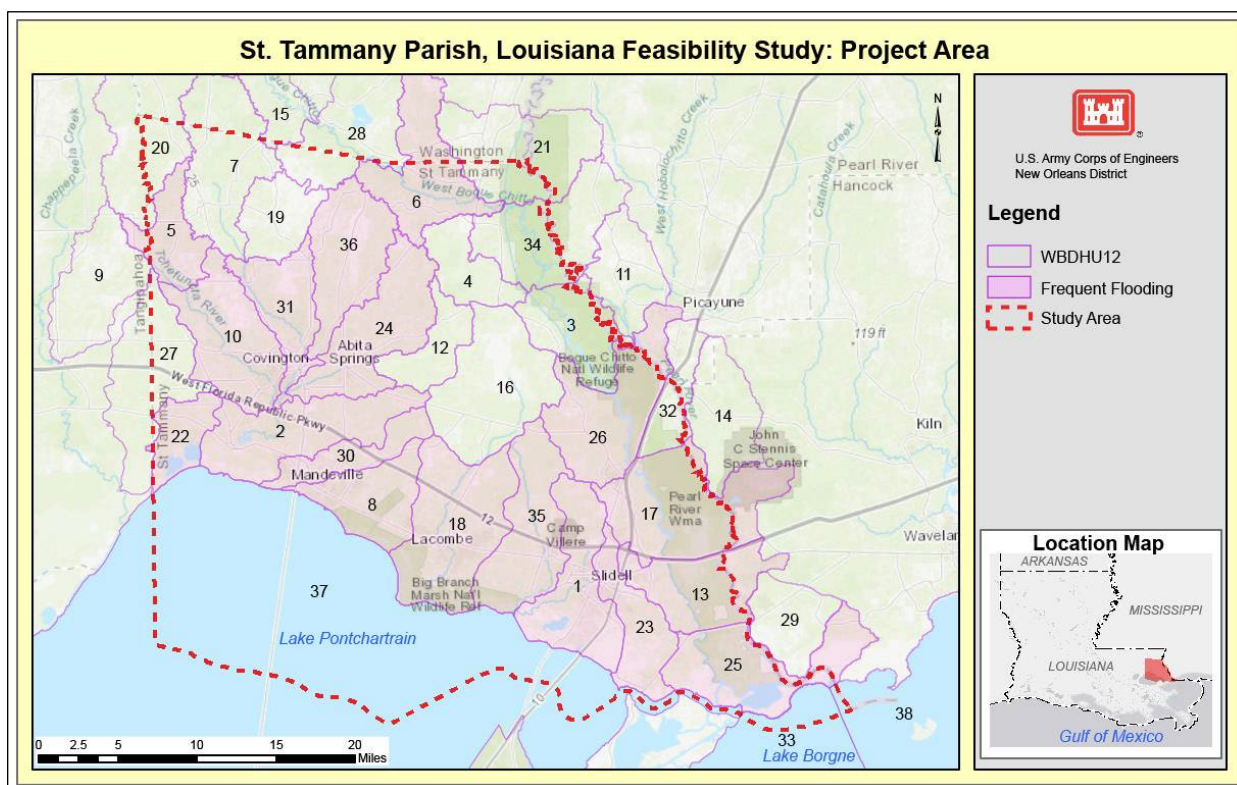


Figure 3-3. St. Tammany Parish Hydrologic Units

Table 3-2. Lists the Project Area Sub-Basins with frequent flooding and the Types of Flooding Occurring

Sub-basin		Type of Flooding
1	Bayou Vincent-Bayou Bonfouca	Coastal (storm surge)/Rainfall
2	Ponchitolawa Creek-Tchefuncte River	Coastal (storm surge)/Rainfall (headwater flooding)
5	Savannah Branch-Tchefuncte River	Rainfall
6	Talleys Creek-Bogue Chitto	Rainfall
8	Bayou Castine-Cane Bayou	Coastal/Rainfall (headwater flooding)
10	Soap and Tallow Branch-Tchefuncte River	Coastal/Rainfall (headwater flooding)
13	Pearlington-Pearl River	Coastal/Rainfall
17	Middle River-Pearl River	Coastal/Rainfall
18	Big Branch Bayou-Lacombe Bayou	Coastal (storm surge)/Rainfall
22	Black River	Coastal/Rainfall
23	Salt Bayou	Coastal/Rainfall
24	Abita River	Rainfall (Headwater Flooding)
25	Rigolets-Pearl River	Coastal/Rainfall
26	Old Channel-Pearl River	Rainfall
30	Bayou Chinchuba	Coastal/Rainfall (headwater flooding)
31	Lower Bogue Falaya River	Coastal/Rainfall
35	Liberty Bayou-Bayou Bonfouca	Coastal/Rainfall, (headwater and backwater flooding)
36	Little Bogue Falaya River	Rainfall

There are a number of rivers and bayous that traverse the parish, generally in a north-south direction: the Tchefuncte River, found in the western portion of the parish, is used for a number of recreational activities, including the Wooden Boat festival in Madisonville; the Bogue Falaya River, which is a tributary of the Tchefuncte River, is another river that hosts a number of recreation activities, including kayaking, tubing, and swimming; the Bayou Lacombe, part of the BBMNWR, is known for its fishing and wildlife viewing and lastly, the Pearl River is the largest river in the parish and forms the eastern border with the State of Mississippi. The Bogue Chitto and Pearl River have the biggest flooding impacts to communities in the eastern and northeastern portion of the parish.

The operation of the Bonnet Carré spillway in times of emergency can also result in impacts to portions of the Lake Pontchartrain as freshwater enters the lake. More information regarding the Bonnet Carre spillway operations can be found in the “1976 Final Environmental Impact Statement EIS for the Mississippi River and Tributaries Mississippi River Levees and Channel Improvement.”

The study area experiences flood risk from three primary sources: coastal storm surge and waves, local rainfall on and around the study area, and the Pearl River Basin that outlets to the Gulf of Mexico along the eastern boundary of St. Tammany Parish.

3.1.7.1 Sea Level Rise

The impacts of SLR with coincident frequency inflows on the Eastern side of the parish are exhibited from the coastline of Lake Pontchartrain inland approximately 4-6 miles, and varies along the extent of the coastline. In general, the impact zone of SLR remains south of I-12 along the eastern side of the parish coastline for the 10-year and 100-year model runs. See Appendix E: Hydrologic & Hydraulics, H&H modeling report.

3.2 RELEVANT RESOURCES

This section contains a description of relevant resources that exist within the study area. The relevant resources described are those recognized by laws, EOs, regulations, and other standards of national, state, or regional agencies and organizations; technical or scientific agencies, groups, or individuals; and the general public. Relevance based on institutional recognition means that the importance of an environmental resource is acknowledged in the laws, adopted plans, and other policy statements of public agencies, federally recognized tribes, and private groups. Relevance based on public recognition means that some segment of the general public recognizes the importance of an environmental resource. Relevance based on technical recognition means that the importance of an environmental resource is based on scientific or technical knowledge or judgment of critical resource characteristics. See Appendix C: Environmental, for a summary of the institutional, technical, and public importance of these resources.

3.2.1 Natural Environment

The natural environment includes areas that have not been developed to support human uses and includes terrestrial and aquatic wildlife, their habitats, and the ecological quality of the current systems. Louisiana's coastal wetlands provide habitat for the largest concentration of over-wintering waterfowl in the U.S., as well as habitat for wildlife, finfish, shellfish, and other aquatic organisms, including threatened or endangered species.

The population of St. Tammany Parish is approximately 260,000 as of the 2020 Census. The increasing numbers are creating tremendous development pressure, suburban sprawl, increased traffic congestion, and environmental degradation. Recognizing the need for planned and sustainable growth, the STPG initiated the New Directions 2025 - St. Tammany Parish Comprehensive Plan. As part of this planning initiative, the LDWF, Wildlife Diversity Program, identified 22 habitat types occurring within St. Tammany Parish and analyzed the status of those habitat types (Tables 3-3 through 3-5). Of the 22 vegetative habitat types identified, 15 are classified as wetlands, of which all are in a state of decline.

Table 3-3. Status of Wetland Vegetative Types in St. Tammany Parish

Wetland Vegetative Type	Abundance/Status	Trend
Fresh Marsh	Rare	Stable/Very Slowly Declining
Intermediate Marsh	Common	Stable/Very Slowly Declining
Brackish Marsh	Uncommon	Stable/Very Slowly Declining
Hillside Seepage Bog	Exceedingly Rare	Declining
Bald Cypress/Bald Cypress-Tupelo Swamp	Common	Slowly Declining
Pond Cypress/Blackgum Swamp	Rare (old growth very rare)	Slowly Declining
Bottomland Hardwood Forest	Common (old growth very rare)	Slowly Declining
Small Stream Forest	Common (old growth very rare)	Declining
Bayhead Swamp	Common (poor quality)	Declining
Slash Pine-Pond Cypress/Hardwood Forest	Critically Imperiled	Declining
Slash Pine/Wiregrass	Rare	Probably Declining
Gum Pond	Uncommon (old growth very rare)	Slowly Declining
Shrub Swamp	Uncommon	Slowly Declining
Forested Seep	Rare	Declining
Longleaf Pine Flatwood Savanna	Rare	Declining

Source: Louisiana Department of Wildlife and Fisheries, 1999

Bold text represents habitat impacted by the RP.

Table 3-4. Status of Aquatic Vegetative Types in St. Tammany Parish

Aquatic Vegetative Type	Abundance/Status	Trend
Submersed Estuarine Grassbeds	Very Rare	May Be Slowly Increasing
Fresh Floating/Submersed Vegetation	Common	Stable

Source: Louisiana Department of Wildlife and Fisheries, 1999 and St. Tammany New Directions 2025 web site

Table 3-5. Status of Upland Vegetative Types in St. Tammany Parish

Upland Vegetative Type	Abundance/Status	Trend
Hardwood Slope Forest	Very Rare	Declining
Mixed Hardwood-Loblolly Forest	Uncommon	Declining
Shortleaf Pine/Oak-Hickory Forest	Critically Imperiled	Declining
Longleaf Pine Flatwoods	Critically Imperiled	Rapidly Declining
Upland Longleaf Pine Forest	Critically Imperiled	Rapidly Declining

Source: Louisiana Department of Wildlife and Fisheries, 1999 and St. Tammany New Directions 2025 web site

3.2.1.1 Wetlands Resources

Louisiana's coastal wetlands provide protection from wave action, erosion, and storm damage and offer various consumptive and non-consumptive recreational opportunities. Coastal wetland types within the planning area include bottomland forests, fresh, intermediate, and brackish emergent wetland, swamps, and pine savannah flatwoods.

The major factors that influence the type of wetland community defined by elements such as plant community and spatial relation to bodies of water are elevation, hydrology, salinity, and soil type. Elevation is critical to the type of wetland occurring in an area, and small elevation changes can result in major shifts in community type (Connor et al, 1981). Freshwater habitats generally have salinities less than 0.5 parts per thousand (ppt), salinities in intermediate marsh range between 0.5-5.0 ppt, brackish marsh has salinities of 5-18 ppt, and saline marsh salinities vary between 18-30 ppt.

The Louisiana coastal plain accounts for 90 percent of the total coastal marsh loss in the nation (USACE 2004). Couvillion et al. (2011) analyses shows coastal Louisiana has undergone a net change in land area of about -1,883 square miles of wetlands from 1932 to 2010. The USGS uses historical surveys, aerial imagery, and satellite data to track landscape changes in coastal Louisiana over time. For the latest study, "Land Area Change in Coastal Louisiana (1932 – 2016)," Couvillion and other scientists at the compiled and analyzed data from a variety of historical and modern sources. The USGS researchers found that over the 84 years studied, Louisiana's rates of loss ranged from a high of 83.5 square kilometers (32.0 square miles) per year to a more moderate 28.0 square kilometers (10.8 square miles) per year. While land loss rate is not a constant, this equates to losing an average of an American football field's worth of coastal wetlands in 34 minutes when losses were rapid, or in 100 minutes at more recent rates. Analyses show that coastal Louisiana has experienced a net change in land area of approximately -4,833 square kilometers (modeled estimate: -5,197 +/- 443 square kilometers) from 1932 to 2016. This net change in land area amounts to a decrease of approximately 25 percent of the 1932 land area in the state of Louisiana. However, the long-term rate of land loss has slowed since its peak in the 1970s, and USGS scientists have recently found a further slowing since 2010 (USGS, 2017).

St. Tammany Parish has more than 12,000 acres of wetlands in 17 mitigation banks, and 11,320 acres of that are pine flatwood savanna (USACE Regulatory 2020). The STPG recently established the Cane Bayou Mitigation Preserve in 2019, a 12,000-acre wetland preserve near Mandeville that would be utilized to offset impacts from public-work projects.

3.2.1.1.1 Bottomland Hardwoods

Bottomland hardwoods (BLH) are alluvial-forested wetlands typically found throughout southern Louisiana in the deltaic plain of the Mississippi River (Hodges, 1997). A variety of plant species, including oak, hickory, sugarberry, and maple occur in this habitat. Between the forested wetlands and marsh lies a thin band of scrub shrub habitat, and typical vegetation includes elderberry, wax myrtle, buttonbush, and red maple (Connor et al, 1976). In coastal BLH forests stressed by prolonged inundation, the less water tolerant tree species gradually die out leaving the more water tolerant bald cypress and water tupelo present (Kiem et al. 2013)

3.2.1.1.2 Swamps

Swamps are defined by their higher proportional representation of bald cypress and tupelo and a repetitive wet-dry cycle. The Louisiana swamps generally lack a mature tree canopy because of historic logging, and have lower productivity where isolated from riverine influences (Shaffer et al., 2003). Bald cypress, as an important indicator species of the health of a swamp, is a large deciduous conifer and has long been recognized for its decay resistant wood. It can grow to a height of 100 to 120 feet with a diameter of 3 to 5 feet. In the original, old grove forests of the south, virgin bald cypress averaged over 500 years old and could reach a diameter of 6 to 8 feet. Young bald cypress tree trunks are considerably tapered and support an open, narrowly pyramidal crown. As the tree ages, the trunk becomes more cylindrical and the crown irregularly fattened. Older trunks often are ash-gray with swollen, fluted bases, and branches bearded with Spanish moss. Older bald cypress trees also have a very distinctive root system that consists of several descending roots, providing anchorage, and many wide-spreading roots commonly known as "knees." This type of root system makes the bald cypress exceptionally stable, even on the most unstable sites. Permanent inundation results in a loss of regeneration and eventually conversion to marsh (Hodges, 1997).

3.2.1.1.3 Marsh

Freshwater marsh is found surrounding bodies of open water and is located in the study area along the shoreline of Lake Pontchartrain and along the mouth of the Pearl River. It forms in accreting, sediment rich, high energy environments typical for this region and is dominated by rush and reed plant species like cattails and arrowhead. These marshes can form detached mats of vegetation, known as flotant, which encourage colonization by other plant species. Historically, wax myrtle trees would colonize the mat, which results in the entire mat sinking, allowing for more open water plants to infiltrate thick marshes. The freshwater marsh that does not float is more dramatically impacted by flood events and can be less productive.

Fresh marshes provide nursery habitat for estuarine-dependent species important to recreational and commercial fisheries such as blue crab, white shrimp, Gulf menhaden, Atlantic croaker, red drum, southern flounder, bay anchovy, striped mullet, and others. Fresh marshes also provide habitat for largemouth bass, warmouth, black crappie, blue catfish, bowfin, and gar.

Intermediate marsh is a unique type of wetland marsh found in the study area whose vegetative community reflects the shifts in salinity associated with proximity to marine environments. This type of marsh is the middle part of the gradient found in vegetative communities shifting from fresh to saline waters, and the marsh species that are found in this type like saltmeadow grass are capable of withstanding spikes of salinity that are associated with tropical storm surge events. It is commonly a fairly narrow band of vegetation when compared with other marsh types due to the large differences between freshwater and brackish salinities. Wildlife found within an intermediate marsh is less diverse than found in freshwater marshes, but more individuals may be present.

Brackish marsh is the last type of marsh found in the study area. The vegetation within a brackish marsh consists of wire grass, smooth cord grass (*Spartina alterniflora*) and black needle rush (*Juncus roemerianus*); however, without many variety in plant species, and often times the habitat is almost entirely composed of saltmeadow cord grass. Waterfowl thrive in this habitat, as well as many invertebrate and fish. This type is more prevalent in the study area around the mouth of the Pearl River, as well as around the Rigolets, which lies between Lake Pontchartrain and the Gulf of Mexico. Exchange between the two bodies of water has a compounding effect on countless species.

3.2.1.1.4 Longleaf Pine Flatwood Savanna

Longleaf pine flatwood savannas (pine savannas) are floristically rich, herb-dominated wetlands, that are naturally sparsely stocked with longleaf pine. They historically dominated the Gulf coastal plain flatwood regions of southeast and southwest Louisiana. The term "savanna" is classically used to describe expansive herb-dominated areas with scattered trees.

Pine savannas are scattered within the study area and are a managed habitat type within the BBMNWR. They are found naturally on broad "flats" in an interdigitated mosaic with mesic to dry-mesic (non-wetland) longleaf pine flatwoods, savannas occupying the poorly drained and seasonally saturated/flooded depressional areas and low flats, while the non-wetland flatwoods occupy the better drained slight rises and low ridges. They are subject to a highly fluctuating water table, from surface saturation/shallow flooding in late fall/winter/early spring to growing-season droughtiness. (LNHP 1988).

3.2.1.2 Uplands

Uplands scattered throughout the parish are dry and generally consist of a mixed hardwoods and loblolly pine forest as well as dry-mesic pine flatwoods. Mixed hardwood-loblolly pine forests are distributed in a variety of ecological settings statewide on broad ridgetops and

gentle side slopes in terrace uplands; on middle and lower slopes between uplands and stream bottoms; and at the heads of drainages along small, intermittent streams. Loblolly pine forests comprise approximately 20 percent of the overstory associated with various hardwood species. Mixed hardwood-loblolly pine forest is estimated to have occupied 500,000 to 1,000,000 acres historically with the same amount thought to remain today. However, older, more natural examples of this habitat are threatened by conversion to pine plantations, agriculture, or other land uses. Other threats include construction of roads, pipelines and utilities, invasive and exotic species, fire suppression, physical damage from timber harvesting, and contamination by chemicals (herbicides, fertilizers).

Pine flatwood habitat is found primarily in the northern portion of the parish. An ideal pine flatwood forest would lack a mid-story; however, due to fire suppression and lack of prescribed burns, much of this habitat is in less than ideal conditions.

Riparian corridors similar to the habitat found along Mile Branch are a combination of mixed hardwoods and pine habitat. Wildlife species found utilizing this habitat rely on streams, bayous, and other bodies of water as transportation corridors, breeding habitat, and for hunting as they serve as a nexus point for biodiversity within the community. Impacts to waterways can have a compounding effect to species located up the trophic chain. This can result in upland species being affected by water resource management projects that cumulatively result in shifts in community composition of flora and fauna.

3.2.1.3 Soils

St. Tammany Parish has a total area of 721,830 acres of which 562,749 acres is land and 159,081 acres is large water areas (streams, small lakes, and Lake Pontchartrain). Soils along the levee alignment are displayed in Figure 3-4. Table 3-6 has the map unit legend and associated acreage of each soil type. Soils identified within the study area are displayed in Figure 3-5 and listed in Table 3-7.

General: The availability of Geotechnical data for the study area is very limited, however, the PDT utilized ongoing investigations conducted by Eustis Engineering in the Slidell area for descriptive soil data. For detailed boring information pulled from Eustis Geotechnical investigations, review Annex D. This boring data was used to analyze existing conditions along the levee footprint and to analyze potential borrow sources.

Levee and Floodwalls: NRCS soil data was utilized understand existing surface soils along the planned levee footprint. Figure 3-4 depicts the various soil types along the entire alignment and Table 3-6 has the map unit legend and associated acreage of each soil type. Existing soil types along the levee right of way include very poorly drained and very frequently flooded soils with mucky or loamy surface layer and clayey subsoil which occurs in broad low swamp and marsh areas.



Figure 3-4. NRCS Soils Types Identified Along the Proposed Levee Alignment.

Table 3-6. NRCS Soil Map Legend and Associated Acreages for the Proposed Levee Alignment

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Aa	Abita silt loam, 0 to 2 percent slopes	7.5	3.2%
AC	Allemands muck	17.0	7.2%
Ad	Allemands muck, drained	14.1	6.0%
Ag	Aquents, dredged	26.5	11.2%
AR	Arat silty clay loam	1.5	0.6%
Bg	Brimstone-Guyton silt loams, 0 to 1 percent slopes, rarely flooded	1.3	0.6%
CV	Clovelly muck, 0 to 0.2 percent slopes, very frequently flooded	23.0	9.7%
Gy	Guyton silt loam, 0 to 1 percent slopes, occasionally flooded	12.3	5.2%
Lt	Latonia fine sandy loam, 0 to 2 percent slopes	2.4	1.0%
Mt	Myatt fine sandy loam, 0 to 1 percent slopes	62.0	26.2%
My	Myatt fine sandy loam, frequently flooded	18.0	7.6%
Pr	Prentiss fine sandy loam, 0 to 1 percent slopes	7.1	3.0%
St	Stough fine sandy loam, 0 to 1 percent slopes	34.0	14.4%
W	Water	9.5	4.0%
Totals for Area of Interest		236.2	100.0%

3.2.1.4 Prime and Unique Farmlands

Prime and unique (P&U) farmlands are designated by the U.S. Department of Agriculture (USDA) based on an identification of soil types. The identification of these soil types often has a correlation with the economic value of a given piece of property due to its potential for agricultural use. Within the parish, agricultural lands are found primarily further inland from the coastal communities along Lake Pontchartrain, though there are tracts identified as P&U farmlands within each of the major coastal communities in the study area. This reflects the fact that farmlands that are closer to the coast generally have been developed for residential and commercial purposes.

P&U farmland soils are listed in Table 3-7. The predominant P&U farmland soils are Stough fine sandy loam at 12.4 percent and Savannah fine sandy loam at 6.7 percent.

There are approximately 211,246 acres of P&U farmlands within the study area reference Figure 3-5 and Table 3-7. A review of the P&U farmland located within the study area and potential borrow sources was conducted using the web soil survey service provided by the Natural Resource Conservation Service (NRCS). See Appendix C: Environmental.

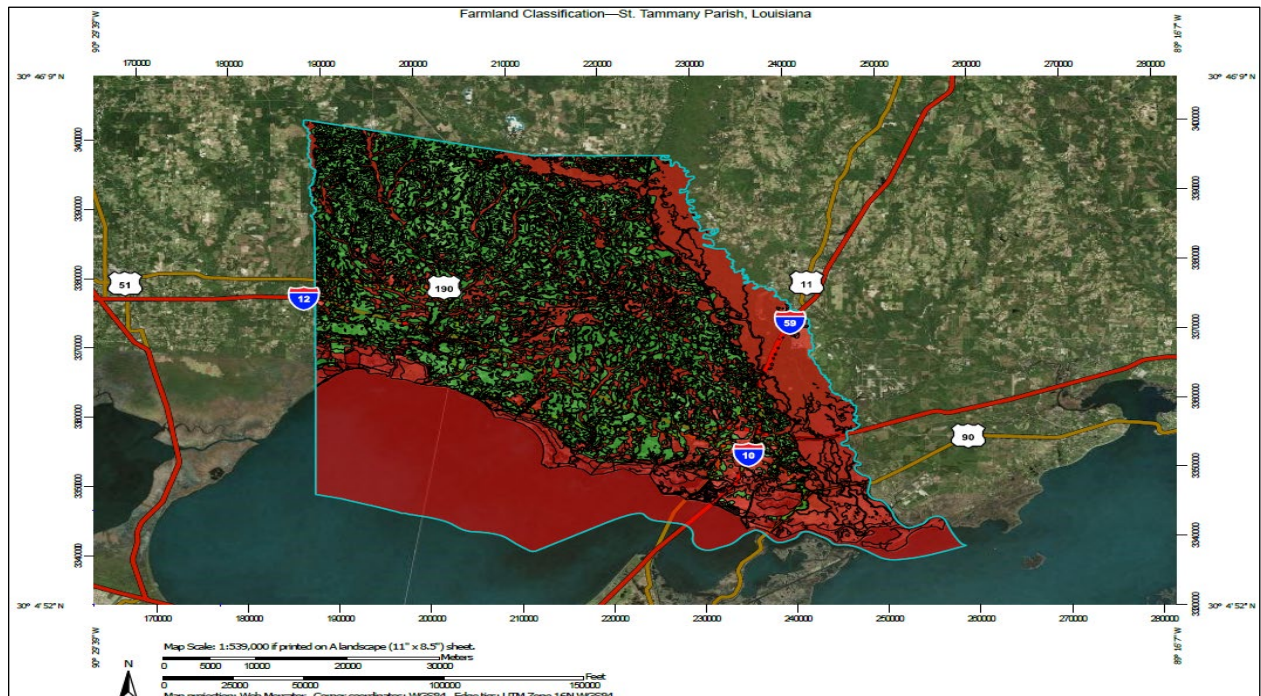


Figure 3-5. Prime and Unique Farmlands in St. Tammany Parish
(Note: Red indicates no prime farmland and Green indicates all areas prime farmland)

Table 3-7. Soils and Farmland Classification for St. Tammany Parish, Louisiana

Soil Type	Rating	Acres	Percent (%)
Maurepas muck, drained	Not prime farmland	510.4	0.1
Myatt fine sandy loam, 0 to 1 percent slopes	Not prime farmland	59,183.7	8.2
Myatt fine sandy loam, frequently flooded	Not prime farmland	37,325.2	5.2
Ouachita and Bibb soils, frequently flooded	Not prime farmland	33,216.0	4.6
Pits	Not prime farmland	1,058.8	0.1
Prentiss fine sandy loam, 0 to 1 percent slopes	All areas are prime farmland	39,183.0	5.4
Prentiss fine sandy loam, 1 to 3 percent slopes	All areas are prime farmland	3,071.5	0.4
Ruston fine sandy loam, 1 to 3 percent slopes	All areas are prime farmland	118.5	0.2
Ruston fine sandy loam, 3 to 6 percent slopes	All areas are prime farmland	5,423.5	0.8
Savannah fine sandy loam, 1 to 3 percent slopes	All areas are prime farmland	48,022.4	6.7
Savannah fine sandy loam, 3 to 6 percent slopes	All areas are prime farmland	25,982.7	3.6
Smithdale fine sandy loam, 8 to 12 percent slopes	Not prime farmland	1,902.1	0.3
Stough fine sandy loam, 0 to 1 percent slopes	All areas are prime farmland	89,444.6	12.4
Water	Not prime farmland	175,820.5	24.4
Total for St. Tammany Parish		719,375.3	100.0

3.2.1.5 *Water Quality*

The Louisiana Department of Environmental Quality (LDEQ) has designated numerous streams and rivers within St. Tammany Parish as impaired. The source of impairment is predominantly excessive nutrients and bacteria, which are partially attributable to discharges from failing sewer systems; and sediment-related pollutants from construction runoff. In many cases, contact recreation (fishing and swimming) is not recommended due to this pollution.

As a result of surface water pollution, the LDEQ has instituted the Total Maximum Daily Load (TMDL) program to quantify water quality and set limits on discharges of pollutants. This program establishes discharge limits from point sources (such as wastewater plants) and nonpoint sources such as stormwater runoff.

Water quality in the watershed is influenced by the emergency operations of the Bonnet Carré Spillway (BCS) during periods of high water along the Mississippi River that threaten the city of New Orleans and other communities along the river. Impacts to water quality also occur from rivers like the Tchefuncte and Pearl, as well as smaller water bodies and bayous that drain into Lake Pontchartrain and the Gulf of Mexico. Sediment transport from the uplands of the parish brings agricultural runoff into Lake Pontchartrain and fuels algal blooms and deposits of large amounts of fine sediment.

Section 305(b) of the Clean Water Act requires each state to monitor and report on surface and groundwater quality, which the Environmental Protection Agency (EPA) synthesizes into a report to Congress. The LDEQ produces a Section 305(b) Water Quality Report that provides monitoring data and water quality summaries for hydrologic units (subsegments) throughout the state. Water quality criteria are elements of state water quality standards that represent the quality of water that would support a particular designated use. These criteria are expressed as constituent concentrations, levels, or narrative statements. There are currently eight designated uses adopted for Louisiana's surface waters: primary contact recreation, secondary contact recreation, fish, and wildlife propagation ("subcategory" for limited aquatic life and wildlife), drinking water supply, oyster propagation, agriculture, and outstanding natural resource waters. None of the sub-basins in this part of the Lake Pontchartrain Basin fully meets EPA's designated use standards, and Bayou Liberty has a fish-consumption advisory for mercury.

Table 3-8 list the impaired waters within the project area as presented in the Louisiana's 2022 Water Quality Integrated Report (IR). The 2022 IR documents LDEQ's progress toward meeting their responsibility under the CWA (U.S Code 1972, 1987), Section 303(d) and Section 305(b).

Table 3-8. Impaired Waters within Project Footprint and their Impairment

Waterbody	Impairment	Not Supporting	Supporting
Bayou Liberty	Low dissolved oxygen, mercury, chlorides, sulfates, total dissolved solids	Fish and wildlife propagation	Designated uses of primary and secondary contact recreation
Bayou Bonfouca	Low dissolved oxygen, enterococcus, mercury, copper	Fish and wildlife propagation and primary contact recreation	Secondary contact recreation
Bayou Lacombe	040901 – fish mercury levels not found to be a cause for concern 040902 – fish mercury levels indicate further testing is needed LDEQ – fecal coliform from on-site treatment systems	040901 – fish and wildlife propagation 040902 – fish and wildlife propagation and primary contact recreation	040901 – natural resource, primary and secondary recreation 040902 – natural resource and secondary contact recreation
Bayou Patassat *	Not IRWQL listed **		
Mile Branch *	Not IRWQL listed		
Bayou Paquet ***	Low dissolved oxygen, enterococcus	Fish and wildlife propagation, primary contact recreation	Secondary contact recreation
Schneider Canal ***	Not IRWQL listed		
W-14 Canal ***	Not IRWQL listed		

3.2.1.5.1 Bayou Liberty

The 2022 LDEQ report states that Bayou Liberty is not supporting Fish and Wildlife Propagation; however, it is supporting its designated uses of Primary Contact Recreation and Secondary Contact Recreation. LDEQ's 2011 Bayou Liberty and Bayou Bonfouca Watershed Total Maximum Daily Load (TMDL) report states that suspected causes of impairment are low dissolved oxygen, mercury, chlorides, sulfates, and total dissolved solids. The suspected source is on-site treatment systems (septic systems and similar decentralized systems), package plant or other permitted small flows discharges, and unknown source. LDEQ is utilizing a phased TMDL approach for Bayou Liberty. This approach provides LDEQ with the opportunity to revise the DO criteria and at the same time, allows LDEQ to develop a meaningful and implementable DO TMDL based upon the appropriate DO criteria and in accordance with EPA's Consent Decree (E. D. La. 2002) deadlines. These efforts should lead to improved water quality while providing local governments and businesses the opportunity to prepare and adjust to the new permit requirements that would be implemented as a result of the TMDL developed in Phases I and II. One of LDWF's goals in managing Bayou Liberty is to improve the waterbody's ability to

support recreation and wildlife propagation (Scenic River Management Plan for Bayou Liberty, 2015, LDWF).

3.2.1.5.2 Bayou Bonfouca

The 2022 LDEQ report indicates that Bayou Bonfouca is not supporting fish and wildlife propagation and primary contact recreation. It is supporting secondary contact recreation. The 2022 LDEQ report states that suspected causes of impairment are low dissolved oxygen and enterococcus.

3.2.1.5.3 Bayou Lacombe

LDEQ has Bayou Lacombe broken into two subsegments. LDEQ sub-segment 040901 does not support fish and wildlife propagation. However, outstanding natural resource and primary and secondary contact recreation uses are fully supported. Fish in this sub segment have been tested for mercury but levels were not found to be a cause for concern. LDEQ sub segment 040902 does not support fish and wildlife propagation and primary contact recreation uses. Outstanding natural resource and secondary contact recreation uses are fully supported. Fish in this sub segment have been tested for mercury contamination and results indicate further testing is needed.

3.2.1.6 Aquatic Resources

Primary fresh and intermediate water bodies of importance include Lake Pontchartrain, Pearl River, Bayou Bonfouca, Bayou Patassat, Bayou Lacombe, Bayou Liberty, Bayou Cane, Bayou Castine, Bayou Chinchuba, and the Tchefuncte River. Average water depths of the lakes and bayous are relatively shallow, with Lake Pontchartrain extending to 15 feet (NOAA Chart 11639). In addition, there are many miles of manmade canals and unnamed waterways used for recreation, irrigation, and drainage.

The Pearl River watershed supports a biodiverse assemblage of fauna with over 40 species of mussel and 130 species of native fish. It supports eight federally listed species including the ringed map turtle, Gulf sturgeon, inflated heelsplitter mussel, Bald Eagle, dusky gopher frog, gopher tortoise, Pearl darter and Louisiana black bear. The ringed map turtle is an endemic, threatened species found only in the Pearl River watershed in Louisiana and Mississippi. The USFWS has designated the Pearl River as a critical habitat for the Gulf sturgeon, which migrates up the river to breed.

Wetlands throughout the area abound with numerous aquatic species: least killifish, threadfin shad, rainwater killifish, sheepshead minnow, American eel, mosquitofish, sailfin molly, and grass shrimp. These species rely upon submerged aquatic vegetation and marsh and provide forage for a variety of fish and wildlife.

Freshwater and estuarine marshes with lower salinities provide habitat for commercially and recreationally important freshwater fish species, including but not limited to: largemouth bass, yellow bass, black crappie, green sunfish, bluegill, redear sunfish, warmouth, blue catfish, channel catfish, walleye, freshwater, bowfin, and gar. Water bodies where there is

minimal water exchange may exhibit low dissolved oxygen conditions that result in higher amounts of algal blooms, and this can lead to a reduced fisheries abundance.

Benthic communities throughout Lake Pontchartrain are directly impacted by geochemical changes that are associated with nutrient exchange between the marshes of the Rigolets that separate Lake Pontchartrain from the Gulf of Mexico.

3.2.1.7 Essential Fish Habitat

All marine and estuarine waters of the northern Gulf of Mexico, including the eastern portion of Lake Pontchartrain, have been designated as Essential Fish Habitat (EFH) through regulations promulgated by the NMFS and the Gulf of Mexico Fishery Management Council, as required by the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA). EFH is described as waters and substrates necessary for federally-managed species to spawn, breed, feed, and grow to maturity. In the northern Gulf of Mexico, EFH has generally been defined as areas where individual life-stages of specific Federally-managed species are common, abundant, or highly abundant. In estuarine areas, EFH is defined as all estuarine waters and substrates (mud, sand, shell, rock, and associated biological communities), including the subtidal vegetation (submerged aquatic vegetation and algae) and adjacent intertidal vegetation (marshes and mangroves).

To assist in meeting consultation requirements, the NMFS local field office reviewed the study area and provided comments to CEMVN that identified the following species as being of concern for this study: brown shrimp, white shrimp, red drum, and bull sharks. Table 3-9 lists the life stages of EFH for federally managed fishery species in the study area. See Appendix C: Environmental for more information.

Table 3-9. Essential Fish Habitat for Life Stages of Federally Managed Species in the Project Area, St. Tammany, Louisiana.

Species	Life Stage	Essential Fish Habitat
Brown Shrimp	Adult	Gulf of Mexico <110 m, silt sand, muddy sand
	Juvenile	Marsh edge, submerged aquatic vegetation (SAV), tidal creeks, inner marsh
	Larvae/Postlarvae	0 to 82 m; pelagic
White Shrimp	Adult	Gulf of Mexico <33 m, Silt, soft mud
	Juvenile	Marsh edge, SAV, marsh ponds, inner marsh, oyster reefs
	Larvae/Postlarvae	Planktonic, soft bottom, emergent marsh
Red Drum	Adult	Gulf of Mexico & estuarine mud bottoms, oyster reef
	Juvenile	SAV, estuarine mud bottoms, marsh/water interface
	Larvae/Postlarvae	All estuaries planktonic, SAV, sand/shell/soft bottom, emergent marsh
Bull Shark	Adult	Gulf of Mexico <25m, bays
	Juvenile	Marsh edge, estuarine mud bottoms, oyster reefs

Brown shrimp (*Farfantepenaeus aztecus*) and white shrimp (*Litopenaeus setiferus*) are two species of shrimp found in the study area and serve as an important commercial resource. Brown shrimp spawn on the Gulf of Mexico continental shelf, and then drift toward the shore, before eventually returning to the continental shelf to reproduce (Li and Clarke, 2005). The white shrimp lifecycle follows a similar pattern, with the primary difference being their seasonal occurrence, with white shrimp found in the fall and brown shrimp found in the spring (Baker et al, 2014). Marshes in and adjacent to the study area serve as a nursery for both species of shrimp and harvests are regulated by the LDWF. EFH for shrimp includes waters of the Gulf of Mexico and substrates extending from the US/Mexico border to Fort Walton Beach, Florida from estuarine waters out to depths of 100 fathoms; waters and substrates extending from Grand Isle, Louisiana to Pensacola Bay, Florida between depths of 100 and 325 fathoms; waters and substrates extending from Pensacola Bay, Florida to the boundary between the areas covered by the Gulf of Mexico Fishery Management Council and the South Atlantic Fishery Management Council out to depths of 35 fathoms, with the exception of waters extending from Crystal River, Florida to Naples, Florida between depths of 10 and 25 fathoms and in Florida Bay between depths of 5 and 10 fathoms (Habitat Conservation Division, 2015).

Red drum (*Sciaenops ocellatus*) is an important recreational gamefish found in coastal waters throughout the Gulf of Mexico (Matlock, 1987; Exec. Order No. 13449, 2007). Adults inhabit nearshore waters, particularly areas within the surf zone or in the vicinity of inlets (Matlock, 1987). Spawning occurs in nearshore areas, and eggs and larvae are transported by tides and wind currents into estuaries (Matlock, 1987; Brown et al, 2004). Larvae and

juveniles typically occupy estuarine environments until maturation (Matlock, 1987). Red drum are predatory in all stages of life; however, the type of prey consumed varies with life stage. Early juvenile red drum primarily consume small marine invertebrates, including mysids and copepods, while adults feed on large marine invertebrates, including shrimp, crabs, and small fishes (Bass and Avault Jr., 1975). EFH for red drum consists of all Gulf of Mexico estuaries; waters and substrates extending from Vermilion Bay, Louisiana to the eastern edge of Mobile Bay, Alabama out to depths of 25 fathoms; waters and substrates extending from Crystal River, Florida to Naples, Florida between depths of 5 and 10 fathoms; waters and substrates extending from Cape Sable, Florida to the boundary between the areas covered by the Gulf of Mexico Fishery Management Council and the South Atlantic Fishery Management Council between depths of 5 and 10 fathoms (Habitat Conservation Division, 2015).

Bull sharks (*Carcharhinus leucas*) are common in coastal waters and use Lake Pontchartrain as a nursery. While they are able to survive in fresh water as a euryhaline species, they do not live there exclusively, and typically prefer to use estuarine conditions as a survival strategy for their young before moving into the marine environment as adults. This reflects their ability to osmoregulate in managing their internal body's chemistry as they move across a wide range of habitat salinities through their lifecycle. EFH for reef fish, including bull sharks, includes waters of the Gulf of Mexico and substrates extending from the US/Mexico border to the boundary between the areas covered by the Gulf of Mexico Fishery Management Council and the South Atlantic Fishery Management Council from estuarine waters out to depths of 100 fathoms (Habitat Conservation Division, 2015).

3.2.1.8 Wildlife

There are a variety of habitats in the study area for wildlife species, including: uplands, forested wetlands, fresh/intermediate marsh, open fields used for foraging, lines of trees, and shrubs along drainage ditches and denser tree growth along waterways that provide cover and connectivity. The study area has undergone extensive artificial modifications in the historic period, resulting in common fauna within the study area primarily being species that can tolerate a wide range of disturbed habitats. Forested wetlands and riparian zones provide important breeding and wintering habitats for a variety of migratory birds. Because the study area is located within the Mississippi Flyway, it is an area that experiences significant seasonal migrations of waterfowl species, which are of particular interest to recreational hunters. Crop fields are seasonally flooded because of inadequate interior drainage in the upper basin, and they provide important feeding areas for wintering waterfowl. Flooded fields are especially valuable to wildlife when they are located adjacent to flooded BLH forests because they provide nocturnal roosting sites for many species.

Two national wildlife refuges (BBMNWR and Bogue Chitto) and three state Wildlife Management Areas (WMA) (Lake Ramsey Savannah WMA, Pearl River WMA, and St. Tammany Wildlife Refuge) whose primary purpose is the conservation of wildlife and fisheries resources are located in St. Tammany Parish.

3.2.1.9 Threatened, Endangered, and Protected Species

Within the project area there are six documented animal species, one plant species, and one Critical Habitat designation under the jurisdiction of the USFWS and/or the NMFS, presently classified as threatened or endangered (Table 3-10). The USFWS and NMFS share jurisdictional responsibility for Gulf Sturgeon. The Alligator Snapping Turtle (*Macrochelys temminckii*) and Monarch Butterfly (*Danaus plexippus*) are also listed on the Endangered Species List as Proposed Threatened and Candidate, respectively. However, they are not subject to ESA Section 7 consultation requirements.

Table 3-10. Threatened and Endangered Species in St. Tammany Parish, Louisiana that may be Present in the Project Area

Species	Status	Potentially Present in Project Areas	Jurisdiction	
			USFWS	NMFS
West Indian Manatee (<i>Trichechus manatus</i>)	Threatened	X	X	
Red-Cockaded Woodpecker (<i>Picoides borealis</i>)	Endangered	X	X	
Gopher Tortoise (<i>Gopherus polyphemus</i>)	Threatened	X	X	
Ringed Map Turtle (<i>Graptemys oculifera</i>)	Threatened		X	
Gulf Sturgeon (<i>Acipenser oxyrinchus desotoi</i>)	Threatened	X	X	X
Gulf Sturgeon Critical Habitat	Final	X	X	X
Louisiana Quillwort (<i>Isoetes louisianensis</i>)	Endangered		X	
Green Sea Turtle (<i>Chelonia mydas</i>)	Threatened	X		X
Kemps Ridley Sea Turtle (<i>Lepidochelys kempii</i>)	Endangered	X		X
Loggerhead Sea Turtle (<i>Caretta caretta</i>)	Threatened	X		X

3.2.1.9.1 West Indian Manatee

The West Indian manatee (*Trichechus manatus*) is Federally and state listed as threatened and is also protected under the Marine Mammal Protection Act of 1972, under which it is considered depleted (USFWS 2001). The West Indian manatee 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 LDWF, Wildlife Diversity Program, 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.

3.2.1.9.2 Red-Cockaded Woodpecker

The red-cockaded woodpecker (RCW, *Picoides borealis*) is a federally listed endangered bird species that prefers open longleaf pine uplands throughout the southeast. RCWs roost and forage year-round and nest seasonally (i.e., April through July) in open, park-like stands of mature pine trees containing little hardwood component, a sparse midstory, and a well-developed herbaceous understory. RCWs can tolerate small numbers of overstory and midstory hardwoods at low densities found naturally in many southern pine forests, but they are not tolerant of dense midstories resulting from fire suppression or from overstocking of pine. Trees selected for cavity excavation are generally at least 60 years old, although the average stand age can be younger. The collection of one or more cavity trees plus a surrounding 200-foot wide buffer of continuous forest is known as a RCW cluster. RCW foraging habitat is located within one-half mile of the cluster and is comprised of pine and pine-hardwood stands (i.e., 50 percent or more of the dominant trees are pines) that are at least 30 years of age and have a moderately low average basal area (i.e., 40 – 80 square feet per acre is preferred). The proposed project would be located in a parish known to be inhabited by RCWs; therefore, RCWs could be present in the project area.

3.2.1.9.3 Gopher Tortoise

The gopher tortoise is an upland species that is federally listed as threatened. The range of protection for this population extends to Alabama; east of Alabama it is listed as a candidate for federal protection under the ESA. It is the only tortoise that is native to the southeastern United States and is known to live up to 60 years in the wild. Despite being an ectotherm that spends much of its time basking in the sun, the gopher tortoise builds elaborate underground burrows in dry, sandy soil where it nests, which can be used by other species.

Gopher tortoises prefer “open” longleaf pine-scrub oak communities that are thinned and burned every few years. Habitat degradation (lack of thinning or burning on pine plantations), predation, and conversion to agriculture or urbanization have contributed to the decline of this species. That habitat decline has concentrated many remaining gopher tortoise populations along pipeline and power line rights-of-way (ROW) within their range. Tortoise burrows also can be found along road ROWs, and other marginal habitats, including fence rows, orchard edges, golf course roughs and edges, old fields, and pasturelands. Tortoises are often pushed into these areas due to adjacent habitat becoming unsuitable.

On 14 June 2022, LDWF along with CEMVN and USFWS personnel, conducted gopher tortoise surveys within the project area. Half of the areas assessed appeared to be uninhabitable for gopher tortoises due to the dense forests completely covering these areas. No evidence of gopher tortoises or their burrows were observed within the project area.

3.2.1.9.4 Ringed Map Turtle

Federally listed as threatened, the ringed map turtle is a riverine species that occurs in the Pearl and Bogue Chitto Rivers. It spends much of its day basking on submerged logs and prefers open channels where the water column experiences a high degree of light penetration. Declines in population for this species are attributed to changes in hydrologic regime, channel modifications, and activities that impact water quality and turbidity. The decline of the ringed map turtle has been attributed to habitat modification (i.e., loss of exposed sandbars, basking areas) and water quality deterioration, reservoir construction, channelization, de-snagging for navigation, siltation, and the subsequent loss of invertebrate food sources. The RP or proposed action is not expected to impact the Pearl or Bogue Chitto Rivers where the Ringed Map Turtle is known to occur. Therefore, the RP or proposed action would have no effect on the species.

3.2.1.9.5 Green, Kemp's ridley, and Loggerhead Sea Turtles

The three species of threatened or endangered sea turtles that could potentially occur in Lake Pontchartrain have a similar appearance, though they differ in maximum size and coloration. The Kemp's ridley is the smallest sea turtle – adults average about 100 pounds with a carapace length of 24 to 28 inches and a shell color that varies from gray in young individuals to olive green in adults. The loggerhead sea turtle is the next largest of these three species – adults average about 250 pounds with a carapace length of 36 inches and a reddish-brown shell color. The green sea turtle is the largest of these three species – adults average 300 to 350 pounds with a length of more than 3 ft and a brown coloration (its name comes from its greenish colored fat). There has been no documented nesting activity along Lake Pontchartrain therefore it is unlikely the nesting activities of these three species would be impacted as all three species nest on sandy beaches, which are minimal in Lake Pontchartrain. The life stages that may occur in Lake Pontchartrain range from older juveniles to adults.

3.2.1.9.6 *Gulf sturgeon*

The Gulf sturgeon was federally listed as threatened throughout its range on 30 September 1991. The Gulf sturgeon is an anadromous fish that migrates from salt water into coastal rivers to spawn and spend the warm summer months. Subadults and adults typically spend the three to four coolest months of the year in estuaries or Gulf of Mexico waters foraging before migrating into the rivers. This migration typically occurs from mid-February through April. Most adults arrive in the rivers when temperatures reach 70 degrees Fahrenheit and spend 8 to 9 months each year in the rivers before returning to estuaries or the Gulf of Mexico by the beginning of October.

Prior to the listing of the species, Davis et al. (1970) reported the collection of Gulf sturgeon from Lake Pontchartrain during a LDWF anadromous fish survey from 1966 to 1969. From 1988 to 1999, LDWF, through various means and studies, captured and recorded at least 60 Gulf sturgeon throughout Lake Pontchartrain, Lake Catherine, the Rigolets, and Lake Borgne. A LDWF trammel net study conducted by Inland Fisheries Division in the spring of 2001 resulted in the capture of three young of the year juvenile sturgeon at the intersection of the East Pearl River and Little Lake. In 2002, LDWF Seafood Division reported the capture of a Gulf sturgeon in one of their gill nets while sampling in a cove west of Alligator Point, Lake Borgne. By-catch of Gulf sturgeon has been reported by several recreational and commercial fishermen within these waters. A total of 177 Gulf sturgeon, measuring up to 7.2 feet in length and weighing from 2 to 152 lbs., were captured in these lakes and in the Rigolets from October 1991 to September 1992 (Rogillio, 1993). Reynolds (1993) reported that sturgeon measuring up to 7.2 feet in length and weighing up to 258 lbs. were incidentally caught by shrimp trawlers, netters, and recreational anglers from 1889 to 1993 in Lake Pontchartrain.

3.2.1.9.7 *Louisiana Quillwort*

Federally listed as an endangered plant species, the Louisiana quillwort (*Isoetes louisianensis*) is a small, semi-aquatic, facultative evergreen plant with spirally arranged leaves (sporophylls) arising from a globose, two-lobed corm. The hollow leaves are transversely septate, and measure approximately 0.12 inches wide and up to 16 inches long. This species grows on sand and gravel bars on the accreting sides of streams and moist overflow channels within riparian forest and bay head swamp communities in Washington and St. Tammany Parishes, Louisiana. The Louisiana quillwort is believed to be dependent on a special hydrologic regime resulting from the presence of small springs scattered at the base of banks or bluffs. Major threats to this species are habitat loss through hydrologic modifications of stream habitat, and land use practices that significantly alter stream water quality and hydrology.

3.2.1.10 *Critical Habitat Present*

Critical habitat identifies specific areas that have been designated as essential to the conservation of a listed species. The project area, specifically the borrow area in Lake Pontchartrain) is located within the boundary of critical habitat Unit 8. In 2003, Unit 8 was

designated as critical habitat for Gulf sturgeon (68 FR 13370, DN 03-5208). Unit 8 encompasses Lake Pontchartrain east of the Lake Pontchartrain Causeway all of Little Lake, the Rigolets, Lake St. Catherine, Lake Borgne, including Heron Bay, and the Mississippi Sound in Jefferson, Orleans, St. Tammany, and St. Bernard Parishes, Louisiana, Hancock, Jackson, and Harrison Counties in Mississippi, and in Mobile County, Alabama. An interactive map for Gulf Sturgeon critical habitat can be located at <https://www.fisheries.noaa.gov/tags/southeast-critical-habitat-map>

Unit 8 includes approximately 1,377 square miles of critical habitat with 277 square miles in Lake Borgne, 3 in Little Lake, 295 in Lake Pontchartrain, 10 in Lake St. Catherine, 5 in the Rigolets, 725 in Mississippi Sound, and 62 along the Mississippi near shore Gulf (68 FR 13369-13495). Critical habitat follows the shorelines around the perimeters of each included lake. The Mississippi Sound includes adjacent open bays, including Pascagoula Bay, Point aux Chenes Bay, Grand Bay, Sandy Bay, and barrier island passes, including Ship Island Pass, Dog Keys Pass, Horn Island Pass, and Petit Bois Pass. Critical habitat excludes St. Louis Bay, north of the Norfolk Southern Railroad bridge across its mouth; Biloxi Bay, north of the U.S. Highway 90 bridge; and Back Bay of Biloxi.

3.2.1.10.1 Protected Species

Bald Eagle

The bald eagle was officially removed from the List of Endangered and Threatened Species as of 8 August 2007. However, the bald eagle remains protected under the Migratory Bird Treaty Act (MBTA) and Bald and Golden Eagle Protection Act (BGEPA). Comprehensive bald eagle survey data have not been collected by the LDWF since 2008 and new active, inactive, or alternate nests may have been constructed in the study area since that time.

Bald eagles typically nest in large trees located near coastlines, rivers, or lakes that support adequate foraging from October through mid-May. In southeastern Louisiana parishes, eagles typically nest in mature trees (e.g., bald cypress, sycamore, wouldow, etc.) near fresh to intermediate marshes or open water. Major threats to this species include habitat alteration, human disturbance, and environmental contaminants. Furthermore, bald eagles are vulnerable to disturbance during courtship, nest building, egg laying, incubation, and brooding. Disturbance during these periods may lead to nest abandonment, cracked and chilled eggs, and exposure of small young to the elements. Human activity near a nest late in the nesting cycle may also cause flightless birds to jump from the nest tree, thus reducing their chance of survival.

On 11 September 2009, Federal Regulations 50 CFR 22.80 and 50 CFR 22.85 were established the authority of USFWS to issue permits for non-purposeful bald eagle take (typically disturbance) and eagle nest take when recommendations of the NBEM Guidelines cannot be achieved. In 2016, the USFWS finalized a rule (81 FR 91494) revising the 2009 Eagle Rule. Permits may be issued for nest take only under the following circumstances where: 1) necessary to alleviate a safety emergency to people or eagles, 2) necessary to ensure public health and safety, 3) the nest prevents the use of a human-engineered

structure, or 4) the activity or mitigation for the activity would provide a net benefit to eagles. Except in emergencies, only inactive nests may be permitted to be taken.

Coastal Forest and Neotropical Migrating Songbirds

The MBTA is the primary legislation in the United States established to conserve migratory birds. In Louisiana, the primary nesting period for forest-breeding migratory birds occurs between 15 April and 1 August. Some species or individuals may begin nesting prior to 15 April or complete their nesting cycle after 1 August, but the vast majority nest during this period.

The Mississippi Alluvial Valley (MAV) is critically important as a major migration corridor for many bird species with more than 40 percent of the waterfowl that breed in North America using the MAV as migratory stopover, wintering, or breeding habitat; the alluvial land located between the river at low-water stage and the levees (i.e., batture) is an important corridor for songbird migration. In addition, at least 107 species of land birds breed in the MAV, with 70 of those depending upon bottomland hardwood forests for most or all of their life cycle. Over the last few decades, documented long-term population declines of migratory bird species have spurred significant concern over the persistence of many species and has contributed to widespread investigations into the causes of these declines, including habitat loss, feral and free-ranging domestic cats, pesticides, and a variety of other stressors. To determine potential occurrences of priority birds occurring within the study area, the USFWS Information for Planning and Consultation (IPaC; USFWS 2019c) was used by CEMVN as a primary source.

Wading Bird Colonies

The study area includes habitats that are commonly inhabited by colonial nesting waterbirds and/or seabirds that are recorded in the 2003 Louisiana Statewide Wading Bird and Seabird Nesting Inventory and it is likely that there are additional colonies that are not listed in that database. A site inspection of all of the RP footprints would be conducted by a qualified biologist before construction for the presence of undocumented nesting colonies during the nesting season in coordination with the USFWS and NOAA because some waterbird colonies change locations year-to-year.

Atlantic Bottlenose Dolphin

Bottlenose dolphins are protected under the Marine Mammal Protection Act and can potentially be found in the coastal waters of the parish. They often venture very close to shore and are naturally curious, so it can be anticipated that they may be drawn to coastal construction activities.

3.2.1.10.2 "At-Risk" Species

USFWS's Southeast Region has defined "at-risk species" as those that are: 1) proposed for listing under the ESA by USFWS; 2) candidates for listing under the ESA, which means the species has a "warranted but precluded 12-month finding;" or 3) petitioned for listing under

the ESA, which means a citizen or group has requested that the USFWS add them to the list of protected species. USFWS's goal is to work with private and public entities on proactive measures to conserve species with low or declining populations, thereby precluding the need to federally list as many at-risk species as possible. While not all species identified as at-risk would become ESA listed species, their potentially reduced populations warrant additional consideration during plan formulation and design to avoid and minimize impacts. See Appendix C: Environmental for a list of "At-Risk" Species from USFWS.

3.2.1.11 *Scenic Rivers*

There are no federally designated Wild and Scenic Rivers as defined by the federal Wild and Scenic Rivers Act, 16 U.S.C. §1271, *et seq* within the study area.

However, there are natural and scenic streams designated by the Louisiana Scenic Rivers Act of 1988 within the parish. The LDWF is the lead State agency in the Scenic Rivers Program. There are approximately 3,000 miles of water that are currently designated as Scenic Rivers in Louisiana. Designated state scenic streams within St. Tammany Parish include: Abita River, Bayou Cane, Bayou Chinchuba, Bayou Lacombe, Bayou Liberty, Bogue Chitto River, Bogue Falaya River, Bradley Slough, Holmes Bayou, Morgan River, Tchefuncte River and its tributaries, West Pearl River, and Wilson Slough. Bayou Liberty and Mile Branch as a tributary to the Tchefuncte River are designed state scenic streams that would be impacted by the RP.

3.2.1.11.1 *Bayou Liberty*

The headwaters of Bayou Liberty are found in St. Tammany Parish, approximately 1.5 miles southeast of St. Tammany Comer. The bayou flows from this point, generally southward to its confluence with Bayou Bonfouca near Lake Pontchartrain. Bayou Liberty, from its headwaters, just north of Horseshoe Island road, to its confluence with Bayou Bonfouca, is designated a Louisiana Natural and Scenic River in an amendment to the Scenic Rivers Act passed in 2010 by Act 406.

Bayou Liberty is approximately 15.3 miles long. The bed of the bayou is privately owned from its headwaters to a point approximately one-half mile north of Interstate 12. From that point southward to its entrance into Bayou Bonfouca the State claims ownership of the water bottom of Bayou Liberty (Office of State Lands). The bayou which is part of the Lake Pontchartrain Basin drains approximately 26,963 acres of land (USDA GIS) and empties into Bayou Bonfouca which then empties into Lake Pontchartrain. The bayou has not been channelized, cleared, snagged, or otherwise altered in the last 25 years (conversations with St. Tammany Parish gov). The primary land uses immediately adjacent to the bayou are silva-culture and residential development; however, a large portion of the watershed, especially within the southern reaches, remains undeveloped floodplain.

Bayou Liberty supports a wide range of recreational opportunities such as boating, paddling, fishing, hunting, birding, etc. There are several boat launches providing direct access, and the bayou benefits from the lower reach of Bayou Bonfouca providing connection from Bayou Liberty to Lake Pontchartrain. Fishermen take common freshwater species (e.g.,

bass, bream, catfish, etc.) regularly and saltwater species (e.g., speckled trout, red drum, etc.) can be had in the lower reaches seasonally, beginning in fall.

3.2.1.11.2 *Mile Branch*

Mile Branch is a tributary to the Tchefuncte River and therefore is designated as a Louisiana Natural and Scenic River in an amendment to the Scenic Rivers Act. The channel is narrow and cut-off from its floodplain. It represents the characteristics of a high gradient ephemeral stream flowing during and after a period of rainfall. When it flows, the flows are faster flowing. The Mile Branch flows through an urban area with housing development directly on the stream banks. The Mile Branch has been channelized through the neighborhood. It is highly incised and subject to high erosive forces during large storm events. There is a narrow broken riparian corridor adjacent to the stream considered highly disturbed given the development on its banks.

3.2.1.12 *Hazardous, Toxic, and Radioactive Waste*

Under Engineer Regulation (ER) 1165-2-132, Hazardous, Toxic, and Radioactive Waste (HTRW) Guidance For Civil Works Projects (26 June 1992), CEMVN undertakes reasonable identification and evaluation of Hazardous, Toxic, and Radioactive Waste (HTRW) contamination within the vicinity of the footprints of the RP in order to avoid construction in HTRW-contaminated areas where practicable. USACE HTRW policy is to avoid the use of project funds for HTRW removal and remediation activities. USACE conducts a Phase I Environmental Site Assessment (ESA) for the footprints of the proposed action (including the proposed borrow sites) in accordance with ER 1165-2-132 and the American Society for Testing and Materials (ASTM) E 1527-13, Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process (ASTM, 1997).

A preliminary Phase I site investigation was conducted on 18 February 2020 for the study area generally, on 8 March 2023 for the Optimized TSP. Two superfund sites, three brownfield sites, eight Resource Conservation and Recovery Act (RCRA) large quantity generator sites, 26 RCRA small quantity generator sites, several crude oil pipelines natural gas pipelines, and several plugged and abandoned oil/gas wells were found within the boundaries of the study area. The two superfund sites and the brownfield sites should be considered as potential recognized environmental conditions (RECs), and the pipelines and wells may be considered as RECs. Three RECs were identified in the regulatory database within the standard 1-mile search radius of the proposed ROW for Mile Branch and South and West Slidell. The EPA and LDEQ's EDMS both revealed no records of enforcement or compliance for the two brownfield sites. The TSCA facility had one reported violation in the 4th quarter of 2020. The issue has been corrected.

Two containment booms and a rusted 55-gallon drum were found within the Mile Branch (Appendix C: Environmental, Photos 15-22). Per LDEQ, the containment booms were placed by the city of Covington to prevent trash from traveling into the waterway. The 55-gallon drum was found to contain no products of concern per LDEQ.

Some areas in the project area have been extensively utilized for oil and natural gas exploration and production activities. This includes the presence of oil and gas wells, tank batteries, and petroleum and natural gas transmission pipelines. Oil and gas wells, tank batteries, and petroleum and natural gas transmission pipelines may have a moderate, potential impact on the soil and water resources within or adjacent to the proposed levee ROW.

Further investigation in the proposed levee ROW is necessary due to lack of Right Of Entry for the entire St. Tammany Parish Feasibility Study footprint.

3.2.1.13 *Air Quality*

The Clean Air Act Amendment of 1990 directed the EPA to establish National Ambient Air Quality Standards (NAAQS) for the following six criteria pollutants considered harmful to public health and the environment:

- carbon monoxide (CO),
- nitrogen dioxide (NO₂),
- ozone (O₃),
- sulfur oxides (commonly measured as sulfur dioxide [SO₂]),
- lead (Pb),
- particulate matter no greater than 2.5 micrometers (µm) in diameter (PM_{2.5}),
- particulate matter no greater than 10 µm in diameter (PM₁₀).

The EPA classifies air quality by air quality control region (AQCR) according to whether the region meets primary and secondary air quality standards. An AQCR or portion of an AQCR may be classified as attainment, nonattainment, or unclassified. A classification of attainment indicates that air quality for one or more criteria air pollutants within the region is within NAAQS values. A nonattainment classification indicates that regional air quality for one or more criteria air pollutants is not within NAAQS values. A classification of unclassified indicates that air quality within the region cannot be classified (generally because of lack of data). A region designated as unclassified is treated as an attainment region. The study area is located in the southern Louisiana AQCR.

The EPA Green Book Nonattainment Areas for Criteria Pollutants (Green Book) maintains a list of all areas within the United States that are currently designated nonattainment areas with respect to one or more criteria air pollutants. Nonattainment areas are discussed by county or metropolitan statistical area (MSA). MSAs are geographic locations, characterized by a large population nucleus, that are comprised of adjacent communities with a high degree of social and economic integration. MSAs are generally composed of multiple counties. Based on review of the Green Book, the parish is currently designated as being in attainment for all NAAQS.

3.2.2 Human Environment

Historically, damages from storm surge and riverine flooding events have adversely impacted business and industrial activity, agricultural activity, local employment and income,

which then led to commensurate negative impacts to property values and the tax base, upon which government revenues rely. 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.

The transportation infrastructure includes major roads, highways, railroads, and navigable waterways that have developed historically to meet the needs of the public. Interstate 12 (I-12) is an east-west thoroughfare that branches off from Interstate 10 (I-10) and is a primary route for hurricane evacuation and post-storm emergency response. Rail and aviation facilities are spread throughout the parish.

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 ways of behavior. These characteristics include race, education, income, ethnicity, religion, language, and mutual economic and social benefits. The study area is comprised of communities with a long history and long-established public and social institutions, including places of worship and schools.

3.2.2.1 Socioeconomics

The socioeconomics can be characterized by inventory of structures, trends in population, number of households, employment, and income. Historically, damages from storm surge and riverine flood 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 state and municipal government revenues rely.

3.2.2.1.1 Structures

An inventory of residential and nonresidential structures was developed by CEMVN in 2019 using the National Structure Inventory (NSI) version 2 for the study area. The inventory consists of approximately 94,000 structures with 90 percent categorized as residential and 10 percent categorized as commercial. Figure 3-6 shows the NSI and the study area boundary. Table 3-11 shows the structures damaged by coastal and riverine combined probability events, which is a specific event that will occur in any given year (specific events listed in the Table 3-11) under existing conditions.

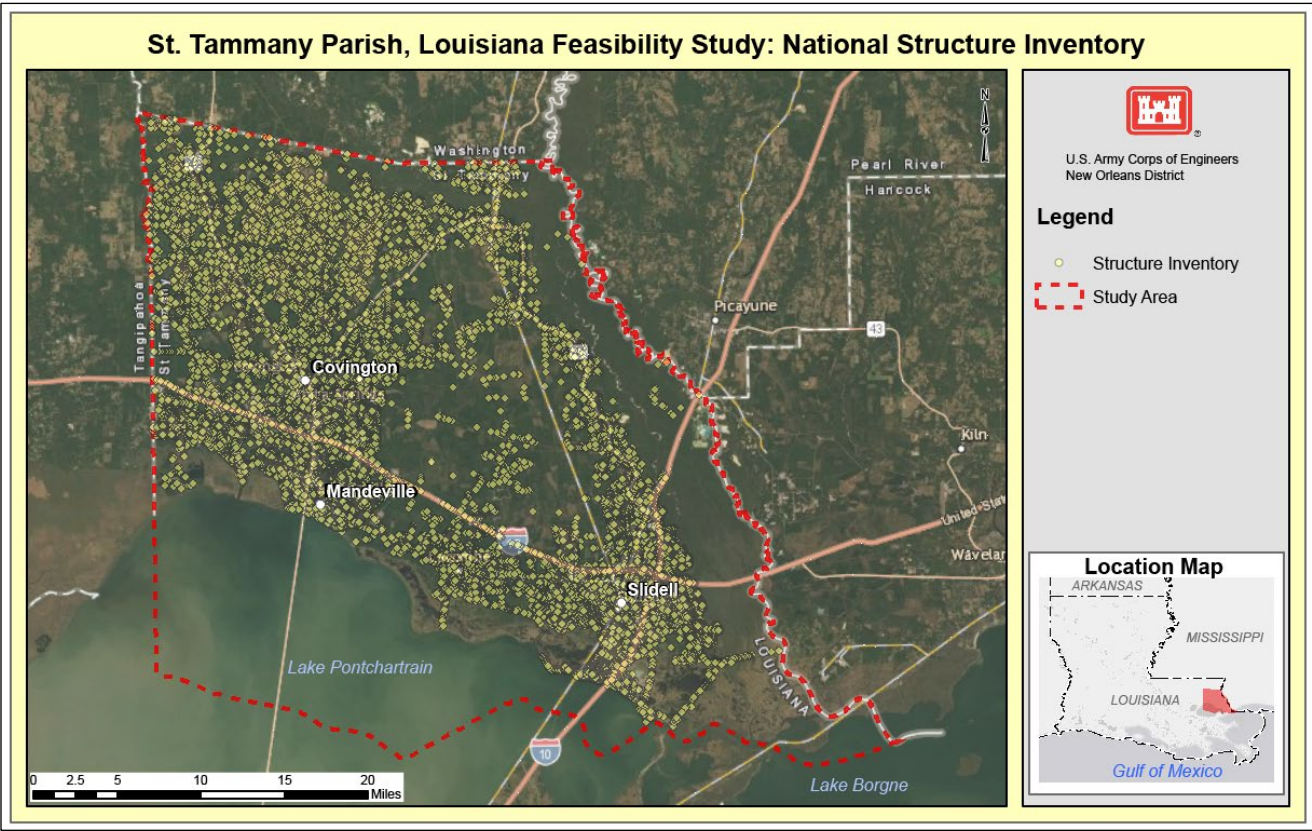


Figure 3-6. Study Area Boundary and National Structure Inventory (2019)

Table 3-11. Structures Damaged by Probability Event under Existing Conditions

Structures Damaged by Probability Event in Existing Conditions	
0.10 (10 year)	6,150
0.04 (25 year)	9,650
0.02 (50 year)	13,800
0.01 (100 year)	17,850
0.005 (200 year)	22,800
0.002 (500 year)	25,600

3.2.2.1.2 Population, Number of Households, and Employment

Tables 3-12, 3-13, and 3-14 display the population, number of households, and the employment (number of jobs) for the years 2000, 2010, 2020, and projections for 2025 and 2045 for St. Tammany Parish.

Table 3-12. Historical and Projected Population

Parish	2000	2010	2020	2025	2045
St. Tammany	192,131	234,567	258,447	262,054	275,133
Sources: 2000 and 2010, and 2020 from U.S. Census Bureau; 2019, 2025, 2045 from Moody's Analytics (ECCA) Forecast					

Table 3-13. Historical and Projected Households

Parish	2000	2010	2020	2025	2045
St. Tammany	69,714	87,915	95,054	105,906	119,757

Sources: 2000 and 2010, and 2020 from U.S. Census Bureau; 2019, 2025, 2045 from Moody's Analytics (ECCA) Forecast

Table 3-14. Historical and Projected Employment

Parish	2000	2010	2020	2025	2045
St. Tammany	59,560	78,379	89,294	96,699	110,549

Sources: 2000 and 2010, and 2020 from U.S. Bureau of Labor Statistics; 2019, 2025, 2045 from Moody's Analytics (ECCA) Forecast

3.2.2.1.3 Income

Table 3-15 shows the actual and projected per capita personal income levels for St. Tammany Parish from 2000 to 2025.

Table 3-15. Actual and Projected Per Capita Personal Income Levels from 2000 to 2025

Parish	2000	2010	2020	2025
St. Tammany	29,945	46,995	70,190	96,474

Sources: 2000, 2010, and 2020 from U.S. Bureau of Economic Analysis; 2019, 2025 from Moody's Analytics (ECCA) Forecast

3.2.2.1.4 FEMA Flood Claims

The FEMA flood loss statistics for St. Tammany Parish from July 2018-July 2019 are shown in Table 3-16. The table includes the total number of insured losses and total dollars paid. According to the Flood Loss Outreach and Awareness Taskforce (FLOAT), approximately 37 percent of the properties in St. Tammany Parish have flood insurance. The table does not account for uninsured losses or unincorporated areas of the parish. Recent disasters and predicted future events would continue to negatively impact the region without some form of flood risk management solution. The PDT developed FRM, CSRM, and combined FRM and CSRM management measures to reduce the risk of flood damages for residential and commercial structures, vehicles, and major transportation routes and activities vital to the economy of the region and nation.

Table 3-16. FEMA Loss Statistics for St. Tammany Parish, Louisiana from 11/1970 through 3/2022

Location	Number of Claims	Total Payments
ABITA SPRINGS, TOWN OF	247	\$2,283,799
COVINGTON, CITY OF	2,731	\$56,600,007
FOLSOM, VILLAGE OF	333	\$10,890,845
MADISONVILLE, TOWN OF	1,298	\$32,209,102
MANDEVILLE, CITY OF	4,708	\$80,767,614
PEARL RIVER, TOWN OF	566	\$8,719,945
SLIDELL, CITY OF	25,992	\$1,504,274,888
ST. TAMMANY PARISH*	38,642	\$1,773,746,121

Source: Federal Emergency Management Agency (FEMA). *Incorporated St. Tammany Parish includes but is not limited to Lacombe and Bush.

3.2.2.1.5 Social Vulnerability Index

The devastation from Hurricane Katrina brought nation-wide attention to the salience of the related concepts of social vulnerability and resiliency when evaluating water resources projects (USACE, 2008). Social vulnerability is a characteristic of groups or communities that limits or prevents their ability to withstand adverse impacts from hazards to which they are exposed. Resiliency, in turn, refers to the ability of groups or communities to cope with and recover from adverse events. The factors that contribute to vulnerability often reduce the ability of groups or communities to recover from a disaster; therefore, more socially vulnerable groups or communities are typically less resilient.

Several factors have been shown to contribute to an area's vulnerability/resiliency, including poverty, racial/ethnic composition, educational attainment, and proportion of the population over the age of 65. The social vulnerability index used in this study was developed by the Center for Disease Control (CDC) which utilized 2020 American Community Survey data. The CDC's Social Vulnerability Index (SVI) measures the relative vulnerability of every U.S. Census tract. The SVI ranks 16 social factors including unemployment, minority status, and disability and then further groups these factors into four related themes. Each census tract receives a rating for each theme as well as an overall theme. The four themes include socioeconomic status, household composition and disability, minority status and language, and housing type and transportation. Tracts are rated as percentile ranking values ranging from 0 to 1, with higher values representing greater vulnerability. The CDC flags census tracts with an overall SVI rating greater than or equal to 0.9 as high vulnerability to hazards.

Of the 59 census tracts in the study area, three census tracts were flagged as "high vulnerability". Census tract 408.07 and 409 are located in Slidell, Louisiana with an overall SVI score of 0.95 for both. Census tract 405.01 is located in Covington, Louisiana with an overall SVI score of 0.91. Of the 6,410 structures in the area, 355 have an SVI score above

0.90. The majority of SVI scores in this study area are below the 65th percentile with only four census tracts ranging from 0.68 to 0.76, located in the southeast portion of the study area in the North Slidell/McClane area. Overall, most of the study area does not have an especially high vulnerability to natural disasters. Additionally, with the two structural components in the study area, risk of flood damages can be further reduced. The Mile Branch Channel Improvements, located in Covington, Louisiana, runs through census tract 405.01. The West and South Slidell Levee and Floodwall System crosses the northwest portion of census tract 408.07. With these structural components crossing through highly socially vulnerable areas, the two census tracts can greatly benefit from the reduction in flood damages.

3.2.2.1.6 Environmental Justice

Environmental Justice (EJ) is the fair treatment and meaningful involvement of all people regardless of race, color, national origin or income regarding the development, implementation and enforcement of environmental laws, regulations, and policies, with no group bearing a disproportionate burden of environmental harm, and risks. EO 12898 directs 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. Areas of EJ concern are identified to help inform planners as to the location of those areas needing a particular focus and attention when determining the impacts of the federal action, as described in EO 12898. Federal agencies should assess the effects of their projects on communities with Environmental Justice concerns in accordance with EO 12898:

Environmental Justice, 1994 and EO 14008, Tackling the Climate Crisis at Home and Abroad, 2021. For USACE, compliance with these EOs is mandatory pursuant to Section 112(b)(1) of WRDA 2020 (Public Law 116-260). (“In the formulation of water development resources projects, the Secretary shall comply with any existing EO regarding environmental justice . . . to address any disproportionate and adverse human health or environmental effects on minority communities, low-income communities, and Indian Tribes.”). For purposes of consistency with EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, the terms “minority populations” and low-income populations” are used in this document.

EO 14008, signed by President Biden in January 2021, is a commitment to securing environmental justice and spurring economic opportunity for disadvantaged communities that have been historically marginalized and overburdened by pollution and underinvestment in housing, transportation, water and wastewater infrastructure, and health care. The federal government has made it a goal that 40 percent of the overall benefits of certain federal investments flow to disadvantaged communities that are marginalized, underserved, and overburdened by pollution. This goal has been designated the Justice 40 Initiative. There are nine census tracts in St. Tammany Parish that have been identified as disadvantaged communities according to the Justice 40 criteria. Each of these communities qualify due to their low-income designation and the economic loss to building value resulting from natural hazards each year. Additionally, categories shared by some but not all these communities include barriers to transportation, unemployment, percent of adults with less than a high school diploma, high rates of heart disease, and projected flood risk.

The PDT used U.S Census Data to identify areas of EJ concern (minority and low-income communities) within the study area, St. Tammany Parish. For purposes of the EJ analysis, “environmental justice communities” were defined as communities that meet established thresholds for identifying low-income area residents who identify as a person of color, or minority. Methods for determining thresholds are explained in EPA’s EJ Promising Practices document and are presented below.

1. Census Data. The PDT used the NHGIS tool to obtain the most recent U.S. Census Bureau 5-year survey data, 2016-2020, herein referred to as 2020 data. Similar demographic data is available through the EJSCREEN tool. Data for cities and towns and for U.S. Census Block Groups are presented which helps highlight areas of EJ concern for different geographic areas. Cities and towns are identified by the U.S. Census bureau. The U.S. Census block is a geographic area consisting of several smaller U.S. Census Blocks which are combined to form Block Groups. Each of these groups represent geographic areas and people living in communities. There are 160 census block groups in the study area, St. Tammany Parish.
 - A. Low-income threshold criteria. A reference area’s percentage of residents living below poverty was used as the threshold for identifying areas of EJ concern based upon poverty status. The state of Louisiana is the reference area for the study. The 2020 percentage of Louisiana residents living below the poverty level is 19.6 percent. Any area in the study area that consists of 19.6 percent or more of residents living below poverty is considered an area of EJ concern. The state poverty income level for year 2020 was \$26,200 for a family of four.
 - B. Minority population threshold criteria. If 50 percent of residents in an area identify as a person of color (minority), then the area is considered an area of EJ concern. Additionally, if the percentage of minority residents in an area is meaningfully greater (15 percent) than the percentage minority in the state of Louisiana, that area is also considered an area of EJ concern. The threshold used to identify minority areas of EJ concern is the lower of the two. In this case, the minority threshold used to identify areas of EJ concern is 48.4 percent or greater.

Data for Places and CDPs gives a broad- brush overview of the parish’s minority and low-income status. Table 3-17 shows the racial composition for the Parish and its cities and towns. A majority of the Parish is white with 83 percent identifying as white and 17 percent identifying as minority. The largest municipality in the study area is Slidell, home to about 11 percent of the Parish population, is also majority white. All of the other locations shown in Table 3-18, including Lacombe, Mandeville, Covington and Abita Springs are majority white. The largest minority in the parish is Black/African American. None of the locations shown in Table 3-18 meet or exceed the minority threshold of 48.4 percent to be considered an area of EJ concern.

Table 3-17. 2020 U. S. Census Bureau Information

Location	Total Population	White	Black	Native American	Asian	Native Hawaiian	Two or more Races	Minority	Hispanic
St. Tammany	264,570	82%	13.9%	0.6%	1.5%	0.1%	2.0%	18.0%	6%
Slidell (city)	28,781	71.5%	17.7%	0.9%	2.9%	0	6.0%	28.5%	7%
Lacombe CDP*	8,519	70.1%	24.9%	0.2%	0.2%	0	3.2%	29.9%	3%
Mandeville (city)	13,192	94.9%	0.8%	0.2%	2.3%	0	1.8%	5.1%	4%
Covington (city)	11,565	78.2%	14.7%	0.2%	0.7%	0	4.0%	21.8%	4%
Abita Springs town	2,605	83.6%	5.5%	0.3%	0.4%	0	10%	16.4%	7%

*Census Designated Place

Source: U.S. Census Bureau, American Fact Finder, ACS 2016-2020.

Table 3-17 shows the percentage of people living below poverty for the Parish and its cities and towns.

The EPA recommends using the state's low-income percentage to identify areas of EJ concern, which is 19.6 percent for year 2020. None of the places shown in Table 3-17 meet or exceed this EJ threshold.

Table 3-18. Places within Study Area Percent of Population Living Below Poverty

Place	Percent of Population Below Poverty
St. Tammany Parish	12.7%
Slidell (city)	14.1%
Lacombe CDP	16.4%
Mandeville (city)	7.6%
Covington (city)	13%
Abita Springs (town)	8%

Source: U.S. Census Bureau ACS 2016-20201

However, there may be neighborhoods within these large places, cities, and towns that meet the criteria for an area of EJ concern.

A more refined and zoomed in approach uses U.S. Census Block Groups, which are much smaller geographic areas compared to cities and towns. Census Block Groups are smaller

geographic areas made up of Census Blocks (the smallest geographic area for which U.S. Census data is available).

A closer look at the study area reveals pockets of neighborhoods with EJ concerns located in Census Block Groups within these larger communities, which are identified in Figure 3-7. The colored polygons in Figure 3-7 depict the U.S. Census Block Groups in the study area that meet or exceed minority or low-income thresholds (or both) used to identify areas of EJ concern. Figure 3-8 shows the minority population percentages and Figure 3-9 shows the low-income population percentages of the block groups that are areas of EJ concern in the study area.

Of the 160 U.S. Census Block Groups in St. Tammany Parish, 22 block groups are low-income while 7 more are low-income and minority for a total of 29 block groups that are considered areas of EJ concern and noted on Figure 3-7 as blue and green polygons, respectively.

Out of the 160 block groups in St. Tammany, 12 are minority block groups and 5 more are minority and poverty. Figure 3-8 shows the minority block groups in the study area.

All the minority and low-income areas identified on Figure 3-7 and Figure 3-8 and in Table 3-19 are the focus of the EJ assessment in Chapter 5.

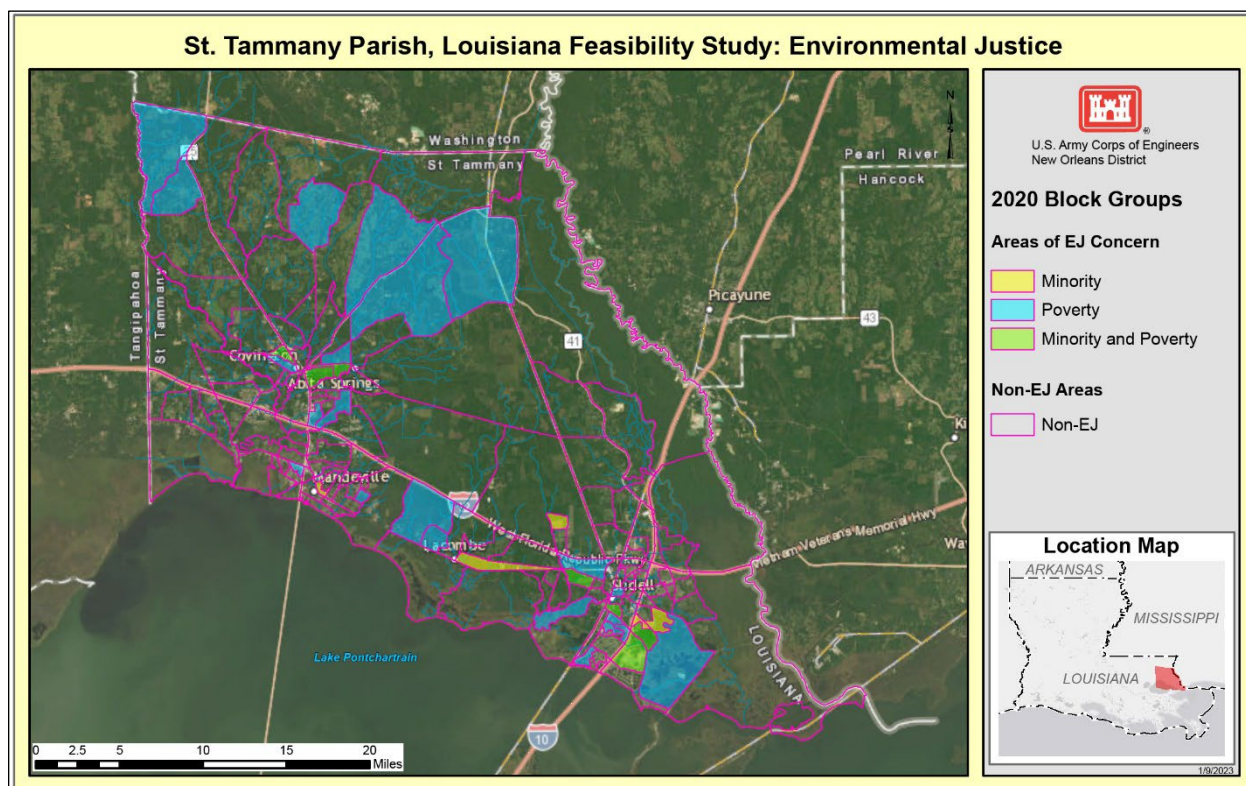


Figure 3-7. Areas of EJ concern at the Block Group Level, Study Area

Source: Steven Manson, Jonathan Schroeder, David Van Riper, Tracy Kugler, and Steven Ruggles. IPUMS National Historical Geographic Information System: Version 16.0 [dataset]. Minneapolis, MN: IPUMS. 2021. <http://doi.org/10.18128/D050.V16.0>

Census Tract/Block Group Number	Total Population	White	Black	Native American	Asian	Hawaiian	Other	Two or More Races	Percent Minority
405013	1772	741	935	7	0	0	0	89	58.2%
406081	1121	458	353	0	0	0	247	63	59.1%
406083	1423	531	360	28	39	0	0	465	62.7%
407111	1976	848	1128	0	0	0	0	0	57.1%
408062	2177	787	912	0	260	0	0	218	63.8%
408063	1096	506	578	0	0	0	0	12	53.8%
408064	1625	587	1017	0	0	0	0	21	63.9%
408072	2882	831	1308	0	38	0	230	475	71.2%
409002	1242	461	606	126	0	0	49	0	62.9%
411051	1743	855	347	0	2	0	293	246	50.9%
412093	1805	740	795	0	0	0	0	270	59.0%
412133	1544	726	815	0	0	0	0	3	53.0%

Figure 3-8. Tract/Block Group, Areas of EJ Concern Minority Percentages

Source: U.S. Census ACS 2016-2020

*Population for Whom Poverty Status is Determined
Source: U.S. Census ACS 2016-2020

Table 3-19. Tract/Block Group, Areas of EJ Concern Poverty Percentages

Census Tract/Block Group Number	Total Population*	Population Living Below Poverty	% of Population Living Below Poverty
401032	2284	837	36.6%
401071	1202	297	24.7%
401072	3038	1096	36.1%
401081	1465	436	29.8%
402031	1016	265	26.1%
402033	898	371	41.3%
403061	1401	376	26.8%
405012	1388	375	27.0%
405013	655	279	42.6%
405021	2353	609	25.9%
406062	1389	474	34.1%
406081	1121	580	51.7%
406083	1423	339	23.8%
406091	2721	507	18.6%
408011	1625	303	18.6%
408012	1058	240	22.7%
408013	1355	350	25.8%
408052	1593	339	21.3%
408064	1625	628	38.6%
408072	2882	912	31.6%
408073	988	343	34.7%
409002	1242	357	28.7%
410021	764	182	23.8%
411032	2267	576	25.4%
411051	1743	392	22.5%
411061	1681	448	26.7%
412112	1713	383	22.4%
412131	1801	613	34.0%
412134	1082	452	41.8%

3.2.2.2 Navigation

The Abita River, Bayou Cane, Bayou Chinchuba, Bayou, Lacombe, Bayou Liberty, Bogue Chitto River, Bogue Falaya River, Morgan River, Tchefuncte River and its Tributaries, and the West Pearl River are navigable waterways that empty into Lake Pontchartrain and the Gulf of Mexico. All are of importance to recreational and commercial interests in the parish. Maintenance of access to these waterways is vital to the continued growth and health of industries and commerce they serve.

3.2.2.3 Cultural, Historic, and Tribal Trust Resources

Cultural resources include historic properties, archaeological resources, and Native American resources, including sacred sites and traditional cultural properties (TCPs). Historic properties have a narrower meaning and are defined in National Historic Preservation Act (NHPA) regulations at 36 CFR 800.16(l); they include prehistoric or historic districts, sites (archaeological and religious/cultural), buildings, structures, or objects listed in or eligible for listing in the National Register of Historic Places (NRHP). Historic properties are identified by qualified agency representatives in consultation with State Historic Preservation Officers (LA SHPO), federally recognized tribes, and other consulting parties. Common cultural resources include prehistoric Native American archeological sites, historic archeological sites, individually NRHP listed buildings, and National Register Historic Districts (NRHDS).

The cultural prehistory and history of the parish is very rich. The generalized cultural chronology for Louisiana has five primary archaeological components, or “periods,” as follows: Paleoindian (11,500-8000 B.C.), Archaic (8000-800 B.C.), Woodland (800 B.C.-1200 A.D.), Mississippian (1200-1700 A.D.), and Historic (1700 A.D.-present). The PDT identified historic properties based on a review of the NRHP database, the Louisiana Division of Archaeology (LDOA) Louisiana Cultural Resources Map (LDOA website), historic maps, pertinent regional and local cultural resources investigations, historic aerial photography, and other appropriate sources. This review revealed a total of 45 historic properties listed in the NRHP are located within St. Tammany Parish. These include 6 historic districts, 36 individual buildings, and 3 sites.

Three historic districts are located in Covington and include the Division of St. John Historic District (Covington Historic District), Bogue Falaya Park (Wayside Park) and, the St. Scholastica Priory and Cemetery. The Division of St. John Historic District (Covington Historic District), listed in 1982 under Criteria A in the area of Community Planning and Development and Criteria C in the area of Architecture, is comprised of largely late-19th and early-20th century residential and commercial buildings. The Bogue Falaya Park (Wayside Park), listed in 2017, includes four contributing resources significant under Criterion A for Entertainment/Recreation. The St. Scholastica Priory and Cemetery, listed in 2018, is a rural 16-acre site comprised of four resources significant under Criteria A in the area of Religion and Education for its association with the Benedictine Sisters of the St. Scholastica in St. Tammany Parish.

Two other NRHDs located in western St. Tammany Parish include Fontainebleau State Park (Tchefuncte State Park) in Mandeville and the Abita Springs Historic District in Abita Springs. The Fontainebleau State Park (Tchefuncte State Park), listed in 1999, is located on Lake Pontchartrain. The park is significant in the area of Entertainment/Recreation and Politics/Government as it represents the early development of the state parks movement in Louisiana and the critical role of the Civilian Conservation Corps in the establishment of state parks in Louisiana. The Abita Springs Historic District, listed in 1982, is comprised of mostly late-19th and early-20th century resources that served Abita Springs, a former vacation resort for New Orleans residents.

The remaining historic district is the Teddy Avenue Residential Historic District located northeast of downtown Slidell. Recently listed in the NRHP in July 2021, the Teddy Avenue NRHD includes 29 contributing early 20th century residential buildings and one public park, Brugier Addition. The district is significant under Criterion C in the area of Architecture as the most cohesive and intact collection of early twentieth century residential buildings in Slidell.

Three sites in St. Tammany Parish include the Wouldiams Cemetery in Lacombe, and the Pottery Hill and Tchefuncte sites in Mandeville. The Wouldiams Cemetery, listed in 2018, is a 1-acre Creole cemetery locally significant under Criteria A in the area of Ethnic Heritage. The Pottery Hill site (16ST48), listed in 2011, is an archaeological site that is significant at the state level for subsurface deposits of prehistoric Tchefuncte and Marksville cultures with a period of significance A.D. 1-250. The Tchefuncte site (16ST1) is located in Fontainebleau State Park. It was listed in the NRHP in 2000 for its extensive and well preserved shell middens associated with the prehistoric Tchefuncte culture.

3.2.2.3.1 Archaeological Site Potential

Approximately 187 cultural resources investigations have occurred within the parish. The LDOA NRHP Eligibility Database indicates that 92 prehistoric and historic archaeological sites have been previously recorded as a result of these investigations. To date, no comprehensive systematic archaeological survey has been conducted throughout the entire study area and the distribution of recorded archaeological sites is largely the result of project-specific federal and state compliance activities (e.g., linear surveys of roads, pipelines, and power line rights-of-way). Therefore, in addition to considering the known sites within the parish, the RP footprints must also be further assessed for archaeological site potential.

In lieu of additional survey data, Louisiana's Comprehensive Archaeological Plan (Girard, et al. 2018) provides a useful site distribution model that can be used for baseline planning purposes. To a great extent, the unique geomorphology and ecology of the study area has influenced site type and location. To examine how the physical landscape in Louisiana impacts the archaeological record, the LDOA divides the state into a series of regions that follow the ecoregions classification of the Western Ecology Division of the United States Environmental Protection Agency (<https://www.epa.gov/eco-research/ecoregion-downloadfiles-state-region-6#pane-16>). There are six regions at Level III, two of which fall within the present study area: Southeastern Plains and Southern Coastal Plain. Girard, et

al., (2018:24-31) define how the unique environmental, biological, and physiological characteristics of each region cumulatively influenced cultural development in order to provide context to the distribution of where sites are likely or unlikely to occur. These characteristics are described below.

Southeastern Plains

This region lies in the northern portions of the Florida parishes in the state of Louisiana and consists of level to gently undulating plains formed in Pliocene and Pleistocene deposits that are covered by thin layers of loess in some areas. These deposits consist of sandy loams, silt loams, and clay loams with cherty gravels present. Cherty gravel bars are common due to north-south trending streams and rivers that drain the region. Long-leaf pine woodlands with mixed oak-pine forest are present within upland vegetation. Sites are typically situated on higher ridge crests and along stream margins. Sites would occur in surface contexts in higher elevations while occasional buried sites may be found in alluvial settings. Agricultural and timber harvesting activities within this region impact sites in surface contexts. Gravel-mining operations within the larger drainages also have destroyed sites within the limits of their activities. Additionally, oil and gas development of the Tuscaloosa shale may have a significant impact on sites in the future.

Southern Coastal Plain

The Southern Coastal Plain region consists of late Pleistocene terraces with Holocene-age alluvial and deltaic deposits along the coast. The uplands consist of gently rolling topography dissected by north-south trending streams and rivers. Cherty gravels that originated from the Pleistocene sediments accumulate in stream beds. Long-leaf pine forests with infrequent open savannas on level upland surfaces dominate upland vegetation. Holocene alluvial deposits are in floodplains and on low terraces along the major streams, especially the Pearl River. Sites within the upland areas are concentrated on higher ridge crests and overlooking streams. Most of these deposits are shallow with overlapping occupations and no opportunity for stratified sites. Buried and stratified sites may be present in the floodplains of the larger streams.

The coastal areas of this region are experiencing some of the fastest urban development of any area in the state. As a result, this growth is impacting many sites. Further, there is significant erosion along the north shore of Lake Pontchartrain that is impacting sites in that area. In upland areas, pine plantations and agriculture are the dominant ground-disturbing activities in areas where sites are generally at the modern ground surface. Additionally, oil and gas development of the Tuscaloosa shale may have a significant impact on sites in the future.

3.2.2.3.2 Tribal Trust Resources

There are six federally-recognized Tribes that have current and/or ancestral interest within the study area:

Alabama-Coushatta Tribe of Texas (ACTT)

Choctaw Nation of Oklahoma (CNO)
Coushatta Tribe of Louisiana (CT)
Jena Band of Choctaw Indians (JBCI)
Mississippi Band of Choctaw Indians (MBCI)
Tunica-Biloxi Tribe of Louisiana (TBTL)

Each Tribe has a Tribal Historic Preservation Officer (THPO) who assumes the responsibilities of the LA SHPO for cultural resources within their Tribal lands and consults with federal agencies on activities that may impact archaeological sites of interest on or off of Tribal lands [as defined in 36 CFR § 800.16(x)].

3.2.2.3.3 *Borrow Sites*

CEMVN completed a preliminary review of existing conditions regarding cultural resources within the Area of Potential Effects (APE) for each of the proposed borrow sites. Historic properties within the proposed APEs for each borrow site were identified based on CEMVN's review of the NRHP database, the *Louisiana Cultural Resources Map* provided by the LA SHPO, and historic map research. No archaeological sites or historic built resources were identified within the proposed borrow sites. CEMVN's preliminary review of the proposed borrow sites evaluated is summarized in Table 3-20.

Table 3-20. Summary of Cultural Resources and Surveys within the Proposed Borrow Sites

Borrow Site	Previously Recorded Cultural Resources	Previous Survey	Previous Survey Coverage	Other Notes:
ST5	None	22-3725	Full	Phase I cultural resources survey on behalf of St. Tammany Parish for a 156.41 acre (63.30 ha) tract on Cypress Bayou in St. Tammany Parish, Louisiana (22-3725; Kuttruff et al. 2011). No cultural resources were identified within the ST5 borrow site.
ST6	None	None	None	City of Slidell constructed the West Diversion Detention Pond in 1998 (USACE 2012).
ST9	None	22-3151	Full	Phase I cultural resources survey on behalf of USCAE for five proposed detention ponds along the north side of the existing W-14 drainage canal (22-3151; Moreno et al. 2012). The parcel surveyed included 30.28 acres (12.25 ha). No cultural resources were identified within the ST9 borrow site. A determination of No Historic Properties Affected was submitted to the LA SHPO on 9 Sept 2008 and 22 Sept 2011. LA SHPO concurred with CEMVN's determination on 7 Oct 2008 and 16 Nov 2011.
MS-1	None	07-395	Full	MS-1 was investigated for cultural resources for IER #19 and #23 for the HSDRRS projects. At that time, the Mississippi Division of Archives and History (MDAH) had no record of listed or eligible historic properties within MS-1. A Phase I survey of the proposed borrow area did not identify any cultural resources within the Pearlinton site (07-395; Pumphrey 2007). The MS SHPO concurred with CEMVN's determination on 22 Nov 2006.
MS-2	None	09-0690	Full	MS-2 was investigated for cultural resources for IER #31 for the HSDRRS projects. A Phase I cultural resources assessment was performed for the Port Bienville contractor-furnished borrow area and no NRHP listed or eligible cultural resources were identified (09-0690; Thorne 2008). Concerns were raised by the Jena Band of Choctaws and the Mississippi Band of Choctaws about potential unrecorded burials within the proposed borrow area. At that time, a Memorandum of Agreement (MOA) was signed between the two tribes as well as by M. Matt Durand, L.L.C. of Port Bienville Clay Mine, L.L.C. outlining procedures to allow use of the borrow area and to care for unexpected discoveries should these occur. It is unknown if this MOA has expired pursuant to its duration provision. If the agreement expired before the undertaking or mitigation measures have been completed, CEMVN must reinitiate consultation to develop a new MOA to resolve the adverse effects from the proposed undertaking. The new agreement may acknowledge, incorporate, or continue already agreed upon measures.

3.2.2.4 Noise and Vibration

The Noise Control Act of 1972 (P.L. 92-574) directs federal agencies to comply with applicable federal, state, interstate and local noise control regulations. In 1974, United States Environmental Protection Agency provided information suggesting that continuous and long-term noise levels in excess of day-night sound level 65 A-weighted decibels (dBA), are normally unacceptable for noise-sensitive land uses such as residences, schools, churches, and hospitals.

Ambient noise levels within the study area are influenced by land uses including industrial, commercial, residential and agricultural areas. Noise sources include primarily vehicular traffic, trains, and large transport vehicles travelling in the study area. Secondary noise sources include industrial activities and construction along parish and township roads.

3.2.2.5 Aesthetics

The visual resources assessment procedure (VRAP) for USACE (Smardon, et al., 1988) provides a method to evaluate visual resources affected by USACE water resources projects. These VRAP criteria identify significant visual resources in the study area such as:

important urban landscapes, including visual corridors, monuments, sculptures, landscape plantings, and greenspace, study area is easily accessible by a major population center, project is highly visible and/or requires major changes in the existing landscape, areas with low scenic quality and limited visibility, historic or archeological sites designated as such by the NRHP or State Register of Historic Places, parkways, highways, or scenic overlooks and vistas designated as such by a federal, state, or municipal government agency, visual resources that are institutionally recognized by federal, state, or local policies, tourism is important in the study area's economy, study area contains parks, forest preserves, or municipal parks, wild, scenic, or recreational water bodies designated by government agencies, publicly or privately operated recreation areas.

Significant visual resources are primarily described in the Cultural/Historic and Recreation Resources sections of this document and the Appendices. Specific examples include:

Mandeville lakefront area, Lake Pontchartrain Causeway, National Registered Historic Districts located in the cities of Covington and Abita Springs, National Registered structures located in the cities of Covington and Slidell and towns of Abita Springs and Madisonville, National Registered Fontainebleau Louisiana State Park, National Registered Bogue Falaya City Park, Abita, Bayou Chinchuba, Bayou Cane, Bayou Lacombe, Bayou Liberty, Bayou Liberty, Bogue Chitto, Bogue Falaya, Bradley Slough, Holmes Bayou, Morgan, Tchefuncte and its tributaries, West Pearl, and Wilson Slough Louisiana State Designated Natural and Scenic Rivers, Bogue Chitto Refuge and BBMNWR, Pearl River, St. Tammany, and Lake Ramsey Savannah Louisiana State Designated Wildlife Refuges, Fairview-Riverside Louisiana State Park.

3.2.2.6 Recreation

There are two federal and five state public areas, comprising 143 square miles, which are used for recreational opportunities and are centered on natural resources: BBMNWR (to include Southeastern Louisiana National Wildlife Refuge Complex Headquarters and Visitor Center in Lacombe), Bogue Chitto National Wildlife Refuge, Fairview-Riverside State Park, Fontainebleau State Park, Lake Ramsey Savannah WMA, Pearl River WMA, and St. Tammany Wildlife Refuge. Many of the parks offer hiking/biking trails, camping, and wildlife observation. Additionally, there are nearly 100 parish and city public areas consisting of green spaces, ball fields, playgrounds, indoor recreation facilities, paths and trails (See Appendix C: Environmental Table C:3-1). See photo of the Tammany Trace in Figure 3-9.



Figure 3-9. Tammany Trace is 31 Miles of Louisiana's only Rails-to-Trails Conversion, which Links Five North Shore Communities with Green Space Photo credit: Louisiana Northshore.com.

Communities like Abita Springs, Covington, Madisonville, Mandeville, Lacombe, and Slidell provide walking and biking trails as an integral part of the recreation development along Tammany Trace and the lakefront. Communities along the I-12 corridor and the lakefront provide numerous opportunities for non-consumptive recreation activities. The majority of forested areas are predominantly BLH and are located north of the I-12 corridor. These forested lands promote consumptive recreation activities, including fishing and hunting, with hunting being predominantly big game hunting (deer and turkey), small game hunting (squirrel, rabbit, raccoon, dove, etc.), and waterfowl hunting. Numerous boat-launching sites along the network of waterways cater to boating activities and sport fishing deep within the parish and along the lakefront.

According to the United States Department of the Interior (USDOI), National Park Service (NPS) Land & Water Conservation Fund (LWCF), nearly \$4 million in LWCF funds has supported 30 recreation projects within the study area between 1965 and 2011 (See Appendix C: Environmental Table C:3-2). Section 6(f)(3) of the LWCF Act assures that once an area has been funded with LWCF assistance, it is continually maintained in public

recreation use, unless NPS approves substitution property of reasonably equivalent usefulness and location and of at least equal fair market value.

SEC. 6(f)(3) Legal Protection for Grant-Assisted Recreation Sites: No property acquired or developed with assistance under this section shall, without the approval of the Secretary, be converted to other than public outdoor recreation uses. The Secretary shall approve such conversion only if he finds it to be in accord with the then existing comprehensive statewide outdoor recreation plan and only upon such conditions as he deems necessary to assure the substitution of other recreation properties of at least equal fair market value and of reasonably equivalent usefulness and location.

3.3 FUTURE WITHOUT PROJECT CONDITIONS

NEPA requires that, in analyzing alternatives to a proposed action, a federal agency must consider an alternative of “no action.” The No Action Alternative or future without project (FWOP) conditions represent the anticipated conditions if the proposed action were not implemented and the predicted project benefits (e.g. flood risk reduction) would not be achieved. Below is a summary of the FWOP conditions. Section 1.6 discusses ongoing programs and potential projects in the study area for floodplain related activities such as the projects listed in the 2023 CPRA Master Plan. Section 3.2 discusses the Relevant Resources and Existing Conditions of the affected environment. The environmental consequences of taking “no action” is discussed by resource in Section 5 of the existing and future conditions within the study area. Appendix E: Hydrologic & Hydraulics discusses the future hydrologic conditions anticipated within the study area.

In the FWOP condition, communities would continue to be at risk from high water events induced by coastal storm surges and flooding without intervention. Due to the low existing elevation and anticipated sea level rise, it is reasonably foreseeable that the communities located adjacent to the main water bodies would continue to be plagued with challenges related to high water events. Continued flooding from the Pearl River, Tchefuncte, Mile Branch, Bogue Chitto, Liberty Bayou, Bayou Bonfouca, and other waterways would continue to negatively impact communities within the parish. Due to heavy development along streams such as Mile Branch and the coast, riparian corridors and wetland habitat have been reduced resulting in a reduction of flood storage capacity of the various habitat to absorb increasing water during storm events. Flooding from the Pearl River is commonplace in Slidell and would only worsen based on current conditions. These trends are expected to continue into the future. Wetlands are beneficial for wave attenuation to reduce the energy of storm surges, and with anticipated increased storm buffering as the result of climate change, these benefits would decline as wetlands are lost (Gedan et al., 2011; Temmerman et al., 2013).

An increased threat and the resulting negative effects from sea level rise, subsidence, and climate change are anticipated to continue into the future. This would result in higher and more frequent storm damages and higher average annual damages which could negatively impact tax revenues as property values decline due to higher risk of damage from flooding events over time. However, it is reasonable to believe that without implementation of the

proposed action, other federal, state, local, and private efforts would attempt to address the needs of the area, which would burden the revenue and budget of the parish and local communities.

Hydrologic modeling for the 10 year and 100 year storm events document a gradient of expected flooding in the parish. The hydrologic gradients were overlayed on the habitat data layers to assess potential future impacts. Increases in precipitation and tropical storm events resulting from climate change and relative sea level rise would cause increases in water temperature. Increases in water temperature along with the trend in climate change correlates with lower dissolved oxygen levels and warmer air temperatures that would likely increase the length of the growing season for certain species of aquatic plants. Species of aquatic plants that can adjust to increasing temperatures and lower dissolved oxygen would become dominant and those species that cannot adapt would become scarce. The adapted aquatic species are often invasive and longer growing seasons would create conditions favorable for growth of invasive species. Concurrently, shifts in the species of aquatic plants would result in lower plant biodiversity which would impact wildlife species dependent on the vegetation. Wildlife that does not adapt would become scarce in the area. Management of those invasive plant species, as is currently practiced in Louisiana, may result in increases in nutrient-laden runoff fueling algal blooms in nearby waterways.

SECTION 4

Formulation of Alternative Plans

Plan formulation is the process of building alternative plans that meet planning objectives by addressing the identified problems while avoiding identified constraints. A systematic and repeatable planning approach is used to ensure that sound decisions are made in accordance with the processes laid out in the Planning Guidance Notebook (ER 1105-2-101). This FIFR-EIS describes the iterative process of identifying measures, continually reevaluating the measures, screening of measures, developing alternative plans and screening alternatives and ultimately identifying the RP. The plan formulation process is consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable EOs, and other federal planning requirements. The plan formulation process considers all effects, beneficial and adverse, to each of the four evaluation accounts identified in the Principles and Guidelines (P&G) (1983), which are: NED, Regional Economic Development (RED), Environmental Quality (EQ), and Other Social Effects (OSE).

The plan formulation process is a data driven process, building upon previous data and information and developing more detail as necessary, including refinement of the measures identified and alternatives developed. Each review and screening iteration identified informational needs necessary to inform planning decisions. In the early phases of the study, the PDT used existing information and professional judgment. As the study progressed, additional data and analyses were deemed necessary to identify the differences between the measures and alternatives. Risk-informed decisions were incorporated into the planning process to balance the level of study detail necessary to make informed decisions and uncertainty that was acceptable in accordance with USACE policies, such as ER 1105-2-101 "Risk Assessment for Flood Risk Management Studies" and ER 1105-2-103 "Planning Policy for Conducting Civil Works Planning Studies."

Early iterations of measures were devoted to understanding the problems while identifying possible solutions (solutions to reduce flood risk) and critical uncertainties. In subsequent iterations, information was developed to reduce uncertainties that affected the choices at hand. While it was not possible to eliminate all uncertainty, priority was given to those that posed the greatest risk to inform decision making. As existing information was utilized to inform the comparison of alternatives, the risk of using existing information was also measured to determine if the risk was acceptable when compared to the cost and time required to collect new data or develop new analyses.

Where information was determined to be insufficient on a critical aspect of the alternatives, consideration was given to the level of analysis and cost required to inform the decision versus the risk of obtaining the critical information at a later stage of the planning process. By using these principles, the tolerance for risk was managed by balancing the level of uncertainty with the tolerance for risk. Figure 4-1 illustrates the planning process and

summarizes the information utilized at the various stages of the planning process. See Appendix B: Plan Formulation for more details.

Step 1 of the Planning Process: Identifying the Problems and Opportunities, is discussed in Section 2. Step 2 of the Planning Process builds off of Step 1.

Step 2 of Planning Process: Identification of Existing Conditions of the Affected Environment. Section 3 of this report describes the affected environment and the historic, existing, and future conditions related to FRM and CSRM. Historic and existing trends were evaluated and projected into the future to assess anticipated changes in the future conditions if no federal actions are taken. The data and trends identified were used to define the FWOP conditions, or the No Action Alternative.

Step 3 of Planning Process: Formulate Alternative Plans. This step of the planning process involves developing a wide range of potential actions or management measures (measures) to solve the problems while also meeting the planning objectives and avoiding study constraints. Individual measures are combined to create different alternatives to meet planning objectives. A measure is, potentially, a piece or part of the solution to resolve a problem, satisfy a need, or take advantage of an opportunity. A management measure, as defined by Yoe and Orth (IWR Report 96-R-21, November 1996, page 134), is “a means to an end; an act, step, or proceeding designed for the accomplishment of an objective. The definition of a measure is a feature or activity that can be implemented at a specific geographic site to address one or more planning objectives. Measures are the building blocks of which alternative plans are made....” Alternative plans are a set of one or more measures functioning together to address one or more planning objective.

Based on the identified problems, opportunities, objectives, constraints, and inventory and forecasting of critical resources defined in Sections 1, 2, and 3 of this FIFR-EIS, 30 management strategies (different types of structural, NS, and engineering with nature-based actions) to reduce flood risk were identified. The PDT initially, developed a total of 195 measures within the structural, NS, and nature-based categories. The initial 195 site-specific management measures were compiled from previous reports, NFS, stakeholders, the public, and recommendations from the PDT based on the identified inventory and forecasting of significant resources that are relevant. An additional 13 management measures were later added throughout the iterative process for a total of 208 measures that were ultimately evaluated. The measures were subsequently evaluated and screened, and the remaining 62 measures were combined to form alternative plans. See Appendix B: Plan Formulation for more details on the measures considered, how measures were screened, and how measures were combined into the Initial Array of Alternatives.

The separate alternatives were developed by combining the remaining 62 measures related to a given area or source of flooding into a geographic based alternative based on hydrologic sub-basins. In areas where the hydrologic influence of the subbasins overlap, measures were looked at in combination with other alternatives in the same vicinity (e.g., measures under Alternative 5 were looked at in combination with Alternative 4 and Alternative 6).

In areas where multiple causes for flooding were documented, measures to reduce the risk from the multiple sources were included in an alternative. The plan formulation strategy included screening and evaluating each of these distinct geographic areas separately to determine the measures that were incrementally justified in each. The Initial Array of Alternatives was assembled by combining the remaining 62 management measures by geographic area/hydrologic sub-units and included the following 13 alternatives: Lacombe, Mandeville Lakefront, Bayou Chinchuba, Abita, Bogue Chitto, Lower Tchefuncte, Upper Tchefuncte, Eastern Slidell, South Slidell, Bayou Liberty, Bayou Bonfouca, Bayou Vincent, and Lake Pontchartrain Surge.

Step 4 and 5 of Planning Process: Evaluate Effects of Alternative Plans and Measures and Compare Alternative Plans. In early iterations of the planning process, the PDT narrowed the focus from many alternatives and measures to a smaller array of alternatives and measures. See Appendix B: Plan Formulation for more details. The PDT looked at each potential measure at multiple points during the study as new information was developed to see what its effects, benefits, costs, and impacts might be. These steps involved using existing and new data to qualitatively determine and, in later iterations, model the physical, economic, and environmental conditions, along with measuring how well each alternative and measure performs at meeting the objectives and avoiding the constraints.

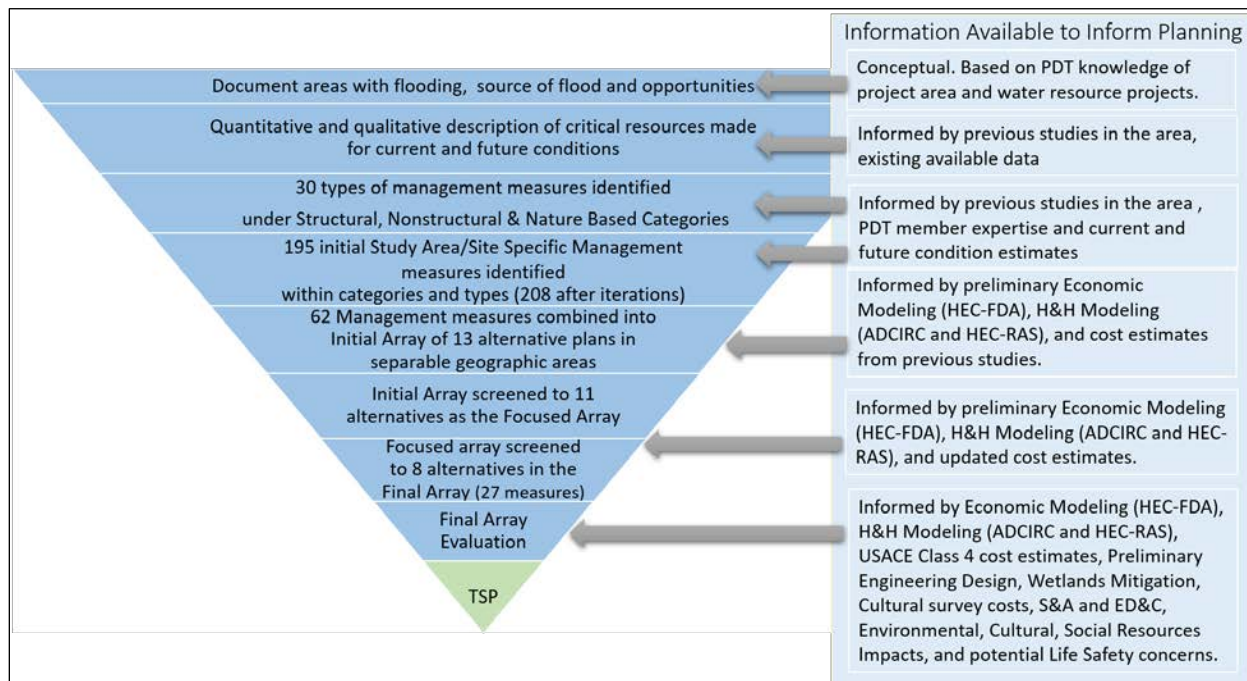
In Step 5, the PDT compared each alternative and measure(s) within the alternatives, including the No Action Alternative. The PDT screened the Initial Array of Alternatives and measures to reach a Focused Array of Alternatives which consisted of 11 alternatives and 43 measures. The screening of the Focused Array of Alternatives was informed by preliminary hydraulic (H&H) modeling (Advanced CIRCulation (ADCIRC) and Hydrologic Engineering Center – River Analysis System (HEC-RAS)), updated cost estimates and economic modeling (Hydrologic Engineering Center Flood Damage Analysis (HEC-FDA)).

The Focused Array of 11 alternatives and 43 measures, was further refined by preliminary H&H modeling (HEC-RAS and analysis of ADCIRC results), updated cost estimates, and economic modeling (HEC-FDA). Based on the evaluations, the PDT was able to determine which alternatives and measures performed the best and warranted further investigation as the Final Array of Alternatives. The PDT identified the Final Array, consisting of 8 alternatives and 27 measures. In Step 5, the PDT compared each alternative and measure(s) within the alternatives, including the No Action Alternative.

Step 6 of Planning Process: Select TSP and then a Recommended Plan. Step 6 was an additional screening step, where the selection of a Draft TSP (and a subsequent Optimized TSP and the RP) from the Final Array of Alternatives was informed by among other things, H&H modeling (HEC-RAS), analysis of ADCIRC results, USACE cost estimates, engineering construction costs, design, supervision and administration costs, environmental impacts and mitigation, risk assessments and potential life safety concerns, and economic modeling (HEC-FDA). The measures that were determined to be incrementally justified from the Final Array of Alternatives were combined to form the Draft TSP, which included a combination of structural and NS measures for both FRM and CSRM. The DIFR-EIS, which contained a

Draft TSP, was released for a 45-day concurrent public, agency technical review (ATR), independent external peer review (IEPR) and policy review in June 2021.

Figure 4-1. Summary of St. Tammany Parish, Louisiana Feasibility Study Plan Formulation Process



During the final phase of the feasibility study, called the feasibility level design phase, additional analyses was completed to refine and optimize the design and cost estimates of the measures included in the TSP. Information gathered through these additional investigations, together with the consideration of comments received from the public, stakeholders, the USFWS and the NMFS assisted in further refining the design of the Draft TSP. Thereafter in July 2023, a RDIFR-EIS was released for a second concurrent public review. The RDIFR-EIS documented the refinements from the DIFR-EIS and recommended an optimized tentatively selected plan (Optimized TSP) that had been formulated by the PDT based on comments received from the public, USACE ATR review and legal and policy review. See Section 4.4 of this report. Ultimately, a RP was finalized based on comments received throughout the process. See Sections 4.5, 4.6, and 6.

4.1 FINAL ARRAY OF ALTERNATIVES

The plan formulation process used the best available information at this phase of the study to identify the Final Array of Alternatives and inform plan selection. The measures, alternatives, and screening and evaluation process that led to the selection of the Final Array are further detailed in Appendix B: Plan Formulation.

The Final Array included 8 alternatives and 27 measures (25 measures remaining from the alternatives in the Focused Array, plus 2 new CSRM structural measures (S-120 and S-122). Measure S-120 Lacombe Levee was combined with West Slidell Levee and added as

a potential variation to evaluate a complete levee and floodwall system from Slidell to Lacombe. Measure S-122 Mandeville Lakefront 18 feet was added to evaluate a 100-year level of risk reduction in Mandeville after the 7.3 feet system being evaluated was shown to have limited flood reduction benefits. The measures within the Final Array of Alternatives (Table 4-1) underwent H&H modeling, preliminary engineering and design, development of full cost estimates, environmental resource analysis, and economic analysis. See Figure 4-2 for the structural measures.

Each Alternative and the separate and combinable measures of each Alternative are listed. Some alternatives have separate measures that can only be implemented with another measure if justified. For alternatives that do not have separate measures and where only one variation could be selected, the measures were denoted with a letter variation following the alternative number (e.g., Alternative 4a, 4b, 4c, Alternative 6a, 6b, 6c and Alternative 9a, 9b, and 9c). For example, the measures in Alternative 6 are mutually exclusive and cannot be combined; therefore, only one of either Alternative 6a, 6b, or 6c could be selected, if justified. On the other hand, the measures in Alternative 7 are separate and combinable and can be combined with economically justified measures from the other alternatives.

The Final Array of Alternatives and Measures:

Alternative 1: No Action Alternative

Alternative 2: Nonstructural (NS-008, NS-009, NS-010, NS-011)

Alternative 4: Lacombe

- 4a Lacombe Levee (S-028)
- 4a.1 Lacombe Levee Short (S-028)
- 4b Lacombe Levee combined with West Slidell Levee (S-120)

Alternative 5: Bayou Liberty/Bayou Vincent/Bayou Bonfouca

- West Slidell Levee (S-081)
- Bayou Bonfouca Detention Pond (S-004)
- Bayou Liberty Channel Improvements (S-010)
- Bayou Patassat Channel Improvements- Clearing and Snagging (S-080)

Alternative 6: South Slidell

- 6a South Slidell Levee and Floodwall System (S-074, S-075, S-076)
- 6b South Slidell Levee and Floodwall System with Eden Isle (S-070, S-075, S-076)
- 6c South Slidell and West Slidell Levee and Floodwall System (S-074, S-075, S-076, S-077, S-081). Alternative 6a and the West Slidell Levee from Alternative 5 (S-081) were combined to form Alternative 6c during evaluation of the Final Array as it was found the combined alternative provided the highest net benefits.

Alternative 7: Eastern Slidell

- Pearl River Levee (S-060)
- Doubloon Bayou Channel Improvements-Dredging (S-069)
- Poor Boy Canal Channel Improvements- Dredging (S-073)
- Gum Bayou Diversion- Channel Improvements (S-072)

Alternative 8: Upper Tchefuncte/Covington

- Mile Branch Channel Improvements (S-057)
- Lateral A Channel Improvements (S-121)

Alternative 9: Mandeville Lakefront

- 9a Mandeville Lakefront-Seawall Passive Drainage (S-046, S-047, S-118)
- 9b Mandeville Lakefront-Seawall and Pump Stations (S-046, S-048, S-118, S-122)
- 9c Mandeville Lakefront-18 feet (S-046, S-048 S-118, S-122)

Additional information regarding the Final Array of Alternatives, the management measures, and identification codes can be found in Appendix B: Plan Formulation.

Alternative 3 was eliminated during an earlier screening stage in the planning process and is not included in the Final Array. Although not depicted in Figure 4-2, NS measures were also considered.

Table 4-1. Measures included in the Final Array of Alternatives

Measure ID	Measure Name	Measure Category (structural, nonstructural, Nature Based)	Measure Type	Location	Type of Flooding Addressed (CSRM/FRM)
NS-08	Buyouts	Nonstructural	Buyouts	Parish wide	FRM or CSRM
NS-09	Flood proofing	Nonstructural	Flood proofing	Parish wide	FRM or CSRM
NS-10	Relocations	Nonstructural	Relocations	Parish wide	FRM or CSRM
NS-11	Structure Raising	Nonstructural	Structure Raising	Parish wide	FRM or CSRM
S-004	Bayou Bonfouca Detention Pond	Structural	Detention Ponds	Bayou Bonfouca	FRM
S-010	Bayou Liberty Channel Improvements	Structural	Channel Improvements	Bayou Liberty	FRM
S-028	Lacombe Levee	Structural	Levee, Flood Wall Pump Station, Flood Gates	Lacombe	CSRM
S-028	Lacombe Levee Short	Structural	Levee, Flood Wall Pump Station, Flood Gates	Lacombe	CSRM
S-046	Mandeville Seawall	Structural	Seawall Repair/Replacement	Mandeville	CSRM
S-047	Mandeville Seawall with Passive Drainage	Structural	Seawall with Passive Drainage	Mandeville	CSRM
S-048	Mandeville Seawall with Pump Stations	Structural	Seawall with Pump Stations	Mandeville	CSRM

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Measure ID	Measure Name	Measure Category (structural, nonstructural, Nature Based)	Measure Type	Location	Type of Flooding Addressed (CSRM/FRM)
S-057	Mile Branch Channel Improvements	Structural	Channel Improvements	Mile Branch, Covington	FRM
S-060	Pearl River Levee	Structural	Levee, Flood Wall	Pearl River	FRM
S-069	Doubloon Bayou Channel Improvements	Structural	Channel Improvements	Doubloon Bayou	FRM
S-070	Eden Isle Floodwall	Structural	Levee/Flood Wall S-70a. Western Segment; S-70-b Southern Segment; S-70c Eastern Segment	Slidell, Eden Isle	CSRM
S-072	Gum Bayou Diversions Channel Improvements	Structural	Channel Improvements	Slidell, Gum Bayou	FRM
S-073	Poor Boy Canal Channel Improvements	Structural	Channel Improvements	Slidell, Poor Boy Canal	FRM
S-074	Pump Stations	Structural	Pump Stations	Slidell West of I-10	CSRM
S-075	South Slidell Levee/Floodwall System-West of I-10	Structural	Levee, Flood Wall	Slidell West of I-10	CSRM
S-076	South Slidell Levee/Floodwall System-East of I-10	Structural	Levee, Flood Wall	Slidell East of I-10	CSRM
S-077	Pump Stations	Structural	Pump Stations	Slidell East of I-10	FRM
S-080	Bayou Patassat Channel Improvements	Structural	Channel Improvements	Slidell, Bayou Patassat	FRM
S-081	West Slidell Levee	Structural	Levee, Flood Wall, Pump Station, Flood Gates	West Slidell	CSRM
S-118	Mandeville Flood Barrier/Floodwall	Structural	Flood Barrier	Mandeville	FRM
S-120	West Slidell Combined with Lacombe Levee	Structural	Levee, Flood Wall Pump Station, Flood Gates	Lacombe to West Slidell	CSRM
S-121	Lateral A Channel Improvements	Structural	Channel Improvements	Lateral A, Covington	FRM

Measure ID	Measure Name	Measure Category (structural, nonstructural, Nature Based)	Measure Type	Location	Type of Flooding Addressed (CSRM/FRM)
S-122	Mandeville 18feet Seawall with Pump Stations	Structural	Flood Wall 18 feet 100 year	Mandeville	CSRM

Individual maps depicting the locations of the alternatives in the Final Array, listed in Table 4-2, are contained in Appendix B: Plan Formulation; engineering details on the structural alternatives are contained in Appendix D: Engineering.

For the structural measures, CEMVN Engineering Division developed the estimated levee lengths, quantities, borrow quantities, etc. using previous reports prepared by (or for) the NFS and stakeholders, H&H modeling performed for this study, similar measures from projects of the same type, and best engineering judgment. The cost estimates for the Final Array were developed using the Micro-Computer Aided Cost Estimating System (MCACES). Existing ground elevations were obtained from terrain raster dataset. Potential borrow sites and their anticipated impacts were investigated using the data that is currently available. See Appendix B: Plan Formulation and Appendix D: Engineering for additional information on borrow.

All elevations are referenced to the North American Vertical Datum of 1988 (NAVD 88 (Geoid 12B)) unless otherwise noted.

All levee and floodwall features in the Final Array are based on the design standards developed by USACE for the Hurricane and Storm Damage Risk Reduction System (HSDRRS) design standards for the greater New Orleans area which includes St. Tammany Parish. The HSDRRS Guidelines may be found at:

<https://www.mvn.usace.army.mil/Missions/Engineering/Hurricane-Design-Guidelines/Hurricane-Design-Guidelines/>

Flood events are referred to herein by their annual exceedance probability (AEP), which is the probability the level of flooding may be realized or exceeded in any given year. For example, a flood event with a 1 percent AEP would have a 1 percent probability of occurring every year.

The NS analysis was conducted concurrent with the development and evaluation of the Final Array of the structural measures. The NS analysis is further described in Sections 4.2.4 and 4.2.5 and Appendix F: Economics.

Table 4-2. Final Array of Alternatives

Alternative		Measure Name	Measure Type and Identification Code					
			Detention pond (FRM)	Channel improvements (FRM/CSRM)	Pump stations (FRM/CSRM)	Levee, floodwall, seawall (FRM/CSRM)	Flood gates (CSRM)	Nonstructural
1	No Action							
2	Nonstructural							NS-008, NS-009, NS-010, NS-011
4	Lacombe	4a Lacombe Levee			S-028	S-028	S-028	
		4a.1 Lacombe Levee Short			S-028S	S-028S	S-028S	
		4.b Lacombe Levee Combined with West Slidell Levee			S-120	S-120	S-120	
5	Bayou Liberty/ Bayou Vincent/ Bayou Bonfouca							
		West Slidell Levee			S-81	S-81	S-81	
		Bayou Bonfouca Detention Pond	S-004					
		Bayou Liberty Channel Improvements		S-010				
		Bayou Patassat Channel Improvements		S-080				
6	6a South Slidell				S-074, S-075, S-077	S-075, S-076	S-075, S-076	

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Alternative		Measure Name	Measure Type and Identification Code					
	6b South Slidell with Eden Isle				S-74, S-075, S-077	S-70, S-075, S-076	S-70, S-075, S-076	
	6c South Slidell with West Slidell*				S-74, S-075, S-076, S-077, S-81	S-075, S-076, S-81	S-075, S-076, S-81	
7	Eastern Slidell	Pearl River Levee			S-060	S-060	S-060	
		Doubloon Bayou Channel Improvements		S-069,				
		Poor Boy Canal Channel Improvements		S-073				
		Gum Bayou Diversion- Channel Improvements		S-072				
8	Upper Tchefuncte/Covington	Mile Branch		S-057,				
		Lateral A		S-121				
9	Mandeville Lakefront	9a. Mandeville Lakefront-Seawall Passive Drainage				S-046, S-118,	S-047	
		9b. Mandeville Lakefront-Seawall and Pump Stations			S-048	S-046, S-118,		
		9c. Mandeville Lakefront-18 ft			S-048	S-046, S-118, S-122		

Note- Alternative 3 was screened out early in the screening process and was not included in the Final Array of Alternatives. See Appendix B: Plan Formulation for additional details on screening prior to the Final Array.

reducing the consequence of flooding for a specific structure, rather than constructing hard infrastructure measures (i.e., levees, floodwalls, culverts, pump stations, etc.) which are physical modifications designed to reduce the frequency of damaging levels of flood inundation. The NS measures that were considered included floodproofing, elevations, acquisitions and relocations. During analysis of the Final Array, the standalone NS alternative was screened out in favor of the combined structural and NS alternative, which would provide more net benefits.

Initially, the nonstructural alternative included voluntary floodproofing measures (i.e., elevation of eligible residential structures and dry floodproofing of eligible nonresidential structures) and the mandatory acquisition and buyout, including the use of eminent domain, of structures and property from within the existing floodplain. Since the study area is most often receiving damages resulting from widespread, low-level flooding; elevation and floodproofing were determined to be more cost effective than other nonstructural measures such as acquisitions or relocations when assessing on a grouping of aggregations using the USACE logical aggregation method. Furthermore, the NFS does not support a plan that mandates the acquisition and permanent evacuation of private property from the study area floodplain as a nonstructural measure. See Section 4.2.4 regarding analysis and screening of the Final Array of Alternatives.

Alternative 2 assumed 100 percent voluntary participation by structure owners and was based on an inventory of residential and non-residential structures using the National Structure Inventory (NSI) version 2.0. For evaluation purposes, the cost of elevating and/or flood-proofing structures was used to determine the cost of the NS plan because the study area is most often receiving damages resulting from widespread, low-level flooding.

An initial assessment of all structures located in the 10, 20, 50, and 100-year (10 percent, 5 percent, 2 percent, and 1 percent AEP) floodplains was performed for the analysis in the Final Array. Each separate floodplain (subaggregate) was analyzed independently. The NS alternative analysis was further refined to combine NS measures with structural measures but no structure could receive the benefits of both structural and NS measures.

It should be noted that later during the study the initial analysis for the NS measures presented in this section were refined. During optimization of the TSP, the initial NS analysis was refined and further subaggregations of the floodplains were made based on the source of the flooding and the assumptions regarding elevations, floodproofing, acquisitions and relocations were reassessed See Section 4.4.4 for refinement of the NS Plan; Section 6; and Appendix F: Economics for additional information regarding the NS analysis. Appendix H: NS Implementation Plan includes the preliminary implementation plan for the NS measures including the preliminary structure eligibility criteria.

[Note: Alternative 3: Lake Pontchartrain Surge Reduction was eliminated during an earlier screening stage in the planning process. See Appendix B: Plan Formulation for additional details.]

4.1.3 Alternative 4. Lacombe (Mutually Exclusive Measures: S-028, S-028S, S-120).

Alternative 4 contains measures for a levee system to reduce coastal flooding in the vicinity of the unincorporated community of Lacombe, Louisiana (Lacombe) and includes three variations (Alternative 4a, 4a.1, and 4b). Alternatives 4a.1, 4a, and 4b are mutually exclusive alternatives and cannot be combined with one another, but may be combined with other economically justified alternatives in the Final Array.

Alternative 4a consists of a footprint of approximately 126 acres and 9 miles (47,700 feet) of levee, pump stations, floodgates, vehicular floodgates, and ramps. This alignment is estimated to impact 110 acres of construction area and require approximately 595,000 cubic yards of fill. Alternative 4a includes a 3,200 cubic feet second (cfs) and a 300-foot long pump station complex across Bayou Lacombe. This complex includes a 20-foot navigable floodgate. Alternative 4a includes 14 vehicular road ramps over the levee and 1 vehicular floodgate to provide vehicular access through the levee. The Measure ID included in this Alternative is S-028.

Alternative 4a.1 is a shorter version of the Lacombe Levee and consists of approximately 7.5 miles (39,000 feet) of levee, floodwalls, floodgates, vehicular floodgates, and ramps. The footprint includes 115 acres. This levee alignment is estimated to require 574,000 cubic yards of fill (borrow material) (includes 30 percent contingency). This variation includes a 3,200 cfs and 300-foot long pump station complex across Bayou Lacombe, a 20-foot navigable floodgate, 10 vehicular road ramps over the levee, and 1 vehicular floodgate to provide vehicular access through the levee. The Measure ID included in this Alternative is S-028S.

Alternative 4b consists of the shorter version of the Lacombe Levee from Alternative 4a.1 and the West Slidell Levee from Alternative 5 (to evaluate a levee from Lacombe to Slidell). The combined levee and floodwall alignment is approximately 13.7 miles (72,000 feet) long and has a footprint of 2,133 acres. The levee alignment would require approximately 1,205,000 cubic yards of fill/ borrow (includes 30 percent contingency). The floodwall alignment includes 0.07 mile (350 feet) of floodwall. In addition, there are four pump stations with navigable gates and three with sluiceways. There are also five road ramps and two vehicular floodgates. The Measure ID included in this Alternative is S-120.

Appendix D: Engineering contains additional engineering details for this Alternative.

4.1.4 Alternative 5. Bayou Liberty/ Bayou Vincent/Bayou Bonfouca (Separable Measures S-081, S-004, S-080, S-010)

Alternative 5 includes measures to address riverine, rainfall, and coastal storm flooding to the areas of Bayou Liberty, Bayou Vincent, and Bayou Bonfouca. The measures are all separate and combinable and could all be implemented, if environmentally sound and economically justified.

The *West Slidell Levee* measure includes 6.5 miles of levee and floodwall alignment. This alignment is a combination of approximately 6.5 miles (34,000 feet) of levees and 0.08 miles (450 feet) of floodwall. The footprint includes 111 acres. This levee alignment would require 611,000 cubic yards of fill. Within the levee alignment, there are three pump stations, three floodgates, two sluiceways, one vehicular road ramp, and a 30-foot vehicular floodgate that are part of this alternative. The Measure ID included in this Alternative is S-081.

The *Bayou Bonfouca Detention Pond* aims to reduce rainfall and riverine flooding and comprises of 109 acres and has a water detention capacity of 1,308 acre-feet. The footprint includes 110 acres. Approximately 125 acres would have to be cleared and grubbed prior to excavation. Approximately 2,500,000 cubic yards of excavated material is assumed. The detention pond also includes the construction of a weir. The Measure ID included in this Alternative is S-004.

Alternative 5 includes the *Bayou Patassat Channel Improvements* (channel improvements work) between Bayou Vincent Pump Station and U.S. Route 11. The Bayou Patassat channel improvements consist of approximately 0.17 miles (900 feet) of clearing and snagging that would occur in the channel. The footprint includes 1 acre. The Measure ID included in this Alternative is S-080.

Alternative 5 includes the *Bayou Liberty Channel Improvements* (channel improvements work to address rainfall and riverine flooding) which would begin from north-south, starting immediately south of the I-12, crossing U.S. Highway 190, the bridge that crosses the Tammany Trace, and LA Highway 433, and ending at the confluence with Bayou Bonfouca in the proximity of Lake Pontchartrain. The channel improvements include clearing and snagging of 8 miles (41,232 feet) of the channel and would be broken up into four reaches due to the length of this bayou. The footprint includes 103 acres. All trees and debris cleared would likely be chipped on site and then hauled to the nearest landfill. The Measure ID included in this Alternative is S-010.

Appendix D: Engineering contains additional engineering details for this Alternative.

4.1.5 Alternative 6. South Slidell (Mutually Exclusive Measures 6a: S-074, S-075, S-076 / and 6b: S-070, S-075, S-076 and / 6c: S-074, S-075, S-076, S-077, S-081)

Alternative 6 provides for three variations of measures (Alternatives 6a, 6b, and 6c) which include a combination of levees, floodwalls, floodgates, pump stations, vehicular floodgates, and ramps proposed to reduce damages from coastal storm events. Alternatives 6a, 6b, and 6c are stand-alone alternatives and cannot be combined with one another, but can be combined with other justified measures in the Final Array of Alternatives.

Alternative 6a consists of 13 miles of alignment with a combination of 7.3 miles of levees (38,500 feet) and 5.9 miles (30,000 feet) of floodwall in Slidell. The alignment would impact 88 acres of construction area. This alignment would require 851,000 cubic yards of fill. This variation would include 2 pump stations, 2 floodgates, 8 vehicular ramps over the levee, 14

vehicular floodgates, and the raising of the Interstate 10 roadway over the new levee section to 15 feet. The Measure IDs included in this Alternative 6a are S-074, 075, and 076.

Alternative 6b includes the *Slidell levee and floodwall system and incorporates an Eden Isle floodwall*. This Alternative comprises 17.1 miles of alignment with a combination of levee and floodwall. The alignment would have 5.2 miles of levee (27,400 feet). The alignment would also have approximately 6 miles (31,000 feet) of floodwall at Eden Isle and 5.9 miles (30,000 feet) of floodwall in the Slidell levee alignment. The floodwall alignment totals 11.9 miles (61,000 feet). The levee alignment would impact 63 acres of construction area. This levee alignment would require 742,000 cubic yards of fill. There would be 3 navigable floodgate structures, 2 pump stations, 5 vehicular floodgates, 4 vehicular ramps over the levee, 13 vehicular floodgates, and the Interstate 10 roadway would be raised 15 feet to ramp over the new levee section. The Measure IDs included in this Alternative 6b are S-070, 075, and 076.

Alternative 6c consists of a combination of portions of the *West Slidell levee alignment* proposed in Alternative 5 and the *South Slidell levee and floodwall system* alignment proposed in Alternative 6a (except for the northwestern portion of that alignment), with the two alignments being connected by a new railroad gate across the existing Norfolk Southern Railroad tracks. This Alternative was created based on the results of the economic analysis. The alignment for the levee and floodwall system was comprised of approximately 16.3 miles (85,900 feet) of alignment with a combination of 14 miles of levees (73,700 feet) and 2.3 miles (12,200 feet) of floodwall. The I-10 would be raised to ramp over the new levee section to the preliminary design elevation of 15 feet. The levee alignment would impact approximately 169 acres of construction area. The levee alignment would require approximately 1,528,000 cubic yards of fill. There would be five pump stations, and five floodgates associated with the pump stations. There would also be a total of three sluiceways, eight vehicular floodgates, one railroad floodgate across the Norfolk Southern, and seven ramps. The preliminary description presented for Alternative 6c above was later refined during further engineering and design described in Section 4.2.11. The Measure IDs included in this Alternative 6c are S-074, 075, 076, 077, and 081.

Additional details on the optimized West and South Slidell Levee and Floodwall System are described in Section 4.4.1.6. Appendix D: Engineering contains additional engineering details for this Alternative.

4.1.6 Alternative 7. Eastern Slidell (Separable Measures S-060, S-072, S-073, S-069)

Alternative 7 includes measures to reduce risk to both riverine and rainfall flooding and coastal storm flooding to eastern Slidell. Measures include Gum Bayou Diversion, Poor Boy Canal improvements, channel improvements on Doubloon Bayou, and a levee to reduce riverine flooding from the Pearl River. The features in this alternative are all separate and combinable and could all be implemented if justified.

The overall length of the *Pearl River Levee* is approximately 4.8 miles (25,000 feet). This alignment was estimated to have approximately 57 acres of construction area. This levee alignment would require 350,000 cubic yards of fill. There are four floodwall sections for a total of 0.64 miles (3,400 feet) for this alternative. There would also be one vehicular floodgate, a floodgate, a pump station, and a sluiceway. The Measure ID included in this Alternative is S-060.

The *Gum Bayou diversion* measure addresses rainfall and riverine flooding. The diversion channel would divert the existing Gum Bayou to the Pearl River through a new channel. The Gum Bayou diversion is 1.8 miles (9,300 feet) in length. The footprint includes 20 acres. A maximum of 100,000 cubic yards of material would be removed. The material requiring disposal would be trucked away from the site or side cast along the bank line of the Gum Bayou channel. The Measure ID included in this Alternative is S-072.

Alternative 7 includes the *Poor Boy Canal channel improvements* measure to address rainfall and riverine flooding. The channel improvements in Poor Boy Canal would extend from LA Highway 1091, would cross LA Highway 59 and North Military Road, and would end into the Gum Bayou. The Poor Boy channel improvements consist of approximately 1 mile (5,288 feet) of clearing and snagging and mechanical dredging of the channel. The channel bottom would be lowered by 5 feet. The footprint includes 4 acres. Approximately 12 acres of channel would be cleared and grubbed prior to mechanical dredging. An assumed maximum of 80,000 cubic yards of material may be removed from the channel. The material requiring disposal would be trucked away from the site. The Measure ID included in this alternative is S- 073.

This Alternative includes the *Doubloon Bayou channel improvements* to address rainfall and riverine flooding. The Doubloon Bayou channel improvements would extend from the intersection of Doubloon Bayou and W-15 Canal and end on West Pearl River. The Doubloon Bayou channel improvements consist of approximately 3 miles (13,500 feet) of clearing and snagging and mechanical dredging of the channel. The footprint includes 4 acres. Approximately 30 acres of channel would be cleared and grubbed prior to mechanical dredging. An assumed maximum of 190,000 cubic yards of material may be removed from the channel. The material would need to be pumped to a disposal area or pumped/placed into a barge for hauling away and disposed of downriver. The Measure ID included in this Alternative is S-069.

Appendix D: Engineering contains additional engineering details for this Alternative.

4.1.7 Alternative 8. Upper Tchefuncte/Covington (Separable Measures S-057, S-121)

Alternative 8 includes separable measures to reduce rainfall and riverine flooding in the upper reaches of the Tchefuncte and Bogue Falaya Rivers which are combinable within this Alternative or could also be combined with other Alternatives, if justified.

Alternative 8 includes enlarging the lower 2 miles of *Mile Branch* and enlargement of Lateral "A" to reduce risk from headwater flooding in the upper reaches of the Tchefuncte and

Bogue Falaya Rivers. The Alternative also includes channel improvements on the lower 2.15 miles (11,341 foot channel) of Mile Branch for clearing and grubbing and mechanical dredging of approximately 20 acres (mechanical dredging and removal of approximately 130,000 cubic yards of material) and the lowering of the channel bottom by 5 feet. Disposal of debris would be trucked off-site and disposed at a facility licensed to handle the material. The Measure ID included in this Alternative is S-057. The preliminary description of this measure of Alternative 8 was refined and the optimized measure is described in Section 4.4.2. Appendix D: Engineering contains additional engineering details for the optimized version of this measure.

Lateral A Mile Branch channel improvements include clearing and snagging of approximately 1.73 miles (9,129 feet channel; footprint of 7 acres) of Lateral A with approximately 16 acres to be cleared and grubbed prior to mechanical dredging. An assumed maximum of 104,000 cubic yards of material may be removed and hauled away from the site. Disposal of debris would be trucked off-site and disposed at a facility licensed to handle the material. The Measure ID included in this Alternative is S-121.

Appendix D: Engineering contains additional engineering details for this Alternative.

4.1.8 Alternative 9. Mandeville Lakefront (Mutually Exclusive Measures 9a: S-046, S047, S-118 / 9b: S-046, S047, S-118, S-122 / 9c: -046, S047, S-118 / 9b: S-046, S047, S-118, S-122)

Alternative 9 consists of three variations (Alternatives 9a, 9b, and 9c), of measures for replacing and raising the existing seawall and constructing floodwalls, floodgates, and or pumps to address tidal and storm surge flooding in Mandeville and investigations into both full pump options (forced drainage via pump stations) and passive drainage systems at Little Bayou Castine and Ravine aux Coquille. Alternatives 9a, 9b, and 9c are stand-alone mutually exclusive alternatives that cannot be combined with one another, but can be combined with other justified measures in the Final Array of Alternatives. Therefore, only one variation within Alternative 9 could be selected.

Alternative 9a consists of replacing the existing Mandeville lakefront seawall and constructing new floodwalls, pump stations, floodgates, and passive flood barriers at the lakefront of Mandeville, Louisiana. The design elevation for the seawall is 7.3 feet which is 2 feet higher than the existing seawall. The new seawall would be approximately 1.5 miles long (7,703 feet). The new floodwall at Galvez Canal would be at elevation 7.3 feet and 0.3 miles (1,740 feet) long. The Ravine Aux Coquilles West and East Passive Barrier combined is approximately 1.1 miles (5,552 feet) of floodwall. The Little Bayou Castine West Passive Barrier would be approximately 0.6 miles (3,000 feet) of floodwall. This variation would also include four pump stations along the lakefront seawall on West Beach Parkway (116 cfs), Lafayette Street (33 cfs), Coffee Street (106 cfs), and Girod Street (139 cfs), nine vehicular floodgates, and six pedestrian floodgates. The footprint includes 14 acres. The Measure IDs included in Alternative 9a are S- 046, 047, and 118.

Alternative 9b consists of replacing the existing Mandeville lakefront seawall and constructing new floodwalls, two pump stations, and floodgates. The design elevation for the new seawall is 7.3 feet and it will be approximately 1.5 miles long (7,703 feet). The elevation of the new floodwall at the Galvez Canal would be at 7.3 feet and 0.3 miles (1,740 feet) long. The elevation of the new floodwall at Little Bayou Castine would be at 7.3 feet and 0.64 miles (3,400 feet) long. One pump station would be constructed at the Mandeville lakefront seawall near the Lakeshore drive and Girod Street intersection (preliminary estimated capacity of 200 cfs) with a construction area of 0.009 acres. A second 500 cfs pump station and 20 foot floodgate would be constructed at Ravine Aux Coquilles at the Mandeville lakefront (construction area is 2 acres). There would also be four vehicular floodgates: one vehicular gate at the intersection of Madison street and Lamarque street, and a second vehicular gate with two pedestrian gates near the intersection of Lakeshore drive and Foy street. The footprint includes 14 acres. The Measure IDs included in this Alternative are S-046, 048, 118, and 122.

Alternative 9c consists of elevating approximately 1.8 miles (9,600 feet) of the existing Mandeville lakefront seawall to 18 feet and the construction of two new pump stations, floodwalls, and floodgates. The new floodwall at Galvez Canal would start at North street, cross the Causeway Approach and end at Oakwood drive. The new floodwall along Bayou Castine will connect to the floodwall in the bayou and continue along Little Bayou Castine, continue on Monroe and Lamarque streets, cross U.S Highway 190, and end on Dupard and Lamarque streets. The new seawall elevation of 18 feet will provide 1 percent risk reduction (100-year) in future conditions in the year 2082. The elevation of the new floodwall at the Galvez Canal would be at 18 feet and would be 0.5 miles (2,700 feet) long. The new floodwall elevation at Little Bayou Castine would be 18 feet and would be 1.7 miles (9,000 feet) long. The total seawall and floodwall length would be approximately 21,300 feet. One pump station would be constructed at the Mandeville lakefront seawall near the intersection of Lakeshore drive and Girod Street (preliminary estimated capacity of 450 cfs) with a construction area of 0.009 acres. A second 500 cfs pump station and 20 feet sluiceway would be constructed at Ravine Aux Coquilles at the Mandeville lakefront (construction area is 2 acres). There would also be 6 vehicular floodgates and 14 roller floodgates. The vehicular gates will be located at the following intersections along Galvez street: Monroe street, Pecan street, Villere street, HWY 190, and Oakwood drive. Vehicular gates will also be installed at the following intersections along Lamarque street: Madison street, Livingston street, Montgomery street, HWY 190, America street, Valmont street, Orleans street, Caroline street, and McNamara street. There will also be a vehicular gate installed at the intersection of Lakeshore drive and Foy street. Pedestrian gates will be installed the intersection of Lakeshore drive and Foy street as well as Lamarque street and Tammany Trace. The footprint includes 14 acres. The Measure IDs included in this Alternative are S-046, 048, 118, and 122. Measure S-122 was added during the analysis of the Final Array of Alternatives and was not evaluated in the Initial or Focused Array of Alternatives.

Appendix D: Engineering contains additional engineering details for the variations of this Alternative.

4.2 FINAL ARRAY ANALYSIS, EVALUATION, AND COMPARISON

The measures in the Final Array of Alternatives were evaluated, compared, and screened against the following criteria: physical performance, costs, economic benefits, impacts to life, impact to environmental resources, societal impacts, planning objectives and constraints, P&G alternative criteria, and contributions to federal objectives and accounts. The analysis used for evaluation comparison and selection of the Draft TSP are included in Sections 4.2.1 to 4.2.10. The environmental and social benefits and impacts for the Final Array of Alternatives were presented in Section 5 of the 2021 DIFR-EIS and the remainder of the analysis is presented within this Section 4.2 and Appendix B: Plan Formulation. This evaluation and screening informed the decisions in selecting the Draft TSP.

A DIFR-EIS containing a Draft TSP was released for 45-day concurrent public, Agency Technical Review (ATR), Independent External Peer Review (IEPR), and legal and policy review in June 2021. The Draft TSP selection is presented in Section 4.3. Subsequent to the release of the DIFR-EIS, the PDT conducted additional engineering, economic, and environmental investigations on the separate measures of the Draft TSP. Information gathered through these additional investigations, together with the consideration of comments received from the public, stakeholders, the USFWS and the NMFS assisted in further refining the design of the Draft TSP. Refinement/optimization of the Draft TSP leading to the Optimized TSP are described in Section 4.4. Thereafter in July 2023, a RDIFR-EIS was released for a second concurrent public review. The RDIFR-EIS documented the refinements from the DIFR-EIS and recommended an optimized tentatively selected plan (Optimized TSP) that had been formulated based on comments received from the public, USACE ATR review and legal and policy review. After review of the comments received on the RDIFR-EIS, additional analyses were performed to inform the final RP. Refinements from the optimized TSP to the RP are described in Section 4.5

4.2.1 Performance Analysis of Final Array Structural Measures

To assess the benefits of the structural measures of the Final Array of Alternatives, hydrologic and hydraulic (H&H) modeling was performed. Additionally, a coastal modeling analysis was performed to quantitatively measure the reductions in Water Surface Elevations (WSEs) for the Final Array. This is referred to as the “With Project” modeling. H&H numerical modeling is a study of the movement of water as it moves through a watershed, basin, channel or man-made structure through numerical characterization of physical hydrologic and hydraulic features of a system in an effort to simulate real-world performance. See Appendix E: Hydrologic & Hydraulics for additional details.

Each FRM measure within an alternative was analyzed using Hydrologic Engineering Center-River Analysis System HEC-RAS modeling. Measures within an alternative were modeled together in a single geometry when they were not expected to hydraulically impact another measure. When one measure was expected to influence the H&H of another measure, they were modeled in distinct model geometries. Each model geometry was run for each frequency event (2, 5, 10, 25, 50, 100, 200, 500 year) for both base (2032) and future (2082) conditions. This totaled to 80 model simulations and results that were

processed for analysis. Hydraulic model results were provided for analysis of flood damages in the form of geographic information system (GIS) rasters showing the maximum water surface elevation WSE during each frequency storm stimulation.

The 10-year rainfall event was used as the study design frequency event because during the study period, the existing St. Tammany Parish drainage system was functioning at a 10-year level of capacity. Additionally, interior drainage systems for leveed systems in Southeast Louisiana are typically designed to convey the 10-year event during tropical storms which require closing of surge protection systems. The design recurrence interval that was used is based on historical observations and practice and is not based on probability of occurrence of coincident hydrologic interior and exterior conditions.

In analyzing the CSRM measures, the PDT delineated areas protected by structural measures in the Final Array and estimated the water surface elevation changes to determine the preliminary design elevations and tie in locations for the levee and floodwall alignments, capacities of existing drainage facilities in the locations where the alignments would cross large waterways were also estimate for the Final Array. Areas that would receive flood damage risk reduction from the proposed levee and floodwall alignments were determined using a terrain raster dataset. See Section 5.1 of Appendix E: Hydrologic & Hydraulics.

For the initial evaluation of the Final Array of Alternatives, coastal modeling used for the 2009 Louisiana Coastal Protection and Restoration (LACPR) study, the USACE Morganza to the Gulf project, and the ongoing USACE West Shore Lake Pontchartrain project, were used to provide additional context for the analysis and estimates.

The results of the HEC-RAS with-project modeling results and the CSRM analysis were then compared to the modeling results without any alternatives (without project modeling). This comparison allowed the PDT to determine the potential flood damage reduction and the ability of each alternative to reduce WSEs. A brief summary of model results for the structural measures is presented in Table 4-3 and difference grids displaying with-project vs. without project difference is contained in Appendix E: Hydrologic & Hydraulics. The analysis of the NS measures is included in Section 4.2.4.

It is noted that although the CSRM structural features were not directly modeled during initial analysis of the Final Array, Advanced Circulation Model (ADCIRC) modeling was ultimately performed for the structural CSRM Measures that were included in the Draft TSP during feasibility level of design and optimization. See Appendix E: Hydrologic & Hydraulics.

Table 4-3. Project Performance Comparison Based On H&H Results Structural Alternatives/Measures Compared to Without Project (No Action Alternative)

Alternative	Measure	Qualitative Summary of Modeling Results
1	No Action	Continued flood damages for the Study Area.
4a, 4a.1	Lacombe Levee	Reduced coastal storm flood risk for Lacombe area.
4b	Combined Lacombe-West Slidell Levee	Reduced coastal storm flood risk for Lacombe and Western Slidell area.
5	West Slidell Levee	Reduced coastal storm food risk for Western Slidell area (west of Front St.).
5	Bayou Bonfouca Detention Pond	Reductions precipitate from pond location downstream to Lake Pontchartrain along the floodplain of bayou Bonfouca. Reductions range from 0-1 feet. Small inducements (i.e. increased water levels) are caused at the upstream end.
5	Bayou Liberty Channel Improvements	Reductions range from 0-1 feet along the Bayou Liberty floodplain.
5	Bayou Patassat Channel Improvements- Clearing and Snagging	Reductions range from 0-1 feet along the floodplain of Bayou Patassat and downstream of the confluence with Bayou Bonfouca.
6a	South Slidell Levee and Floodwall System	Reduced coastal storm flood risk for the South Slidell area.
6b	South Slidell Levee and Floodwall System with Eden Isle	Reduced coastal storm flood risk for the South Slidell and Eden Isle area.
6c	West and South Slidell Levee and Floodwall System	Reduced coastal storm flood risk for the West Slidell to South Slidell area.
7	Doubloon Bayou Channel Improvements-Dredging	Inducements of 0-1 feet along the dredged channel. lowerings, or reduction in the WSE with the project in place are seen in the Pearl River floodplain. This is because dredging Doubloon Bayou causes it to act as a conduit when Pearl River floods.
7	Poor Boy Canal Channel Improvements- Dredging	Minimal lowerings exhibited for the 10yr. frequency event.
7	Gum Bayou Channel Improvements- Diversion	Reductions of 0-0.1 feet for the 10yr. frequency event. Inducements are seen in lower frequency events along the floodplain of the proposed diversion.
7	Pearl River Levee	Reductions of more than 1 feet. on protected side of levee alignment for 200yr. frequency event. Inducements of up to 1feet. in certain areas outside the levee alignment.
8	Mile Branch Channel Improvements	Reductions of approximately 0-1feet for the 10yr. event upstream and in the floodplain of Mile Branch channel deepening location.
8	Lateral A Channel Improvements	Reductions of approximately 0-1feet. for the 10yr. event upstream and in the floodplain of Lateral A channel deepening location.
9a, 9b, 9c	Mandeville Lakefront	Reduced coastal storm flood risk for Mandeville area.

The HEC-RAS and ADCIRC model outputs and analysis results required conversion so that the results could be input into the HEC-FDA Economics Model described in Section 4.2.3. The hydraulic model results, provided in WSE for each event frequency (both ADCIRC and HEC-RAS models), were exported as Tag Image File Format (TIF) raster files. ArcGIS software was used to overlay structure inventory point sites with all eight frequency rasters,

plus the elevation raster of combined topography and bathymetry data. A custom GIS python script was run against the structure inventory dataset to review the WSE results and output into an FDA-format American Standard Code for Information Exchange (ASCII) file. If the WSE for a structure inventory site is NO RESULT, then the GIS script outputs the terrain elevation minus 2.1 feet as the WSE for this location (this matches the FDA definition for no flooding at the site). The script reviews each frequency WSE result against the previous lower frequency results to ensure that WSE outputs increase for each increasing frequency. If the lowest frequency event has NO RESULT, and the next lowest frequency value has NO RESULT, then terrain elevation – 2.1 feet is output as the WSE for the lowest frequency, and terrain elevation – 2.1 feet + .01 feet is output as the WSE for the next lowest frequency. Additional information regarding the modeling is contained in Appendix E: Hydrologic & Hydraulics.

4.2.2 Final Array Cost Estimate-Structural Alternatives/Measures

To determine the cost estimates for evaluation and comparison of alternatives and plan selection, the total cost and estimated annual costs for the structural alternatives/measures were developed to include planning, engineering and design, construction, construction management, real estate, and compensatory and cultural architectural mitigation costs, all of which include contingencies. See Tables 4-4 through 4-6. For the purposes of planning, construction was assumed to begin in 2027 and continue through 2032. This was the basis for the 50-year period of analysis that starts in 2032 and goes through 2082.

Levee Assumptions for cost estimates: Additional levee lifts (to maintain levee height notwithstanding expected sinking and subsidence) were assumed to occur at three times post initial construction at 5-7 years, 15-20 years, and 30 years. The schedule was refined during feasibility level of design (FLD) and optimization and is contained in Section 6. The first levee lifts would be overbuilt and allowed to settle for several years before the latter levee lift is added for each alternative. The current assumptions for the proposed levees are based on typical sections, which do not include berms. Future analyses (during PED) will include site specific data collection. Information gathered from data collection could result in the need for additional geotechnical analyses for individual levee features in PED. The lack of subsurface information and the consequential number of assumptions required were documented as study risks.

Hydraulic Steel Structures assumptions for cost estimates: The design life of hydraulic steel structures is 100 years, which applies to the pump stations and gates included in the Final Array. The design of hydraulic steel structures will be in accordance with the requirements of ETL 1110-2-584. See also: ER 1110-2-8155; ECB 2021-6; and ECB 2019-10.

Compensatory mitigation costs for unavoidable habitat impacts were calculated for each alternative in the Final Array of Alternatives based on visual inspection of habitat types that could be potentially impacted along proposed structural measure alignments. Professional judgment and experience with similar structural systems, and engineering assumptions of right-of-way (ROW) footprints were also used to aid in development of the mitigation costs. A

final Mitigation Plan was developed for the RP which includes current estimated mitigation costs. See Section 7 and Appendix I: Compensatory Mitigation Plan.

See Section 4.2.5 regarding the preliminary cost estimates for the NS measures. There is no cost for Alternative 1, No-Action.

The initial costs used for evaluation and comparison of the Final Array were ultimately updated for measures included in the RP. The costs for measures in the RP are set forth in Section 6. In addition, the final Mitigation Plan for the RP which includes current estimated mitigation costs is contained in Section 7 and Appendix I: Compensatory Mitigation Plan.

4.2.3 Final Array Economics Analysis- Structural Alternatives

The HEC-FDA Version 1.4.2 USACE-certified model was used to calculate the damages and benefits for the Final Array of Alternatives. A Benefit Cost Ratio (BCR) analysis was conducted to evaluate the economic feasibility of each of the alternatives and measures in the Final Array. Expected annual benefits for 50-year period of analysis from 2032 and 2082 were converted to an equivalent annual value using the FY21 federal interest rate of 2.5 percent.

H&H model outputs and the economics functions were fed into the HEC-FDA, (<https://www.hec.usace.army.mil/software/hec-fda/>) and those results were tabulated and compared. The economic and engineering inputs necessary for the model to calculate damages and benefits include the structure inventory, contents-to-structure value ratios, vehicles, FFEs, and depth-damage relationships, ground elevations, and without-project stage probability relationships. The uncertainty surrounding each of the economic and engineering variables was included. Either a normal probability distribution, with a mean value and a standard deviation, or a triangular probability distribution, with a most likely, a maximum, and a minimum value, was entered into the model to quantify the uncertainty associated with the key economic variables. A normal probability distribution was entered into the model to quantify the uncertainty surrounding the ground elevations. The number of years that stages were recorded at a given gage was entered for each reach to quantify the hydrologic uncertainty or error surrounding the stage-probability relationships.

Tables 4-4 through 4-6 show the results for the structural measures in the Final Array including total construction costs, average annual costs, average annual benefits, and BCR. The economic analysis yielded several structural measures that had a positive BCR. Twelve measures within the Final Array were screened due to negative net benefits. The measures that were screened and those that were retained to form the Draft TSP are summarized in Section 4.3.

Table 4-4. Estimated Costs for Structural Measures in the Final Array of Alternatives (in 1,000s)

Alt	Real Estate	Relocations	Mitigation– Environmental	Levees and Floodwalls	Pumping Plant	Channels and Canals	Mitigation– Cultural Resources	PED	Construction Management (CM)	Total Cost
4a-Lacombe Levee (S-028)	\$8,249	\$25,860	\$71,159	\$26,228	\$256,426	-	\$210	\$64,409	\$33,502	\$487,101
4a.1-Lacombe Levee Short (S-028)	\$6,739	\$18,302	\$59,227	\$25,125	\$256,426	-	\$177	\$62,436	\$36,137	\$461,934
4b-West Slidell Levee with Lacombe Levee (S-120)	\$5,549	\$13,323	\$133,368	\$55,549	\$847,053	-	\$316	\$190,550	\$102,246	\$1,347,853
5 (S-004, S-010, S-80, S-081)	\$7,182	\$933	\$160,899	\$31,035	\$663,317	\$8,491	\$718	\$147,318	\$79,049	\$1,098,943
6a-South Slidell (S-074, S-075, S-076, S-077)	\$6,505	\$16	\$67,719	\$406,711	\$327,261	-	\$478	\$151,940	\$81,529	\$1,042,159
6b-South Slidell with Eden Isle (S-070, S-074, S-075, S-076, S-077))	\$6,157	\$16	\$98,783	\$869,237	\$327,261	-	\$666	\$247,229	\$132,659	\$1,682,008
6c-South Slidell with West Slidell Levee (S-074, S-075, S-076, S-077 & S-081)	\$13,799	\$887	\$118,059	\$265,200	\$948,358	-	\$993	\$250,950	\$134,656	\$1,732,902
7-Eastern Slidell (S-060, S-069, S-073, S-072)	\$5,253	-	\$74,671	\$56,284	\$76,135	\$12,281	\$535	\$31,073	\$16,673	\$272,876
8-Mile Branch and Lateral A (S-057, S-121)	\$7,023	-	\$5,127	-	-	\$29,998	\$153	\$6,193	\$3,323	\$51,818
9a-Mandeville Seawall (7.3 feet) Passive Drainage (S-046, 118, S-047)	\$12,491	-	\$8,503	\$104,568	\$10,027	-	\$183	\$23,671	\$12,702,000	\$172,144
9b-Mandeville Seawall (7.3 feet) Pump Stations (S-046, S-118, S-048)	\$12,491	-	\$8,357	\$51,758	\$73,860	-	\$83	\$25,940	\$13,919	\$186,409
9c- Mandeville Seawall (18 feet) (S-122)	\$12,491	-	\$8,357	\$258,503	\$120,545	-	\$149	\$77,803	\$41,748	\$519,596

*The initial costs used for evaluation and comparison of the Final Array were updated for the RP and are set forth in Section 6.

Table 4-5. Structural CSRM Measures in Final Array of Alternatives. Net Benefit Summary, FY 2021 Price Level, FY 21 Discount Rate (in 1,000s)

	Alt 6a: South Slidell Levee (S-074, S-075 & S-076, S-077)	Alt 6b: South Slidell Levee with Eden Isle (S-070, S-074, S-075, S-076, S-077)	Alt 5: West Slidell Levee (S-081)	Alt 6c: South Slidell with West Slidell Levee (S-074, S-075, S-076, S-077, S-081)	Alt 4a1: Lacombe Levee (S-028)	Alt 4b: West Slidell Levee with Lacombe Levee (S-120)	Alt 9b: Mandeville Seawall (7.3 feet) (S-46, S-47, S-048, S-118)	Alt 9c: Mandeville Seawall (18 feet) (S-46, S-48, S-118, S-122)
Project First Cost	\$1,042,158	\$1,682,008	\$888,576	\$1,732,901	\$461,934	\$1,347,853	\$172,144	\$519,596
Interest During Construction	\$67,037	\$108,196	\$57,158	\$111,470,000	\$29,714	\$86,701	\$11,073	\$33,423
Total Investment Cost	\$1,109,195	\$1,790,204	\$945,734	\$1,844,371	\$491,648	\$1,434,554	\$183,217	\$553,019
AA Average Annual (AA) Investment Costs	\$39,108	\$63,119	\$33,345	\$65,029	\$17,335	\$50,580	\$6,460	\$19,499
AA Operation & Maintenance (O&M) Costs	\$3,264	\$3,313	\$2,692	\$5,956	\$1,361	\$4,150	\$1,882	\$2,823
Total AA Costs	\$42,372	\$66,433	\$36,036	\$70,985	\$18,696	\$54,730	\$8,342	\$22,322
Without Project Expected Annual Damages (EAD)	278,978	278,978	278,978	278,978	278,978	278,978	278,978	278,978
EAD Reduced Benefits	75,706	93,114	42,455	118,160	8,538	51,173	1,404	9,753
Net Benefits	\$33,334	\$26,682	\$6,419	\$47,175	(\$10,158)	(\$3,557)	(\$6,938)	(\$12,569)

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	Alt 6a: South Slidell Levee (S-074, S-075 & S-076, S-077)	Alt 6b: South Slidell Levee with Eden Isle (S-070, S-074, S-075, S-076, S-077)	Alt 5: West Slidell Levee (S-081)	Alt 6c: South Slidell with West Slidell Levee (S-074, S-075, S-076, S-077, S-081)	Alt 4a1: Lacombe Levee (S-028)	Alt 4b: West Slidell Levee with Lacombe Levee (S-120)	Alt 9b: Mandeville Seawall (7.3 feet) (S-46, S-47, S-048, S-118)	Alt 9c: Mandeville Seawall (18 feet) (S-46, S-48, S-118, S-122)
B/C Ratio	1.8	1.4	1.2	1.7	0.5	0.9	0.2	0.4

* Table 4-5 includes costs outside of those direct and indirect mitigation costs beyond those calculated in the initial ROM estimates used in screening measures. The Direct Wetland Impact Summary Table by Alternative in Appendix C: Environmental mitigation costs only includes specific environmental costs for direct and indirect impacts to wetlands.

* The initial costs used for evaluation and comparison of the Final Array were updated for the RP and are set forth in Section 6.

Table 4-6. Structural FRM Measures in Final Array of Alternatives, Net Benefit Summary, Rainfall and Riverine, FY 2021 Price Level, FY 21 Discount Rate (in 1,000s)

	Alt 8: Mile Branch Lateral A (S-121)	Alt 8: Mile Branch (S-057)	Alt 5: Bayou Bonfouca Detention Pond	Alt 5: Bayou Liberty (S-010)	Alt 5: Bayou Patassat (S-080)	Alt 7: Gum Bayou Diversion (S-072)	Alt 7: Poor Boy Canal (S-073)	Alt 7: Doubloon Bayou (S-069)	Alt 7: Pearl River Levee (S-060)
Project First Cost	\$25,626	\$26,337	\$151,624	\$52,656	\$957	\$22,174	\$15,307	\$34,938	\$216,51
Interest During Construction	\$1,648	\$1,694	\$9,753	\$3,387	\$62	\$1,426	\$985	\$2,247	\$13,927
Total Investment Cost	\$27,274	\$28,032	\$161,377	\$56,043	\$1,018	\$23,601	\$16,292	\$37,185	\$230,439
AA Investment Costs	\$962	\$988	\$5,690	\$1,976	\$36	\$832	\$574	\$1,311	\$8,125
AA O&M Costs	\$102	\$127	\$12	\$41	\$10	\$107	\$59	\$151	\$1,360
Total AA Costs	\$1,064	\$1,115	\$5,702	\$2,390	\$46	\$939	\$634	\$1,462	\$9,485
Without Project EAD	\$209,484	\$209,484	\$209,484	\$209,484	\$209,484	\$209,484	\$209,484	\$209,484	\$209,484
EAD Reduced Benefits	292	2,221	1,056	935	133	-44	1	-1,537	3,739
Net Benefits	-772	1,106	-4,646	-1,455	87	-983	-633	-2,999	-5,746
B/C Ratio	0.3	2.0	0.2	0.4	2.9	0.0	0.0	-1.1	0.4

*The initial costs used for evaluation and comparison of the Final Array were updated for FRM measures included in the RP and are contained in Section 6.

4.2.4 Final Array Analysis- Nonstructural Alternative

ER 1105-2-100, Planning Guidance Notebook (2000) requires that USACE formulate, evaluate, and present a plan that reasonably maximizes net National Economic Development (NED) benefits. Prior interpretation of this requirement with respect to NS measures and plans was to formulate and evaluate plans at the individual structure level. Because there are numerous problems with that approach, which include but are not limited to: fidelity of depth damage function, uncertainty with individual structure data, overall risk management, and other social effects, the current USACE policy (USACE Planning Bulletin (PB) 2019-03 Subject: Further Clarification of Existing Policy for USACE Participation in NS Flood Risk Management and Coastal Storm Risk Management Measures) is that 'reasonably maximizing' does not require individual structure benefit-cost analysis.

The NS analysis for the Final Array was based on a 2019 residential and non-residential structure inventory developed using the National Structure Inventory (NSI) version 2.0. There were 100,252 residential structures and 11,440 non-residential structures in the inventory. According to USACE Planning Bulletin (PB) 2019-03, NS analyses are to be conducted using a "logical aggregation method." Rather than an individual structure being the unit of analysis, a selected aggregate (i.e., a floodplain) is used as the unit of analysis. Each aggregate is a separable element that must be incrementally justified. Aggregates could be structures that share a common floodplain or share other common flood characteristics among others.

For the initial analysis, structures were aggregated according to a shared floodplain. For each incremental floodplain aggregate, the combination of structures being elevated and floodproofed within an incremental floodplain, must be economically justified. An assessment of all structures located in the 10, 20, 50, and 100-year (10 percent, 5 percent, 2 percent, and 1 percent AEP) floodplains were performed (Figure 4-3). Floodplain aggregation was employed as a manageable means to account for the large number of structures within a large study area.

Elevations and floodproofing were used during the analysis of the final array of alternatives to determine the effectiveness of the NS alternative based on existing information. Historical analysis of nonstructural measures in South Louisiana where most structures experience damages from widespread, low-level flooding (as in the study area) has shown that elevations and floodproofing were more cost effective than relocations and or acquisitions (Southwest Coastal Storm Risk Management Project). During this early analysis in the feasibility study this existing data was used and was later reassessed during feasibility level of design.

For the analysis, residential structures would be elevated to the future 100-year stage but no higher than 13 feet above the ground (due to engineering and risk related factors such as wind loading considerations) and nonresidential structures would be floodproofed up to 3 feet above the ground.

Due to the different sources of flooding, separate FDA model simulations were run for CSRM and FRM separately and the results combined. Two NS plans were developed and analyzed. First, a comprehensive NS alternative was evaluated to determine the benefits of a standalone NS plan that did not include any structural measures. The second was a combined plan that included NS measures and economically justified CSRM and FRM structures. However, structures that would receive the benefits and protections of the structural measures were excluded from participating in the NS component of the plan. In other words, a structure could not receive both the benefits of the structural measures and also participate in the NS part of the plan.

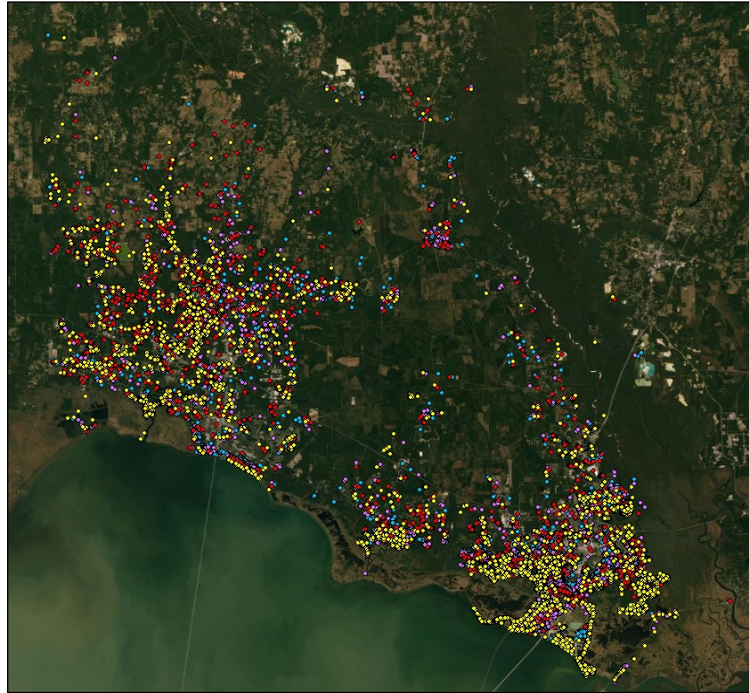


Figure 4-3. Structures Identified by Incremental Floodplain

Blue dots represent structures in the 1 percent or 100 year floodplain, purple are in the 2% (50 year) floodplain, red is within the 4 percent (25 year) floodplain and yellow structures are within the 10 percent (10 year) floodplain. Data from 2018.

4.2.5 Final Array Cost Estimate- Nonstructural Costs

NS costs were developed both for residential and nonresidential structures. For residential structures, elevation costs were based on the difference in the number of feet between the original FFE and the target elevation (based on the 2082 hydrologic conditions) for each structure. Elevation costs by structure were summed to yield an estimate of total structure elevation costs. For analysis of the Final Array, cost for raising a structure was based on data obtained during interviews with representatives of three major metropolitan New Orleans area firms that specialize in structure elevation. Separate cost estimates were developed to flood proof non-residential structures based on their relative square footage using costs developed by contacting local contractors and were escalated to FY 2021 prices.

Additional estimates for required administrative activities, real estate cost, and contingency were added to the cost estimates. See Appendix F: Economics for additional details regarding the development of cost estimates for the NS alternative and Appendix H: NS Implementation Plan.

4.2.6 Final Array Economic Analysis of Nonstructural Plan

4.2.6.1 Final Array- Standalone Nonstructural Plan (No Structural Measures)

The reduction in flood damages achieved by a standalone NS plan (with no structural measures included) is displayed in Table 4-7. All floodplains had positive BCRs in the cumulative combined FRM and CSRM analysis. The results were further analyzed incrementally to determine and verify which floodplains were justified. For the initial standalone NS plan, the 50-year floodplain for all of St. Tammany Parish (2 percent AEP) was incrementally justified because that floodplain provided as providing the most net benefits to reduce flood damages in the parish.

Table 4-7. Standalone Comprehensive Nonstructural Plan (in 1,000s)

Comprehensive Nonstructural Plan – Combined CSRM/FRM (NS-09 & NS-11)						
	Average Annual Benefits	Average Annual Cost	Net Benefits	B/C Ratio	Approx. Number of Structures	Estimated Costs
100-Year	\$271,833	\$170,662	\$101,171	1.6	17,900	\$4,825,397
50-Year	\$253,096	\$131,441	\$121,655	1.9	13,800	\$3,716,442
20-Year	\$212,255	\$91,293	\$120,962	2.3	9,600	\$2,581,277
10-Year	\$152,100	\$59,110	\$92,990	2.6	6,100	\$1,671,304

FY 2021 Price Level, FY 21 Discount Rate

4.2.6.2 Final Array- Exclusion of Areas Receiving Protection from Structural Measures From Participation in Nonstructural Plan

Subsequent to evaluation of the standalone NS plan and the evaluation of the structural measures (Section 4.2.3), the PDT compared NS vs structural alternatives for each of the separate subbasins in the study area. Although the NS measures for the West and South Slidell levee (Alternative 6c) and the Mile Branch Channel Improvements (Alternative 8) both have economically justified NS increments, the corresponding structural measures have higher net benefits. As a result, the NS alternatives in these locations were not included in the broader NS portion of the combined structural and NS plan.

Areas that would receive flood protection benefits from the implementation of structural measures, were identified and excluded from participation in the NS plan. As a result, no single structure would receive a double benefit from both structural and NS measures. The result was a modified NS plan which was combined with the justified structural measures

and carried forward as a combined structural and NS plan. Benefits of the combined plan were attributed to either risk reduction from structural measures or NS measures, but not both.

The cumulative NS benefits (1 percent, 2 percent, 5 percent, and 10 percent annual exceedance probability or AEP) for the areas of the study area that would not receive benefits from the implementation of the economically justified *structural* measures, are displayed in Table 4-8. During the initial NS plan analysis, all floodplains had a positive BCR. Thereafter, the incremental floodplains were determined to be economically justified up to the 2 percent AEP. The structures in the 0–50-year floodplain were in the NS portion of the combined structural and NS plan. The NS plan with the cumulative 2 percent AEP floodplain, consisted of elevating 6,643 residential structures and dry floodproofing 1,855 nonresidential structures. Additional information regarding the initial incremental floodplain analysis results is presented in Appendix F: Economics.

Table 4-8. Cumulative Nonstructural Benefits for Locations within the Study area not Benefited by Economically Justified Structural Measures (in 1,000s)

	(10%AEP)	(5% AEP)	2% AEP)	1% AEP)
Project First Cost	1,326,554	1,755,280	2,241,108	2,885,893
Interest During Construction	4,101	5,426	6,928	8,921
Total Investment Cost	1,330,653	1,760,704	2,248,034	2,894,812
AA Investment Cost	46,917	62,080	79,263	102,067
Benefits EAD Reduced	111,242	137,105	157,421	169,647
Net Benefits	64,325	75,025	78,158	67,580
B/C Ratio	2.4	2.2	2.0	1.7

4.2.7 Final Array - Evaluation and Comparison of Measures with Specific Study Planning Objectives and Constraints

The cost-effective measures in the Final Array were compared to the specific study planning objectives and constraints and which are set forth in Section 2.2 and Section 2.3 of this FIFR-EIS. Table 4-9 and Table 4-10 summarize the results based on the degree to which the measures in the Final Array satisfy the stated planning objectives without violating planning constraints.

Objective 1 (reduce the risk to public health and safety by reducing flood impacts to structures and critical infrastructure) and Objective 2 (reduce flood damage to structures (i.e., businesses, residential, commercial, and public structures) were evaluated through the performance analysis described in Section 4.2.1. The analysis quantitatively measured the reductions in WSEs which informed the subsequent economic analysis to determine the change in the number and frequency of flooded structures compared to without the No Action Alternative. Critical infrastructure including but not limited to, hospitals, schools, electrical substations, and public safety facilities, etc., were included in the analysis. The No Action Alternative does not decrease the risk to public safety. All of the cost-effective measures in the Final Array decreased the risk to public health and safety by reducing the number of structures impacted by flooding and also reducing the annual flood damages. The comparative values between measures are included in Tables 4-9 and 4-10. The No Action Alternative does not decrease the risk to public safety. A life safety risk analysis was conducted on Alternatives 4, 5, 6, 7, and 9 resulting in a determination that the measures for the channel improvements, detention ponds, and/or clearing and snagging did not contribute to an increased risk to life safety. See Section 4.2.10.

Table 4-9. FRM: Comparison of Measures in Final Array with Planning Objectives

		Alt 1: No Action	Alt 2: 50 Year Nonstructural I (NS-09 & NS-11)	Alt 5: Bayou Bonfouca Detention Pond	Alt 5: Bayou Liberty (S-010)	Alt 5: Bayou Patassat (S-080)	Alt 7: Gum Bayou Diversion (S-072)	Alt 7: Poor Boy Canal (S-073)	Alt 7: Doubloon Bayou (S-069)	Alt 7: Pearl River Levee (S-060)	Alt 8: Mile Branch Lateral A (S-121)	Alt 8: Mile Branch (S-057)
Obj 1- Public Health and Safety		Does not meet	Yes: reduces population impacted by flood risk (13, 811 structures)	Yes: reduces population impacted by flood risk (80 structures)	Yes: reduces population impacted by flood risk (70 structures)	Yes: reduces population impacted by flood risk (30 structures)	Yes: reduces population impacted by flood risk (0 structures)	Yes: reduces population impacted by flood risk (0 structures)	Yes: reduces population impacted by flood risk (0 structures)	Yes: reduces population impacted by flood risk (400 structures)	Yes: reduces population impacted by flood risk (30 structures)	Yes: reduces population impacted by flood risk (250 structures)
Obj 2 Flood Damage		Does not meet	Yes: EAD reduction \$244,563,150	Yes: EAD reduction \$1,056,128	Yes: EAD reduction \$935,338	Yes: EAD reduction \$132,724	Yes: EAD reduction (\$43,787)	Yes: EAD reduction \$880	Yes: EAD reduction (\$1,882,280)	Yes: EAD reduction \$3,738,733	Yes: EAD reduction \$2,221,189	Yes: EAD reduction \$291,747
Obj 3 Interruption Evacuation Routes/ Transportation		Does not meet	Indirect Benefits	Indirect Benefits	Indirect Benefits	Indirect benefits	Indirect Benefits	Indirect Benefits	Indirect Benefits	Indirect Benefits	Indirect Benefits	Indirect Benefits

**The cost information for Alternative 8 was updated as further modeling and design was completed.

Table 4-10. CSRM: Comparison of Measures in Final Array with Planning Objectives

		Alt 1: No Action	Alt 2: 50 Year Nonstructural (NS-09 & NS-11)	Alt 4a1: Lacombe Levee (S-028)	Alt 4b: West Slidell Levee with Lacombe Levee (S-120)	Alt 5: West Slidell Levee (S-081)	Alt 6a: South Slidell Levee (S-074, S-075 & S-076, S-077)	Alt 6b: South Slidell Levee with Eden Isle (S-070, S-074, S-075, S-076, S-077)	Alt 6c: South Slidell with West Slidell Levee (S-074, S-075, S-076, S-077, S-081)	Alt 9b: Mandeville Seawall (7.3 feet) (S-46, S-47, S-048, S-118)	Alt 9c: Mandeville Seawall (18 feet) (S-46, S-48, S-118, S-122)
Obj 1- Public Health and Safety		Does not meet	Yes: reduces population impacted by flood risk (13, 811 structures)	Yes: reduces population impacted by flood risk (600 structures)	Yes: reduces population impacted by flood risk (3,100 structures)	Yes: reduces population impacted by flood risk (2,513 structures)	Yes: reduces population impacted by flood risk (4,456 structures)	Yes: reduces population impacted by flood risk (5326 structures)	Yes: reduces population impacted by flood risk (6,969 structures)	Yes: reduces population impacted by flood risk (400 structures)	Yes: reduces population impacted by flood risk (400 structures)
Obj 2 Flood Damage		Does not meet	Yes: EAD reduction \$244,563,150	Yes: EAD reduction \$8,538,915	Yes: EAD reduction \$51,168,356	Yes: EAD reduction \$ 42,455,739	Yes: EAD reduction \$ 75,698,183	Yes: EAD reduction \$93,1105,215	Yes: EAD reduction \$118,148,922	Yes: EAD reduction \$1,595,911	Yes: EAD reduction \$9,752,231
Obj 3 Interruption Evacuation Routes/ Transportation		Does not meet	Indirect benefits	Direct Benefits	Direct Benefits	Directly reduces flooding to Hwy 433 along with Indirect benefits	Indirect benefits	Direct benefits for roads in Eden Isle along with Indirect benefits	Directly reduces flooding to Hwy 433 along with Indirect benefits	Direct benefits	Direct Benefits

**The cost information for Alternative 6c was updated as further modeling and design was completed.

Objective 3 is to reduce interruption, to the maximum extent practicable, to the Nation's transportation corridor and evacuation routes e.g., the I-10, I-12, and the I-59 interchange. Transportation corridors include one or more routes that connect centers of economic activity. Transportation corridors provide transportation and other logistics services that promote trade among the cities and countries along the corridor. Interstate 10 is the major transportation corridor within the study area. A hurricane evacuation route (also called coastal evacuation route or evacuation route) is a highway in the United States that is a specified route for hurricane evacuation. The following are officially designed evacuation routes within the study area: Interstate 12, Lake Pontchartrain Causeway, U.S. Highway 190, U.S. Route 11, LA Highway 59, and Interstate 10 (See Figure 4-4).

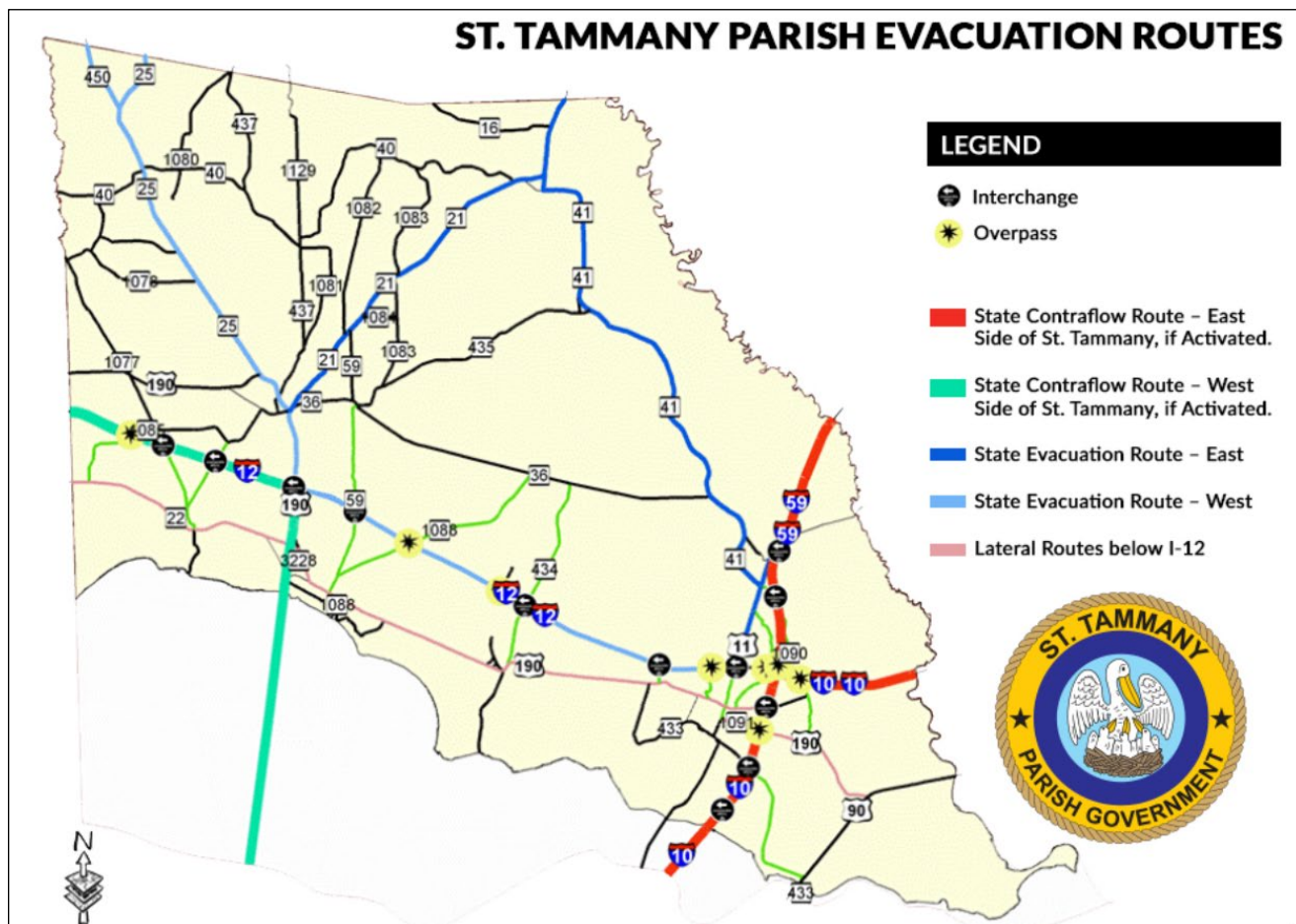


Figure 4-4. Evacuation Routes within the Study Area

The PDT conducted an analysis on frequently flooded roadways to determine which measures might reduce roadway flooding. Four different input datasets were received from STPG regarding frequently flooded roadways. The flooded roads were digitized into ArcGIS line features and were then densified to include a vertex every 1,000 feet. The flooded road point locations were overlaid with the study elevation grid, and an elevation was assigned to each point feature. The flooded roadways were overlaid to the H&H modeling results to

determine which measures reduced flooding to those locations. All measures showed varying benefits to minimize roadway flooding, but the Pearl River Levee, Lacombe Levee, and West and South Slidell Levee provided the most direct benefits by reducing flooding on LA Hwy 433 and U.S. Highway 190. These highways are critical evacuation routes and provide access to 1-10 and 1-12, which are transportation corridors and evacuation routes (shown under Objective 3 in Tables 4-9 and 4-10).

In addition to the alternatives identified as directly reducing flooding to roadways, the NS and Mile Branch alternatives are expected to indirectly reduce roadway flooding and impacts to smaller roadways, and benefit overall evacuation in the area.

4.2.8 Final Array Evaluation and Comparison against Principle and Guidelines Criteria

The cost-effective measures in the Final Array of Alternatives were evaluated against the four P&G evaluation criteria (shown in Tables 4-11 and 4-12) as defined in P&G Section VI.1.6.2(c). Only those that met the efficiency criteria were further evaluated against the other criteria and presented below.

Completeness is a determination of whether or not the plan includes all elements necessary to achieve the objectives. It is an indication of the degree to which the outputs of the plan are dependent upon the actions of others.

Effectiveness is the extent to which an alternative plan alleviates the specified problems and achieves the specified opportunities (P&G Section VI.1.6.2(c)(2)). Alternative plans that do not contribute or minimally contribute to the planning objectives should be dropped from consideration.

Efficiency is the extent to which an alternative plan is the most cost-effective means of alleviating the specified problems and realizing the specified opportunities, consistent with protecting the Nation's environment (P&G Section VI.1.6.2(c)(3)). Benefits can be both monetary and non-monetary. Alternative plans that provided little benefits relative to the cost should be dropped from further consideration.

Acceptability is the workability and viability of the alternative plan with respect to acceptance by State and local entities and the public and compatibility with existing laws, regulations, and public policies (P&G Section VI.1.6.2(c)(4)). Acceptability means a measure or alternative plan is technically, environmentally, economically, and socially feasible. Alternative plans that are clearly not feasible should be dropped from further consideration.

Table 4-11. Evaluation of FRM Measures with P&G Criteria

	Alt 1: No Action	Alt 2: 50 Year Nonstructural (NS-09 & NS-11)	Alt 5: Bayou Bonfouca Detention Pond	Alt 5: Bayou Liberty (S-010)	Alt 5: Bayou Patassat Channel Improvements (S-080)	Alt 7: Gum Bayou Diversion (S-072)	Alt 7: Poor Boy Canal (S-073)	Alt 7: Doubloon Bayou (S-069)	Alt 7: Pearl River Levee (S-060)	Alt 8: Mile Branch (S-057)	Alt 8: Mile Branch Lateral A (S-121)
Completeness	Does not meet objectives to reduce flood risk	Can be implemented and contributes to addressing identified problems or opportunities	Can be implemented and contributes to addressing identified problems or opportunities	Can be implemented and contributes to addressing identified problems or opportunities	Can be implemented and contributes to addressing identified problems related to flooding around Bayou Patassat	Can be implemented and contributes to addressing riverine and rainfall flooding	Can be implemented and contributes to addressing riverine and rainfall flooding	Can be implemented and contributes to addressing riverine and rainfall flooding	Can be implemented and contributes to addressing identified problems or opportunities in Slidell	Can be implemented and contributes to addressing identified problems or opportunities in Covington	Can be implemented and contributes to addressing identified problems or opportunities in Covington
Effectiveness	Would not alleviate any problems or achieve any opportunities.	Addresses Problems and Opportunities. Meets goals and objectives.	Addresses Problems and Opportunities. Meets goals and objectives.	Addresses Problems and Opportunities. Meets goals and objectives.	Addresses Problems and Opportunities. Meets goals and objectives.	Determined to be not effective in reducing flooding through H&H modeling	Determined to be not effective in reducing flooding through H&H modeling	Determined to be not effective in reducing flooding through H&H modeling	Determined to be not effective in reducing flooding through H&H modeling	Addresses Problems and Opportunities. Meets goals and objectives.	Determined to be not effective in reducing flooding through H&H modeling
Efficiency	Is cost effective since it does not require a federal investment	Effective at meeting the objectives	Did not meet efficiency due to BCR below 1. BCR 0.2	Did not meet efficiency due to BCR below 1. BCR 0.4	Effective at meeting objectives BCR 2.9	Did not meet efficiency due to BCR below 1. BCR 0.0	Did not meet efficiency due to BCR below 1. BCR 0.0	Did not meet efficiency due to BCR below 1. BCR	Did not meet efficiency due to BCR below 1. BCR 0.4	Effective at meeting objectives BCR 2.2	Did not meet efficiency due to BCR below 1. BCR 0.3
Acceptability	Acceptable in meeting required laws and policies; Plan provides no solution to the identified problems.	Acceptable in meeting required laws and policies	Acceptable in meeting required laws and policies	Acceptable in meeting required laws and policies	Acceptable in meeting required laws and policies	Acceptable in meeting required laws and policies	Acceptable in meeting required laws and policies	Acceptable in meeting required laws and policies	Acceptable in meeting required laws and policies	Acceptable in meeting required laws and policies; would require further coordination with LDWF regarding Scenic Rivers	Acceptable in meeting required laws and policies; would require further coordination with LDWF regarding Scenic Rivers

Table 4-12. Evaluation of CSRM Measures with P&G Criteria

	Alt 1: No Action	Alt 2: 50 Year Nonstructural (NS-09 & NS-11)	Alt 4a1: Lacombe Levee (S-028)	Alt 4b: West Slidell Levee with Lacombe Levee (S-120)	Alt 5: West Slidell Levee (S-081)	Alt 6a: South Slidell Levee (S-074, S-075 & S-076, S-077)	Alt 6b: South Slidell Levee with Eden Isle (S-070, S-074, S-075, S-076, S-077)	Alt 6c: South Slidell with West Slidell Levee (S-074, S-075, S-076, S-077, S-081)	Alt 9b: Mandeville Seawall (7.3 feet) (S-46, S-47, S-048, S-118)	Alt 9c: Mandeville Seawall (18 feet) (S-46, S-48, S-118, S-122)
Completeness	Does not meet objectives to reduce flood risk.	Can be implemented and contributes to addressing identified problems or opportunities	Can be implemented and contributes to addressing identified problems or opportunities	Can be implemented and contributes to addressing identified problems or opportunities	Is not standalone and an add on to the South Slidell Levee	Can be implemented and contributes to addressing identified problems or opportunities in the South Slidell Area.	Can be implemented and contributes to addressing identified problems or opportunities for South Slidell and Eden Isle.	Can be implemented and contributes to addressing identified problems or opportunities in the West and South Slidell Area.	Can be implemented and contributes to addressing identified problems or opportunities in the Mandeville Lakefront Area.	Can be implemented and contributes to addressing identified problems or opportunities in the Mandeville Lakefront Area.
Effectiveness	Would not alleviate any problems or achieve any opportunities.	Addresses Problems and Opportunities. Meets goals and objectives.	Addresses Problems and Opportunities. Meets goals and objectives.	Addresses Problems and Opportunities. Meets goals and objectives.	Addresses Problems and Opportunities. Meets goals and objectives.	Addresses Problems and Opportunities. Meets goals and objectives.	Addresses Problems and Opportunities. Meets goals and objectives.	Addresses Problems and Opportunities. Meets goals and objectives.	Addresses Problems and Opportunities. Meets goals and objectives.	Addresses Problems and Opportunities. Meets goals and objectives.
Efficiency	Is cost effective since it does not require a federal investment	Efficient at meeting the objectives	Did not meet efficiency due to BCR below 1. BCR 0.5	Did not meet efficiency due to BCR below 1. BCR 0.9	Effective at meeting the objectives for the West Slidell area. BCR 1.2	Effective at meeting the objectives for the South Slidell Area BCR 1.9	Eden Isle portion is cost effective but the South Slidell and West Slidell combination provided higher net benefits. BCR 1.5	More efficient at objectives than South Slidell or West Slidell alone BCR 1.7	Did not meet efficiency due to BCR below 1. BCR 0.2	Did not meet efficiency due to BCR below 1. BCR 0.4

	Alt 1: No Action	Alt 2: 50 Year Nonstructural (NS-09 & NS-11)	Alt 4a1: Lacombe Levee (S-028)	Alt 4b: West Slidell Levee with Lacombe Levee (S-120)	Alt 5: West Slidell Levee (S-081)	Alt 6a: South Slidell Levee (S-074, S-075 & S-076, S-077)	Alt 6b: South Slidell Levee with Eden Isle (S-070, S-074, S-075, S-076, S-077))	Alt 6c: South Slidell with West Slidell Levee (S-074, S-075, S-076, S-077, S-081)	Alt 9b: Mandeville Seawall (7.3 feet) (S-46, S-47, S-048, S-118)	Alt 9c: Mandeville Seawall (18 feet) (S-46, S-48, S-118, S-122)
Acceptability	Acceptable in meeting required laws and policies; Plan provides no solution to the identified problems.	Acceptable in meeting required laws and policies	Levee had a medium incremental risk for life safety.	Levee had a medium incremental risk for life safety.	Acceptable in meeting required laws and policies; would require further coordination with LDWF regarding Scenic Rivers	Acceptable in meeting required laws and policies	Acceptable in meeting required laws and policies	Acceptable in meeting required laws and policies; West Slidell portion would require further coordination with LDWF regarding Scenic Rivers where the levee crosses over a scenic river	Mandeville Lakefront area identified as high incremental risk for life safety due to population in Mandeville.	Mandeville Lakefront area identified as high incremental risk for life safety due to population in Mandeville.

4.2.9 Evaluation of Final Array Using the System of Accounts

In compliance with EC 1105-2-409, the PDT evaluated measures and alternatives across multiple benefit and impact categories, which included economic (national and regional), environmental (national and regional), and social considerations. The benefits and impacts were captured under the following accounts: NED, Regional Economic Development (RED), Other Social Effects (OSE), and Environmental Quality (EQ). A quantitative analysis for the four accounts is contained in Section 6.4 of this FIFR-EIS.

After the evaluation of the Final Array and selection of the Draft TSP, the MEMORANDUM FOR COMMANDING GENERAL, U.S. ARMY CORPS OF ENGINEERS SUBJECT: POLICY DIRECTIVE – Comprehensive Documentation of Benefits in Decision Document dated 5 January 2021 was issued. This policy directive updated the procedures to identify and analyze benefits in total and equally across a full array of benefit categories. Since the Draft TSP had been selected at the time of the issuance of the policy directive, it is acknowledged that the new requirements of the policy directive were not fully met for the Final Array since a plan had already been selected. The analysis that was conducted for the Final Array prior to TSP selection and the policy directive is documented in this Section. Additional information on the comprehensive benefits of the RP are included in Section 6.5.

Factors Considered and further described below:

National Economic Development (NED)

- o Structure and Content Damage
- o Vehicle Damage
- o Emergency Costs

Regional Economic Development (RED)

- o Jobs
- o Labor Income
- o Value Added

Other Social Effects (OSE)

- o Social Vulnerability and Resiliency
- o Community Cohesion
- o Recreational Opportunities
- o Life Safety

Environmental Quality (EQ)

- o Habitat Change
- o Threatened & Endangered Species Risk
- o Cultural Resources Sites

NED (National Economic Development) The NED Account represents increases in the net value of the national output of goods and services, expressed in monetary units, and are the direct net benefits that accrue in the planning area, and the rest of the Nation. The benefits, average annual cost, and total cost were based on the monetary costs or damages prevented and were ranked accordingly. The benefits for each alternative plan were evaluated based on damages avoided using HEC-FDA. These benefits were used to compare across the Final Array and select the NED plan. The NED account documents the economic value of the national output of goods and services produced by the proposed investment. Planning guidance requires identification of the plan that would produce the greatest contribution to NED. The NED plan is the plan with a positive BCR that most reasonably maximizes net annual benefits. The net annual benefits of a plan are equal to its annual benefits minus its annual costs.

An economic analysis of NED benefits was completed for all alternatives that were included in the Final Array. The intent of comparing alternative flood risk reduction plans in terms of NED account was to identify the beneficial and adverse effects that the plans may have on the national economy. Beneficial effects were considered to be increases in the economic value of the national output of goods and services attributable to a plan. Increases in NED were expressed as the plans' economic benefits, and the adverse NED effects were the investment opportunities lost by committing funds to the implementation of a plan. See Tables 4-13 and 4-14. Alternatives 2, 5, 6 (Alternative 6a, 6b, and 6c) and 8 all provided positive net benefits with a positive BCR.

RED (Regional Economic Development): changes in the distribution of regional economic activity that result from each alternative plan. The RED account is intended to illustrate the effects that the proposed plans would have on regional economic activity, specifically, regional income and regional employment. Regional impacts are expected to include an increase in local, state, and national employment statistics as a result of the labor required for construction. Local and regional sales industries, including temporary housing, are expected to increase as a result of temporary laborers coming into the area for construction.

The Final Array of Alternatives is expected to create a long-term increase in economic productivity by providing a more reliable flood risk and coastal storm damage risk reduction system for the study area. Increased reliability could create a long-term economic benefit to existing businesses that rely on reduced flooding for production. An improved 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.

Estimated annual project costs were used as proxy construction expenditures. Of total expenditures, a portion will be captured within the local impact area and the remainder of the expenditures will be captured within the state and the nation. Direct expenditures capture direct impacts to the area's employment and income based on the goods and services necessary to complete construction of the alternative. Construction will also generate secondary economic activity often called multiplier effects. This would be realized through companies that supply materials or services to companies engaged in construction. Local restaurateurs, for example, will have higher disposable income because of an increase in

clientele and as a result, they will spend their dollars to purchase appliances, do home repairs and otherwise put money back into the economy. The extent of the multiplier effect is dependent upon how consumers respond to the additional income, in today's climate consumers might be inclined to save for an emergency rather than spend. In summary, the higher the expenditure, the greater the contribution to the RED account. Alternatives were ranked as high, medium or low contribution to the RED account. See Tables 4-13 and 4-14.

EQ (Environmental Quality): non-monetary effects on relevant resources; assessment of favorable or unfavorable ecological, aesthetic and cultural or natural resources changes. The environmental benefits and impacts are discussed in detail as part of the NEPA analysis in Section 5). A summary of impacts for each of the alternatives is included in Table 4-16 Alternatives were summarized as high, medium, or low based on their impacts, in cases where benefits are expected a "+" is denoted. Temporal loss was considered in the WVA analysis between the time of the analysis and the start of project construction.

OSE (Other Social Effects): effects from perspectives that are relevant to the planning process, but are not reflected in the other three accounts OSE. Final Array of Alternatives were evaluated as low, medium, or high on that basis to which they would potential provided improvements or benefits to socially vulnerable groups in risk managed areas, community cohesion, changes in recreation and nature spaces and reduced risk to life and safety for residents in risk-managed area. A social vulnerability index analysis (Agency for Toxic Substances and Disease Registry. 2022. CDC SVI Documentation 2020) was conducted for the study and life safety risk assessment was considered for structures in the Final Array.

The Final Array provides opportunity for improvement in these areas since it addresses flood damages and life safety risks to several communities in the study area. The implementation of the alternatives in the Final Array would help preserve community cohesion should a significant flood event occur. In addition, risks from future floods and loss of life would be greatly reduced in the areas at high risk for structure and property damages.

Under the No Action Alternative, it was 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. 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.

All Alternatives provide reduced risk to public health and safety from flood risk.

Table 4-13. FRM Measures: Evaluation and Comparison of Systems of Accounts

System of Accounts	Alt 1: No Action	Alt 2: 50 Year Nonstructural (NS-09 & NS-11)	Alt 5: Bayou Bonfouca Detention Pond	Alt 5: Bayou Liberty (S-010)	Alt 5: Bayou Patassat Channel Improvements (S-080)	Alt 7: Gum Bayou Diversion (S-072)	Alt 7: Poor Boy Canal (S-073)	Alt 7: Doubloon Bayou (S-069)	Alt 7: Pearl River Levee (S-060)	Alt 8: Mile Branch (S-057)	Alt 8: Mile Branch Lateral A (S-121)
NED	None	\$136,095,426- Avg. Annual Costs	\$5,702,200- Avg. Annual Costs	\$2,390,300- Avg. Annual Costs	\$45,900- Avg. Annual Costs Lowest Average AAC	\$939,400- Avg. Annual Costs	\$633,600 -Avg. Annual Costs	\$1,461,800- Avg. Annual Costs	\$9,484,500 -Avg. Annual Costs	\$988,300- Avg. Annual Costs	\$1,064,000- Avg. Annual Costs
		\$108,467,724- in Net Benefits. Highest net benefits of nonstructural	(\$4,646,072) - in Net Benefits.	(\$1,454,962) - in Net Benefits.	\$86,824- in Net Benefits.	(\$983,187) - in Net Benefits.	(\$632,720) - in Net Benefits.	(\$3,284,080) - in Net Benefits.	(\$5,745,767) - in Net Benefits.	\$1,232,889 - in Net Benefits. 2.0 BCR	(\$772,253)-in Net Benefits.
		1.8 BCR	0.2 BCR	0.4 BCR	BCR 2.9	0.0 BCR	0.0 BCR	BCR (1.2)	0.4 BCR	BCR 2.2	0.3 BCR
		Positive net benefits	Negative net benefits	Negative net benefits	Positive net benefits	Negative net benefits	Negative net benefits	Negative net benefits	Negative net benefits	Positive net benefits	Negative net benefits
EQ	Continued impacts include flooding, sea level rise/ subsidence	Low impacts	Medium Impacts to Pine Savanna and waterbottoms	Medium Impacts	Low Impacts	High Impacts	Low Impacts	High Impacts	High Impacts to Pine Savanna Marsh,	High Impacts to Riparian and low impacts waterbottoms	High Impacts to Riparian and low impacts waterbottoms
RED	Does not provide RED benefits	High	Low	Low	Low	Low	Low	Low	Medium	Low	Low
OSE	Continued impacts due to continued flooding and risk to	High	Medium	Medium	Low	Medium	Low	Low	High	High	High

System of Accounts	Alt 1: No Action	Alt 2: 50 Year Nonstructural (NS-09 & NS-11)	Alt 5: Bayou Bonfouca Detention Pond	Alt 5: Bayou Liberty (S-010)	Alt 5: Bayou Patassat Channel Improvements (S-080)	Alt 7: Gum Bayou Diversion (S-072)	Alt 7: Poor Boy Canal (S-073)	Alt 7: Doubloon Bayou (S-069)	Alt 7: Pearl River Levee (S-060)	Alt 8: Mile Branch (S-057)	Alt 8: Mile Branch Lateral A (S-121)
	life, safety and community impacts										

* The initial costs used for evaluation and comparison of the Final Array were updated for measures included in the Draft TSP, Optimized TSP and RP. Final Costs for the RP are presented in Section 6.

Table 4-14. CSRM Measures: Evaluation and Comparison of Systems of Accounts

System of Accounts	Alt 1: No Action	Alt 2: 50 Year Nonstructural (NS-09 & NS-11)	Alt 4a: Lacombe Levee (S-028)	Alt 4a1: Lacombe Levee short (without western extension) (S-028)	Alt 4b: West Slidell Levee with Lacombe Levee (S-120)	Alt 5: West Slidell Levee (S-081)	Alt 6a: South Slidell Levee (S-074, S-075 & S-076, S-077)	Alt 6b: South Slidell Levee with Eden Isle (S-070, S-074, S-075, S-076, S-077)	Alt 6c: South Slidell with West Slidell Levee (S-074, S-075, S-076, S-077, S-081)	Alt 9b: Mandeville Seawall (7.3 feet) (S-46, S-47, S-048, S-118)	Alt 9c: Mandeville Seawall (18 feet) (S-46, S-48, S-118, S-122)
NED		\$136,095,426-Avg. Annual Costs	\$19,788,400-Avg. Annual Costs	\$18,695,500-Avg. Annual Costs	\$54,729,700-Avg. Annual Costs	\$36,036,200-Avg. Annual Costs	\$40,391,100-Avg. Annual Costs	\$64,038,000-Avg. Annual Costs	\$68,655,800-Avg. Annual Costs	\$8,342,000-Avg. Annual Costs	\$22,321,700-Avg. Annual Costs
		\$108,467,724-in Net Benefits. Highest net benefits of nonstructural	\$(11,070,783) in Net Benefits	\$(10,158,585) in Net Benefits	\$(3,561,344)-in Net Benefits.	\$6,414,539-in Net Benefits.	\$35,307,083-in Net Benefits	\$29,067,215-in Net Benefits	\$49,493,122-in Net Benefits. Highest net benefits for structural measure	\$(6,746,089)-in Net Benefits.	\$(12,569,469)-in Net Benefits.
		1.8 BCR	0.4 BCR	0.5 BCR	0.9 BCR	1.2 BCR	1.9 BCR	1.5 BCR	1.7 BCR	0.2 BCR	0.4 BCR
		Positive net benefits	Negative net benefits	Negative net benefits	Negative net benefits	Low net benefits	Positive net benefits	average net benefits	average net benefits	Negative net benefits	Negative net benefits
EQ	None	Low impacts	High impacts to marsh and pine habitat	High	High	High	High	High	High	Medium impacts to waterbottoms	Medium impacts to waterbottoms
OSE	Continued impacts due to continued flooding and risk to life, safety and community impact	High	High	High	High	High	High	High	High	Low	Medium
RED	Continued impacts on	High	Medium	Medium	High	Medium	Medium	High	High	Low	Medium

System of Accounts	Alt 1: No Action	Alt 2: 50 Year Nonstructural (NS-09 & NS-11)	Alt 4a: Lacombe Levee (S-028)	Alt 4a1: Lacombe Levee short (without western extension) (S-028)	Alt 4b: West Slidell Levee with Lacombe Levee (S-120)	Alt 5: West Slidell Levee (S-081)	Alt 6a: South Slidell Levee (S-074, S-075 & S-076, S-077)	Alt 6b: South Slidell Levee with Eden Isle (S-070, S-074, S-075, S-076, S-077)	Alt 6c: South Slidell with West Slidell Levee (S-074, S-075, S-076, S-077, S-081)	Alt 9b: Mandeville Seawall (7.3 feet) (S-46, S-47, S-048, S-118)	Alt 9c: Mandeville Seawall (18 feet) (S-46, S-48, S-118, S-122)
	regional economics due to continued flood damages.										

* The initial costs used for evaluation and comparison of the Final Array were updated for measures included in the Draft TSP, Optimized TSP and RP. Final Costs for the RP are presented in Section 6.

4.2.10 Final Array: Life Safety Evaluation

Managing risks to human lives is a fundamental component of the USACE Planning Bulletin 2019-04 “Incorporating Life Safety into Flood and Coastal Storm Risk Management Studies”. EC 1165-2-218 “Levee Safety;” and ER-1110-2-1156 “Dam Safety Policy and Procedures.” For the study, two different life safety analyses were conducted including both a qualitative assessment on the Final Array of Alternatives and a Life Safety Risk Indicator (LSRI) assessment on the Optimized TSP (See Section 4.4.7). LifeSim and a Semi-Quantitative Risk Assessment would be used to estimate the potential life loss under various overtopping and failure scenarios in PED. Appendix D: Engineering contains and Appendix F: Economics for additional information.

The qualitative life safety assessment was conducted on the levees and floodwalls measures since it was determined that the channel improvements, detention pond, and/or clearing and snagging measures in the final array were not contributing significantly to the evaluation, nor increased risk to life safety. Potential risk drivers identified include water velocity and depths during flood events, combination of coastal storm, riverine and rainfall flooding in some areas, incremental risk associated with existing flood reduction structures, short warning time, limited availability of stream gage data that inform warning systems and evacuations, and vulnerable populations.

To inform the flood velocity metric, the PDT evaluated model results for a 500-year rainfall event to look at conservative floodplain depth and velocities in the study area.

- The city of Slidell had an average depth of 2- 3 feet and a velocity of 1-2 ft/s at Bayou Bonfouca.
- The city of Mandeville had an average depth of 2 –3 feet with a velocity of 1 -2ft/s at Bayou Castine.
- The town of Madisonville had an average depth of 4 – 5 feet with a velocity of 4 -5ft/s on the Tchefuncte River.
- The city of Covington had an average depth of 2 – 3 feet and a velocity of 4 -5 ft/s on Bogue Falaya River.

The evaluation of the warning time and evacuation metric was based on the Louisiana State Police Contra Flow Plan for evacuation with identified trigger points at H- hour minus 50-40-30-hour marks where H-hour is the arrival of gale force winds. Since 2004, evacuations have occurred in 2005 for Hurricane Katrina, 2008 for Hurricane Gustav and 2012 for Hurricane Isaac. No known evacuations have been conducted for riverine flood events.

The data to inform the metric related to the vulnerable population was not available during the study and would be incorporated during the PED phase of the study.

The results of the assessment of the Final Array of Alternatives are shown in Figure 4-5. Alternatives 4 and 5 were considered substantially similar and received the same ratings. Alternatives 6 and 9 contain floodwalls near populated areas and were evaluated with similar risks. It was assumed that for Alternatives 6 and 9, all variations of the alternatives were

similar in terms of life safety risk and were evaluated together. The life safety evaluation for Alternative 7 primarily considered the Pearl River levee.

Measure	Metric					
	Expected Annual LL ¹	Flood Velocity LLR	Warning Time LLR ²	Evacuation LLR	Vulnerable Population > 2ft ³	Incremental Risk ³
No Action	Low	Medium	Low	Low	-	Low
Non-Structural	Low	Medium	Low	Low	-	Low
Alternative 4a	Low	Low	Low	Low	-	Medium
Alternative 4a.1	Low	Low	Low	Low	-	Medium
Alternative 4b	Low	Low	Low	Low	-	Medium
Alternative 5	Low	Low	Low	Low	-	Medium
Alternative 6	Medium	Medium	Low	Low		High
Alternative 7	Low	Low	Low	Low		Medium
Alternative 8	Low	Low	Low	Low		Low
Alternative 9	Medium	Medium	Low	Low		High

Notes: LL – Life Loss, LLR – Life Loss Risk

1. Expected annual life loss is assumed to be low to medium for all scenarios based on population density.
2. Warning time based on the tropical storm forecasting days in advance of event.
3. Inundation maps generated through HEC-LifeSIM were unavailable at time of assessment, Incremental Risk is based on evaluation of proposed flood control measure and populations of protected areas.

Figure 4-5. Life Safety Matrix

4.2.11 Summary of the Evaluation and Comparison of Final Array of Alternatives

The PDT evaluated the measures and alternatives in the Final Array and screened them based on their ability to meet the study planning objectives, avoid study constraints, environmental impacts and to maximize benefits provided over the 50-year period of analysis from 2032-2082. The Final Array was also evaluated against the P&G criteria and the contributions to federal objectives and accounts. Table 4-15 summarizes the screening and evaluation of the measures in the Final Array of Alternatives. Table 4-16 and Table 4-17 provides a summary of the cost-effective measures evaluated in the Final Array. Measures that met the study screening criteria and that were independent, combinable, and cost effective were moved forward for inclusion in the combined structural and NS plan. The combined structural and NS plan was then compared to the standalone NS plan for the entire parish.

Alternative 1 - No Action - was screened. It does not address planning objectives and was screened based on completeness since it would not alleviate problems or provide flood risk reduction benefits. The No Action was cost effective since it did not require a federal

investment and did meet acceptability criteria. The continued flood damages under the No Action would lead to negative RED, EQ, and OSE impacts in the future. There is a medium flood velocity risk for life safety associated with the No Action Alternative.

Alternative 2 - NS - met planning objectives, avoided study constraints and was determined to be complete, acceptable, and effective. The NS plan (using 50-year flood plain/ 2% AEP) was efficient and incrementally justified because it provided the most net benefits to reduce flood damages. The NS plan also had positive NED, RED and OSE benefits and the least EQ impacts of any alternative in the Final Array of Alternatives. Alternative 2 was ranked medium flood velocity risk for life safety purposes.

- Screened (NS-08 and NS-010): The NS plan (using 10, 20, and 100-year floodplains) were screened based on efficiency.
- The standalone NS alternative (no structural measures) was screened because the combined structural and NS plan provided more net benefits.

Alternative 4 - Lacombe (4a, 4a.1, and 4b) – Even though Alternative 4 met planning objectives and was determined to be complete and effective, Alternatives 4a, 4a.1, and 4b were screened based on efficiency due to a negative BCR. The proposed levee alignment had a medium incremental risk for life safety.

- Screened Measures: S-028, S-120

Alternative 5 - Bayou Liberty/ Bayou Vincent/Bayou Bonfouca-- Alternative 5 includes measures to address riverine, rainfall, and coastal storm flooding to the areas of Bayou Liberty, Bayou Vincent, and Bayou Bonfouca.

Bayou Patassat Channel Improvements (Clearing and Snagging). The measure was determined to be complete, effective, efficient, and acceptable during initial evaluation of the Final Array of Alternatives. The measure met planning objectives and avoided study constraints (low risk related to HTRW constraints), although there is a HTRW site located a mile away from the clearing and snagging location that was expected to present a low risk. The measure was expected to have positive NED, RED, and OSE benefits, and low EQ impacts. During TSP optimization, the Bayou Patassat feature was ultimately removed due as not cost effective. See Appendix F: Economics.

West Slidell Levee Measure. For the combined structural and NS plan, the West Slidell levee was combined with the South Slidell levee as it was determined that these two measures combined produced the greatest net benefits. This combination was also determined to be complete, effective, efficient and acceptable. The combination of the South Slidell alignment with the West Slidell alignment removed an area that was an HTRW concern from the South Slidell alignment, reducing implementation risk. The measure is expected to have positive NED, RED, and OSE benefits. The West Slidell levee is expected to result in EQ impacts on BBMNWR and Bayou Liberty Louisiana Scenic Waterway, but they would be offset by the anticipated land swap and nature-based designs for the floodgate at Bayou Liberty. This

alternative was determined to be a low risk related to life safety. The West Slidell levee is not a standalone measure and therefore is not complete when not combined with the South Slidell levee in Alternative 6a. Therefore, the West Slidell levee measure combined with the South Slidell levee measure from Alternative 6c (West and South Slidell Levee and Floodwall System) was carried forward to be combined with the NS alternative.

Bayou Bonfouca Detention Pond and Bayou Liberty Channel Improvements were determined to be complete and effective at addressing problems and opportunities and acceptable, but screened on efficiency due to a negative BCR. Even though cost effective, the West Slidell levee was screened as a standalone since a combination of the West and South Slidell Levee and Floodwall System produced greater net benefits and West Slidell is not a complete standalone measure.

- Screened Measures: S-004 and S-010

Alternative 6 - South Slidell Storm Surge - portion retained for inclusion into the combined structural and NS plan. The South Slidell Levee (Alternative 6a), South Slidell Levee with Eden Isle (Alternative 6b) and the Combined South Slidell and West Slidell Levee (Alternative 6c) all had a positive BCR, but these measures were not all separable and could not all be selected. The West and South Slidell Levee and Floodwall System combination provided the greatest net benefits for this area and was the only alternative moved forward. The combination was determined to be complete, effective, efficient, and acceptable, meeting planning objectives and avoiding study constraints. The measure is expected to have positive NED, RED, and OSE benefits. EQ impacts to managed habitat impacts and the West Slidell levee impacts on BBMNWR and Bayou Liberty Louisiana Scenic waterway. There is a high incremental risk for life safety due to population in Slidell.

- Screened Measures: The South Slidell Levee (Alternative 6a) and the South Slidell Levee with Eden Isle (Alternative 6b), were screened as a standalone measure. The South Slidell Levee (Alternative 6a) was combined with the West Slidell levee measure from Alternative 5 to form the West and South Levee and Floodwall System (Alternative 6c). Alternative 6c was carried forward to be combined with the NS alternative.

Alternative 7 - Eastern Slidell - was screened and not included in the combined structural and NS plan.

- Screened Measures: S-060, S-069, S-072, and S-073.
- The Pearl River levee, Doubloon Bayou channel improvements, Gum Bayou Diversion, and Poor Boy Canal improvements were all screened based on efficiency due to a negative BCR. The Pearl River Levee Alignment E was screened based on not meeting the planning objectives, P&G criteria, and the estimated implementation costs exceeding the potential damages avoided. Additionally, Doubloon Bayou Channel

Improvements, Gum Bayou Diversion, and Poor Boy Canal Improvements were determined to not be effective in reducing flooding through the H&H modeling as only minor reductions in WSE or in some cases substantial increases in WSE were observed. All were identified as a medium incremental risk for life safety.

Alternative 8 - Upper Tchefuncte/Covington – The Mile Branch Channel Improvements Measure (Measure S-057) of this Alternative was moved forward to be combined with the NS alternative and the other economically justified structural measures discussed in this section. Together, the measures were determined to be complete, effective, efficient, and acceptable, meet planning objectives and avoid study constraints and is expected to have positive NED, RED, and OSE benefits. There is a low risk related to life safety. EQ impacts are expected to be temporary and non- significant related to terrestrial habitat, with some additional impacts to aquatic habitat during construction, which are being compensated for with creation of a backwater area off of Mile Branch.

- Screened Measures: S-121.
- Lateral A channel improvements were screened based on efficiency due to a negative BCR. Additionally, Lateral A channel improvements were determined to not be effective in reducing flooding through the H&H modeling as only minor reductions in WSE were observed.

Alternative 9 - Mandeville Lakefront- none of the variations (Alternatives 9a, 9b, or 9c) were retained.

- Screened Measures: S-046, S-047, S-048, S-118, and S-122.
- All structural measures that made up the Mandeville Lakefront alternative were screened based on efficiency due to a negative BCR. This area was identified as high incremental risk for life safety due to population in Mandeville.

Table 4-15. Summary Evaluation and Comparison Final Array of Alternatives. The measures in bold were retained and included in the combined structural and nonstructural plan.

Alt/Measures	Increase Public Health and Safety	Reduce Flood Damage (Table 4-4)	Reduce Interruption Transportation	Avoid Constraints (Table 4.2.6)	Resource Impacts (Section 5)															
					Wetlands	P&U Soils	Aquatics	EFH	Wildlife	T&E	WQ	Air Quality	HTRW	Cultural	Noise	Aesthetics	Recreation	Socioeconomic	Navigation	EJ
1-No Action	N	N	N	Yes	Wetland loss would follow current trends	Development would continue to threaten P&U soils	There would be more open water for fisheries. Less spawning/ refugia habitats	Beneficial impacts from more water bottom habitat. Adverse impact from loss of cover, spawning and nursery grounds.	As wetlands are lost and habitat is converted to open water, wildlife would move into adjacent areas including developed areas looking for cover and food sources.	Continued threat due to loss of habitat and increased development. National trends to support T&E protection would continue	Impacts to WQ would follow current trends	AQ would follow current trends	No impact	No impact. Trends would continue into future	No impact	No impact	No impact	Continued threat from storms and flood risk	No impact	Risk to minority and low-income population groups
2-Non-Structural (Standalone Parish wide) 100 year	Y	Y	Y	Yes	Wetland loss would follow current trends	Development would continue to threaten P&U soils	There would be more open water for fisheries. Less spawning/ refugia habitat	Beneficial impacts from more water bottom habitat. Adverse impact from loss of cover, spawning and nursery grounds.	As wetlands are lost and habitat is converted to open water, wildlife would move into adjacent areas including developed areas looking for cover and food source	Continued threat due to loss of habitat and increased development. National trends to support T&E protection would continue	Impacts to WQ would follow current trends	Short-term. Parish is in attainment	No Impact	Potential effect on known and undocumented archeological resources and historic built resources, modifications to viewshed and visual landscape	No Impact	Viewshed	No Impact	Temporary	No Impact	Temporary, further investigation needed

Alt/Measures	Increase Public Health and Safety	Reduce Flood Damage (Table 4-4)	Reduce Interruption Transportation	Avoid Constraints (Table 4.2.6)	Resource Impacts (Section 5)															
					Wetlands	P&U Soils	Aquatics	EFH	Wildlife	T&E	WQ	Air Quality	HTRW	Cultural	Noise	Aesthetics	Recreation	Socioeconomic	Navigation	EJ
2-Non-Structural (Standalone Parish wide) 50 year	Y	Y	Y	Yes	Wetland loss would follow current trends	Development would continue to threaten P&U soils	There would be more open water for fisheries. Less spawning/ refugia habitat	Beneficial impacts from more water bottom habitat. Adverse impact from loss of cover, spawning and nursery grounds	As wetlands are lost and habitat is converted to open water, wildlife would move into adjacent areas including developed areas looking for cover and food source	Continued threat due to loss of habitat and increased development.	Impacts to WQ would follow current trends		No Impact		No Impact		No Impact		No Impact	
2-Non-Structural (Standalone Parish wide) 25 year	Y	Y	Y	Yes	Wetland loss would follow current trends	Development would continue to threaten P&U soils	There would be more open water for fisheries. Less spawning/ refugia habitat	Beneficial impacts from more water bottom habitat. Adverse impact from loss of cover, spawning and nursery grounds	As wetlands are lost and habitat is converted to open water, wildlife would move into adjacent areas including developed areas looking for cover and food source	National trends to support T&E protection would continue	Impacts to WQ would follow current trends		No Impact		No Impact		No Impact		No Impact	
2-Non-Structural (Standalone Parish wide) 10 year	Y	Y	Y	Yes	Wetland loss would follow current trends	Development would continue to threaten P&U soils	There would be more open water for fisheries. Less spawning/ refugia habitat	Beneficial impacts from more water bottom habitat. Adverse impact from loss of cover, spawning and nursery grounds	As wetlands are lost and habitat is converted to open water, wildlife would move into adjacent areas including developed areas looking for cover and food source	Continued threat due to loss of habitat and increased development.	Impacts to WQ would follow current trends		No Impact		No Impact		No Impact		No Impact	
4a-Lacombe Levee (S-028)	Y	Y	Y	Yes	Loss of Pine Savanna, Riparian, Marsh	P&U soils would be impacted for borrow	Temp short-term impacts to Migration, Spawning	Conversion of marsh habitat to uplands. Loss of nursery, spawning habitat off set by mitigation	Adverse impacts resulting from Habitat shift, Mortality, Displacement; Beneficial impacts by restoring habitat via mitigation	May affect NLAA Gulf Sturgeon or critical habitat, NLAA Quillwort; RCW, Indian Manatee, gopher tortoise	Short term impacts due to turbidity. SWPPP and LDPS permit required		No RECs within 1-mile radius				Short-term		Viewshed, Louisiana Scenic Streams	
4a.1-Lacombe Levee Short (S-028)	Y	Y	Y	Y	Loss of Pine and Swamp															
4b-Lacombe Levee combined with West Slidell Levee (S-120)	Y	Y	Y	Y	Loss of Pine Savanna, Marsh															

Alt/Measures	Increase Public Health and Safety	Reduce Flood Damage (Table 4-4)	Reduce Interruption Transportation	Avoid Constraints (Table 4.2.6)	Resource Impacts (Section 5)																
					Wetlands	P&U Soils	Aquatics	EFH	Wildlife	T&E	WQ	Air Quality	HTRW	Cultural	Noise	Aesthetics	Recreation	Socioeconomic	Navigation	EJ	
7-Gum Bayou Channel Improvements - Diversion(S-072)	Y	N	N	Y												Scenic Rivers System	Scenic Rivers System				
7-Poor Boy Canal Channel Improvements - Dredging (S-073)	N	N	N	Y																	
7-Doubloon Bayou Channel Improvements -Dredging (S-069)	N	N	N	Y																	
8-Mile Branch Channel Improvements (S-057)	Y	Y	Y	Y	Adverse long-term impacts to loss of 36 acres Riparian habitat		Loss of 3 acres of water bottoms. Offset by creation of additional water bottoms. Permanent Loss of wildlife riparian habitat				1 brownfield site							Louisiana Natural and Scenic Rivers System			
8- Lateral A Channel Improvements (S-121)	N	N	N	Y																	
9a-Mandeville Seawall (7.3 feet) Passive Drainage (S-046, 118, S-047)	Y	Y	Y	Y	Adverse impact to BLH Swamp, Marsh	P&U soils would be impacted for borrow						No RECs within 1 mile radius				Viewshed	Mandeville Lakefront Park, East Lakefront Children's Park				
9b-Mandeville Seawall (7.3 feet) Pump Stations (S-046, S-118, S-048)	Y	Y	Y	Y																	
9c-Mandeville Seawall (18 feet) (S-122)	Y	Y	Y	Y																	

Alt/Measures	Increase Public Health and Safety	Reduce Flood Damage (Table 4-4)	Reduce Interruption Transportation	Avoid Constraints (Table 4.2.6)	Resource Impacts (Section 5)														
					Wetlands	P&U Soils	Aquatics	EFH	Wildlife	T&E	WQ	Air Quality	HTRW	Cultural	Noise	Aesthetics	Recreation	Socioeconomic	Navigation
Borrow	NA	NA	NA																Temporary

*Bayou Patassat was previously included in the Draft TSP and included in the DIFR-EIS released for review and comment in 2021. Updated analysis indicated that the measure was not cost effective.

**Mile Branch Channel Improvements was previously included in the Draft TSP (DIFR-EIS) and Optimized TSP (RDIFR-EIS). Updated analysis indicated that the measure was not cost effective and it was not included in the RP.

Table 4-16. Summary of the Cost-Effective Measures Evaluated in the Final Array of Alternatives

Alt/Measures	NED Benefits (Sec. 4.2.9)	RED Benefits (Sec. 4.2.9)	EQ Impacts (Sect. 4.2.9)	OSE Benefits (Sec. 4.2.9)	Life Safety from Structure (Section 4.2.10)	P&G Criteria (Section 4.2.8)				BCR (Table 4-5, 4-6, 4-7, 4-8)	Estimated Number of Structures Benefitted	Total Cost (Table 4-4 & Table 4-5, 4-6, 4-7, 4-8)	Notes	Moved forward and included in the Combined Alternative (TSP)
						Completeness	Effectiveness	Efficiency	Acceptability					
1-No Action	N	N	N	N	low	N	N	Y	N	-		0	Screened	No
2-Non Structural (Standalone Parish wide) 100 year	Y	Y	low	Y	low	Y	Y	Y	Y	1.6	17,900	\$4,825,397,000	Screened 50 year NS more efficient	No
2-Non Structural (Standalone Parish wide) 50 year	Y	Y	low	Y	low	Y	Y	Y	Y	1.9	13,800	\$3,716,442,000	Portion of NS plan for areas not covered by the Economically justified structural measures moved forward	Partial
2-Non Structural (Standalone Parish wide) 25 year	Y	Y	low	Y	low	Y	Y	Y	Y	2.3	9600	\$2,581,277,000	Screened-50 year NS more efficient	No
2-Non Structural (Standalone Parish wide) 10 year	Y	Y	low	Y	low	Y	Y	Y	Y	2.6	6100	\$1,671,304,000	Screened- 50 year NS more efficient	No
4a-Lacombe Levee (S-028)	N	Y	Y	Y	med	Y	Y	N	Y	0.5	600	\$487,101,000	Screened- Efficiency; negative B/C ratio	No

4a.1-Lacombe Levee Short (S-028)	N	Y	Y	Y	med	Y	Y	N	Y	0.5	580	\$461,934,000	Screened- Efficiency; negative B/C ratio	No
4b-Lacombe Levee combined with West Slidell Levee (S-120)	Y	Y	Y	Y	med	Y	Y	N	Y	0.9	3,100	\$1,347,853,000	Screened- Efficiency; negative B/C ratio	No
5-West Slidell Levee	Y	Y	Y	Y	med	N	Y	Y	Y	1.2	2,500	\$888,576, 000	Screened as standalone; combined into 6c	No
5-Bayou Bonfouca Detention Pond	N	Y	Y	Y	N/A	Y	Y	N	Y	0.2	80	\$151,623,591	Screened- Efficiency; negative B/C ratio	No
5-Bayou Liberty Channel Improvements	N	Y	Y	Y	N/A	Y	Y	N	Y	0.4	70	\$52,655,730	Screened- Efficiency; negative B/C ratio	No
5-Bayou Patassat Channel Improvements- Clearing and Snagging	Y	Y	Low	Y	N/A	Y	Y	Y	Y	2.9	30	\$956,630	High BC ratio	Yes
6a-South Slidell (S-075 & S-076)	Y	Y	Y	Y	high	Y	Y	Y	Y	1.8	4,500	\$1,042,159,000	Moved forward under 6c	No
6b-South Slidell with Eden Isle (S-070, S-075 & S-076)	Y	Y	Y	Y	high	Y	Y	Y	Y	1.4	5,400	\$1,682,008,000	Screened- not most effective for the area	No
6c-South Slidell with West Slidell Levee (S-081, S-075 & S-076)	Y	Y	Y	Y	high	Y	Y	Y	Y	1.7	7,000	\$1,732,902,000	Most effective variation	Yes
7-Pearl River Levee	N	Y	Y	Y	med	Y	N	N	Y	0.4	400	\$216,511,535	Screened- Efficiency; negative B/C ratio; did not meet planning objectives or P&G criteria	No
7-Gum Bayou Channel Improvements- Diversion(S-072)	N	Y	Y	Y	N/A	N	N	N	N	0	0	\$22,174,443	Screened- Efficiency; negative B/C ratio; did not meet planning objectives or P&G criteria	No
7-Poor Boy Canal Channel Improvements- Dredging (S-073)	N	Y	Y	Y	N/A	N	N	N	Y	0	0	\$15,307,082	Screened- Efficiency; negative B/C ratio; did not meet planning objectives or P&G criteria	No
7-Doubloon Bayou Channel Improvements- Dredging (S-069)	N	Y	Y	Y	N/A	N	N	N	Y	-1.1	0	\$34,937,686	Screened- Efficiency; negative B/C ratio	No

8-Mile Branch Channel Improvements (S-057)	Y	Y	Y	Y	low	Y	Y	Y	Y	2	250	26,337,000	Moved Forward	Yes
8- Lateral A Channel Improvements (S-121)	N	Y	Y	Y	low	Y	Y	N	Y	0.3	30	25,600,000	Screened- Efficiency; negative B/C ratio	No
9a-Mandeville Seawall (7.3 feet) Passive Drainage (S-046, 118, S-047)	N	Y	Y	Y	high	Y	Y	N	Y	0.2	400	\$172,144,000	Screened- Efficiency; negative B/C ratio	No
9b-Mandeville Seawall (7.3 feet) Pump Stations (S-046, S-118, S-048)	N	Y	Y	Y	high	Y	Y	N	Y	0.2	400	\$186,409,000	Screened- Efficiency; negative B/C ratio	No
9c- Mandeville Seawall (18 feet) (S-122)	N	Y	Y	Y	high	Y	Y	N	Y	0.4	400	\$519,596,000	Screened- Efficiency; negative B/C ratio	No
Borrow														

Table 4-17. Summary of Cost-Effective Structural Measures of the Final Array shown alongside the Cumulative Justified Nonstructural Increment at the 2% AEP/50 Year Floodplain (in 1,000s)

	Alternative 5 West Slidell Levee (S-081)	Alternative 6 South Slidell Levee (S-074, S-075 & S-076, S- 077)	Alternative 6 South Slidell Levee with Eden Isle (S-070, S- 074, S-075, S-076, S- 077))	Alternative 6 South Slidell with West Slidell Levee (S-074, S- 075, S-076, S-077, S-081)	Alternative 6 Bayou Patassat Clearing Snagging (S-080)	Alternative 8 Mile Branch Channel Improvements (S-057)	Alternative 2 Rest of Parish Nonstructural (NS-09 & NS- 11) 50 year	Combined Plan-Structural & NS 2% AEP (50 -year) for rest of the parish outside of structural influence (West Slidell and South Slidell Levee and Floodwall System and the Mile Branch Channel Improvements)	Parish Wide Nonstructural Plan Cumulative to the 2% AEP 50 Year floodplain (NS-09 & NS- 11)
First Cost	888,576	1,042,158	1,682,008	1,732,901	957	26,337	2,241,108	3,939,245	4,501,184
Benefits	42,455	75,706	93,114	118,160	133	2,221	157,421	277,935	244,563
AA Cost	36,036	42,372	66,432	70,985	466	1,115	79,263	149,080	136,095
Net Benefits	6,419	33,334	26,682	47,175	87	1,106	78,158	128,855	108,468
B/C Ratio	1.2	1.8	1.4	1.7	2.9	2.0	1.9	1.8	1.8
Approx. # structures	2,500	4,400	5,300	7,000	30	250	8,500	15,800	13,800

Bolded measures moved forward to the combined structural and NS plan to provide flood risk reduction (Draft TSP)

4.3 SELECTION OF THE DRAFT TSP FOR THE DIFR-EIS

Based on the evaluations described in Sections 4.2.1-4.2.10, and summarized in Section 4.2.11 and Table 4-15, the independent, combinable, cost-effective measures with a BCR value greater than 1 were moved forward for inclusion as part of the combined structural and NS plan (Table 4-17).

For FRM, the two justified measures, Bayou Patassat Channel Improvements (clearing and snagging) (S-080) and the Mile Branch Channel Improvements (S-050), were separable and combinable and both moved forward for inclusion in the Draft TSP.

For CSRM, the West Slidell Levee, South Slidell Levee, South Slidell Levee with Eden Isle and the West and South Slidell Levee and Floodwall System all had a positive BCR, but these measures were not all separable and could not all be selected. The West Slidell (S-081) and South Slidell (S-075, S-076) levee combination provided the greatest net benefits for this area and was the only alternative moved forward for CSRM. All of the NS measures (NS-08, NS-09, NS-10, NS-11) that address structures in the 0-50 year floodplain (2 percent AEP) in areas that will not be benefited by the structural measures were also moved forward.

The combined structural and NS FRM/CSRM plan containing the combined West and South Slidell levees (from Alternative 5 and 6c), Bayou Patassat channel improvements-clearing and snagging (from Alternative 5), Mile Branch channel improvements (from Alternative 8) and NS (from Alternative 2) for eligible structures in the 50-year floodplain that do not benefit from the structural measures resulted in a BCR of 1.8 with \$128,855,000 in net benefits (Table 4-16). This combined structural and NS plan was then compared to the “NS only” plan (Alternative 2), which also had a BCR of 1.8, but the net benefits were lower (Table 4-17).

The combined structural and NS plan was moved forward as the NED plan and the Draft TSP. The DIFR-EIS with the Draft TSP was released for public review on 11 June 2021. After the release of the DIFR-EIS, the PDT conducted additional engineering, economic and environmental investigations on the Draft TSP as part of the Feasibility Level Design (FLD) phase of the study. Information gathered through these additional investigations, in conjunction with consideration of concerns raised by the public and by agencies, assisted the PDT in further refining the Draft TSP. Subsections 4.3.1 and 4.4 provide a summary of these investigations and how public and agency concerns were addressed.

The individual measures included in the Draft TSP, previously described in Section 4.1, are summarized below. Figures for the Draft TSP are contained in Section 2.6 of Appendix B: Plan Formulation.

2021 Draft TSP*

1. Addresses flooding parish-wide and includes CSRM, FRM, and NS measures. The TSP is the NED Plan.

- o 2021 NS Plan-CSRM and FRM-**NS flood risk reduction** for eligible structures in the rest of St Tammany Parish not covered by the structural measure of the TSP.
 - Voluntary Program including approximately 8,498 structures to be elevated (6,643 residential) or floodproofed (1,855 nonresidential) to the future 100 year flood stage. *For additional details refer to Section 4.1 Alternative 2; Figure 4-2; Appendix F for analysis and Appendix H for preliminary implementation guidance.*
- o 2021 FRM-**Bayou Patassat Channel Improvements****- Clearing and Snagging-
 - Approximately 0.17 miles (900 feet) of clearing and snagging would occur in Bayou Patassat between Bayou Vincent Pump Station and US Route 11. *For additional details refer to Section 4.1 Alternative 5; Figure 4-2*
- o 2021 CSRM- **West and South Slidell Levee and Floodwall System**
 - The West and South Slidell Levee and Floodwall System is comprised of approximately 16.3 miles of levee and floodwall and includes five pump stations, and eight floodgates. There would also be a total of seven culverts and sluiceways, eight vehicular gates, one railroad gate along the Norfolk Southern Railroad tracks, and eight road ramps. The I-10 would be raised over the new levee section by constructing ramps. *For additional details refer to Section 4.1 Alternative 6c; Figure 4-2*
- o 2021 FRM-**Mile Branch Channel Improvements*****-
 - Channel Improvements include clearing and grubbing and mechanical dredging of Mile Branch. The channel bottom would be lowered by 5 feet. Approximately 20 acres of channel would be cleared and grubbed prior to mechanical dredging. *For additional details refer to Section 4.1 Alternative 8; Figure 4-2*

*Features included in the Draft TSP released in the DIFR-EIS underwent additional analysis and design and were refined as the study progressed to a final RP. The RP is documented in Section 6.

**Note the Bayou Patassat Measure was included in the Draft TSP released in the 2021 DIFR-EIS; additional analysis removed this measure from the Optimized TSP and final RP. .

***Mile Branch Channel Improvements was previously included in the Draft TSP and Optimized TSP released for review and comment in 2021 (DIFR-EIS) and 2023 (RDIFR-EIS). Updated analysis after release of the RDIFR-EIS indicated that this measure was not cost effective and it was removed from the final RP.

4.3.1 Further Investigation and Reevaluation of Structural Measures for the Eden Isle Community in Slidell, Louisiana

Subsequent to the selection of the Draft TSP, but prior to the public release of the DIFR-EIS in 2021, the NFS requested that USACE investigate additional structural measures for the Eden Isle community. The PDT coordinated with the NFS, the STPG, the St. Tammany

Levee, Drainage and Conservation District STLDCD, and other stakeholders to discuss and investigate the development of additional measures. USACE conducted a sensitivity analysis to determine if the estimated change in benefits, impacts and/or costs associated with a refined alignment at Eden Isle to incorporate into the Draft TSP. Further analysis confirmed that there was not a justified alignment to incorporate Eden Isle into the West and South Slidell Levee and Floodwall System of the Draft TSP. The structures in Eden Isles are however included in the NS portion of the project. For additional information See Appendix B: Plan Formulation.

4.4 FINAL FEASIBILITY DESIGN AND REFINEMENTS OF DRAFT TSP LEADING TO THE OPTIMIZED TSP (RDIFR-EIS)

Subsequent to the release of the DIFR-EIS, additional engineering, economic, and environmental investigations on the separate measures of the Draft TSP were conducted as part of the Feasibility Level Design phase of the study to refine and optimize the design and cost estimates of the measures included in the selected plan. Information gathered through these additional investigations, together with the consideration of comments received from the public, stakeholders, the USFWS, and the NMFS regarding the West and South Slidell Levee and Floodwall System, (levee and floodwall system) were used in further refining the selected plan. The revised design and costs were incorporated into the numerical modeling (Hydraulics and Economics) to develop refined assessments of the performance and cost-effectiveness of the Draft TSP and were included in the RDIFR-EIS as the Optimized TSP. Further design (potential minor alignment shifts due to considerations such as real estate) would occur during PED.

Differences in the Draft TSP as compared to the Optimized TSP are shown in Table 4-18 and Figure 4-6. A summary of the optimized structural measures of the TSP (CSRM- West and South Slidell Levee and Floodwall System and the FRM Mile Branch Channel Improvements Measure) are included in Section 6 and described in detail in Appendix D: Engineering. The Bayou Patassat Channel Improvements (FRM structural measure) was screened during optimization of the TSP due to the clearing and snagging not being as effective as the H&H modeling originally estimated. An updated economics analysis Bayou for the Patassat Channel Improvements Measure yielded a BCR of 0.5 resulting in the lack of economic justification.

The NS components of the Draft TSP were also optimized to refine the aggregation of the NS plan. See Section 4.4.4 and Appendix F: Economics for detail on the NS plan refinement.

4.4.1 CSRM Measure- Final Feasibility Level Optimized Levee and Floodwall System

The subsections below provide a summary of the investigations to address public and agency concerns on the Draft TSP and DIFR-EIS. In addition, adjustments/refinements were made to the Draft TSP based on updated Future with Project modeling and included changes to minimize induced flooding, identify hydraulic efficiencies, adjust tie-in locations

and heights, refine the locations, capacities, and dimensions of various structures (i.e., gates, pump stations, etc.) (Appendix E: Hydrologic & Hydraulics). The screening and evaluation of alignment shifts considered efforts to minimize the taking of structures or induce flooding on communities, which includes businesses, residential, and infrastructure. A RSLC analysis (was conducted for three rates of RSLR in accordance with Engineering Regulation 1100-2-8162 to determine how the different rates of RSLR would impact project benefits (Section 4.4.2.2 of Appendix E: Hydrologic & Hydraulics). The optimized alignment for the West and South Slidell Levee and Floodwall System is further detailed in Appendix D: Engineering and Appendix E: Hydrologic & Hydraulics. See Figure 4-6 and Table 4-18. The impact analysis has been updated for the West and South Slidell Levee and Floodwall System in light of the revised design, features and alignment in Section 5, Environmental Consequences.

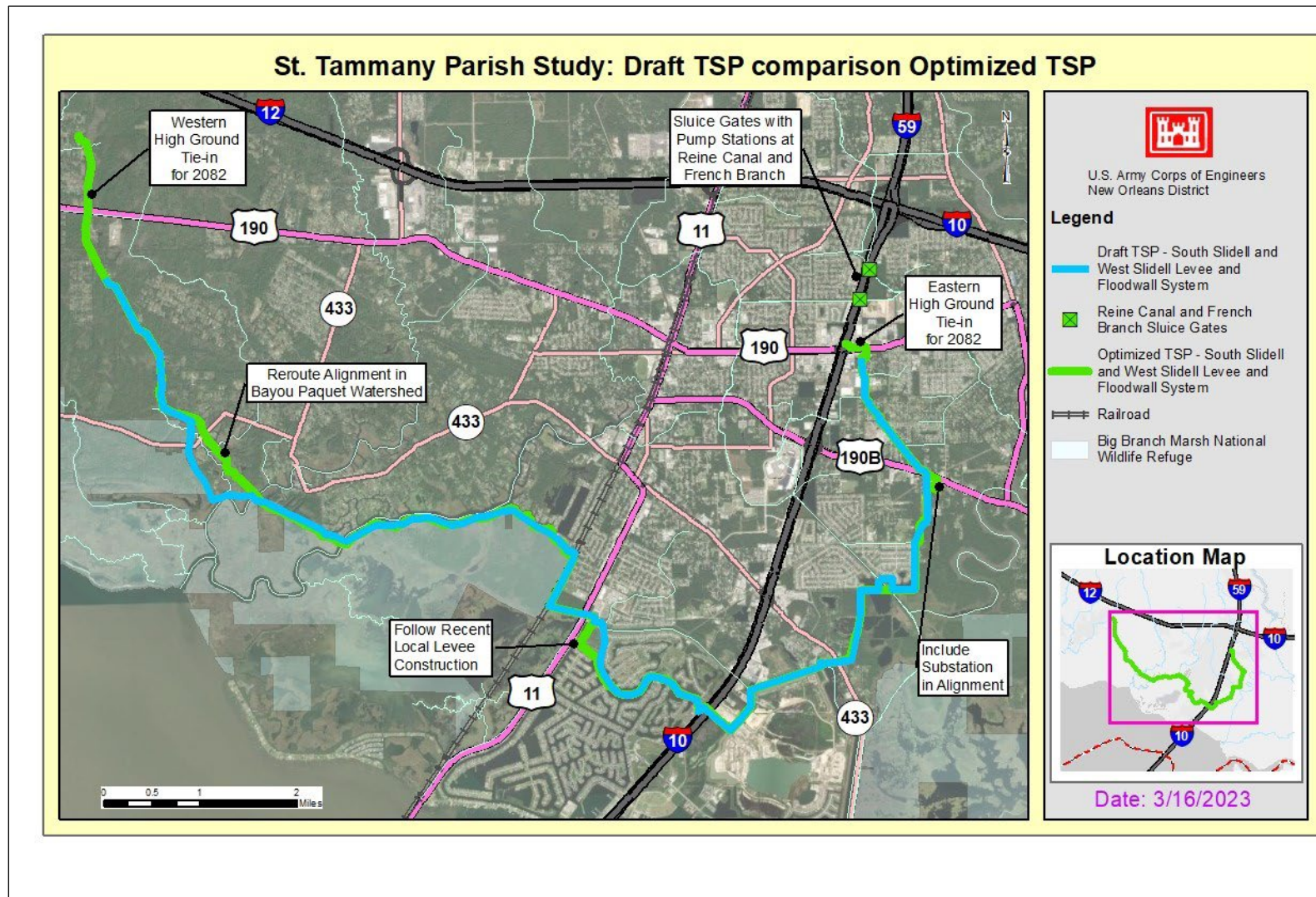


Figure 4-6. Comparison of the Draft TSP Alignment with the Optimized TSP Alignment for the West and South Slidell Levee and Floodwall System

Table 4-18. Comparison of the Draft TSP Alignment with the Optimized TSP Alignment for the West and South Slidell Levee and Floodwall System

Attribute	Draft TSP Alignment Alternative 6c (June 2021)	Optimized TSP* Alignment Alternative 6-3-C (April 2023)
Total Length	16.3 miles (85,900 feet)	18.5 miles (97,700 feet)
Length of Floodwall	2.3 miles (12,200 feet)	3.5 miles (18,200 feet)
Length of Levee	14 miles (73,700 feet)	15 miles (79, 500 feet)
Temporary Acres of Construction for Levee and Floodwall system	169 acres **Initial construction for levees only**	100 acres
Permanent Acres for Levee and Floodwall system	Not available	450 acres
Elevation Range (Depends on location)	13 feet to 15 feet (year 2032) 15.5 feet to 18.5 feet (year 2082) (depending on location)	13.5 feet to 16 feet (year 2032) 17.5 feet to 20 feet (year 2082) (depending on location)
Pump Stations	5	8
Culverts/ Sluice Gates/Lift Gates	8	13
Number of Vehicular Flood Gates	8	18
Number of Pedestrian Floodgates	1	1
Railroad Gates	1	1
Road Ramps	8	6
Length of Levee/ Floodwall on or directly adjacent to Refuge property	4.3 miles	3.4 miles
Length of Levee/ Floodwall directly on Refuge property	3.5 miles	3.3 miles
Mitigation Cost	\$118,059,000	\$42,739,711
Real Estate Cost	\$9,310,000	\$46,871,000
Fill (Borrow Material) Required	1,528,000 cubic yards ** For the Draft TSP the amount of fill required was only counted for the initial construction**	7,239,000 cubic yards (initial cons plus future lifts) 3,000,000 cubic yards for initial construction only

4.4.1.1 Investigation Regarding Variations to the Eastern End of the Alignment to Include Military Road Communities (Screened)

At the request of stakeholders and the public, changes to the eastern end of the alignment to incorporate additional communities along Military Road (U.S. Highway 190) were investigated (Figure 4-7). All variations of the alignment cut through heavily populated and urbanized areas and would require extensive coordination to design and implement practical engineering features. After a thorough evaluation, the PDT determined that none of the proposed alignment adjustments to include Military Road would be effective or efficient and those alignment variations were screened from further consideration based on major factors such as, engineering constructability, economic, and practicality considerations; natural and human environmental impact; and life safety and flood risk concerns.

4.4.1.2 Investigation Regarding Military Road Alignment (Screened)

Military Road is a federal highway south of the intersection at Gause Blvd/Herwig Bluff Road (U.S. Highway 190) in Slidell. North of this intersection, the road is a state highway (U.S. Highway 190). The stakeholders proposed Military Road alignment running along the middle turn lane of the U.S. Highway 190 (Military Road Alignment). Any levee and floodwall alignment that traverses the existing right of way of a state and/or federal highway would require coordination between the appropriate state and federal agencies to determine the obligations for operation, maintenance, repairs, rehabilitation, replacement, inspections, repairs to the features of the Optimized TSP, flood-fighting and other similar concerns.

CEMVN contacted the state of Louisiana, Department of Transportation and Development for feedback on traffic design and construction issues. The Federal Highway Administration (FHWA) has intersection sight distance (ISD) requirements to ensure proper visibility when vehicles cross the road. In order to satisfy FHWA requirements, openings in the floodwall to would be required to accommodate vehicular traffic along Military Road. These opening would be in the form of extremely long (hundreds of feet) floodgates. Large roller gates or swing gates would be impractical from a maintenance, construction, and cost perspective and visibility along Military Road would be cut off completely due to the height of the floodwall resulting in safety concerns. See Figures 4-8 through 4-10.

The construction of a Military Road alignment would also directly and indirectly impact the pine savanna/hardwood and wetland habitat in the area and thereby require compensatory mitigation. In addition, the pine savanna/hardwood habitat may be used by the endangered red-cockaded woodpecker and result if further adverse T&E impacts. Fragmentation of this habitat would result in impacts to terrestrial wildlife and avian species that require larger tracts of forested habitat to thrive.

Although the Military Road alignments are not included in the NED plan, these CSRM measures may be evaluated for future implementation by State or local government entities by a third party under a future study or authorization.

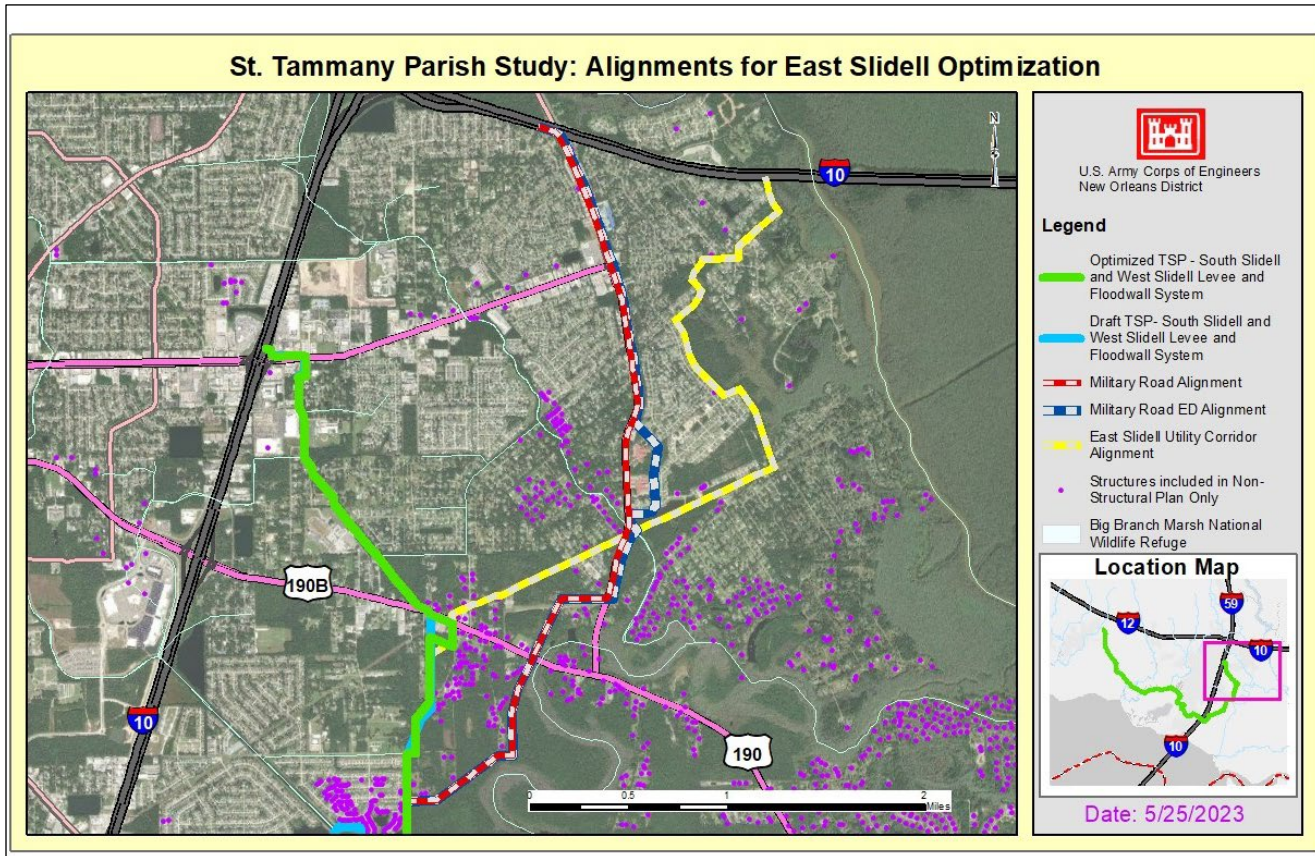


Figure 4-7. Alignments Considered during Optimization of the Eastern Portion of the Levee and Floodwall System

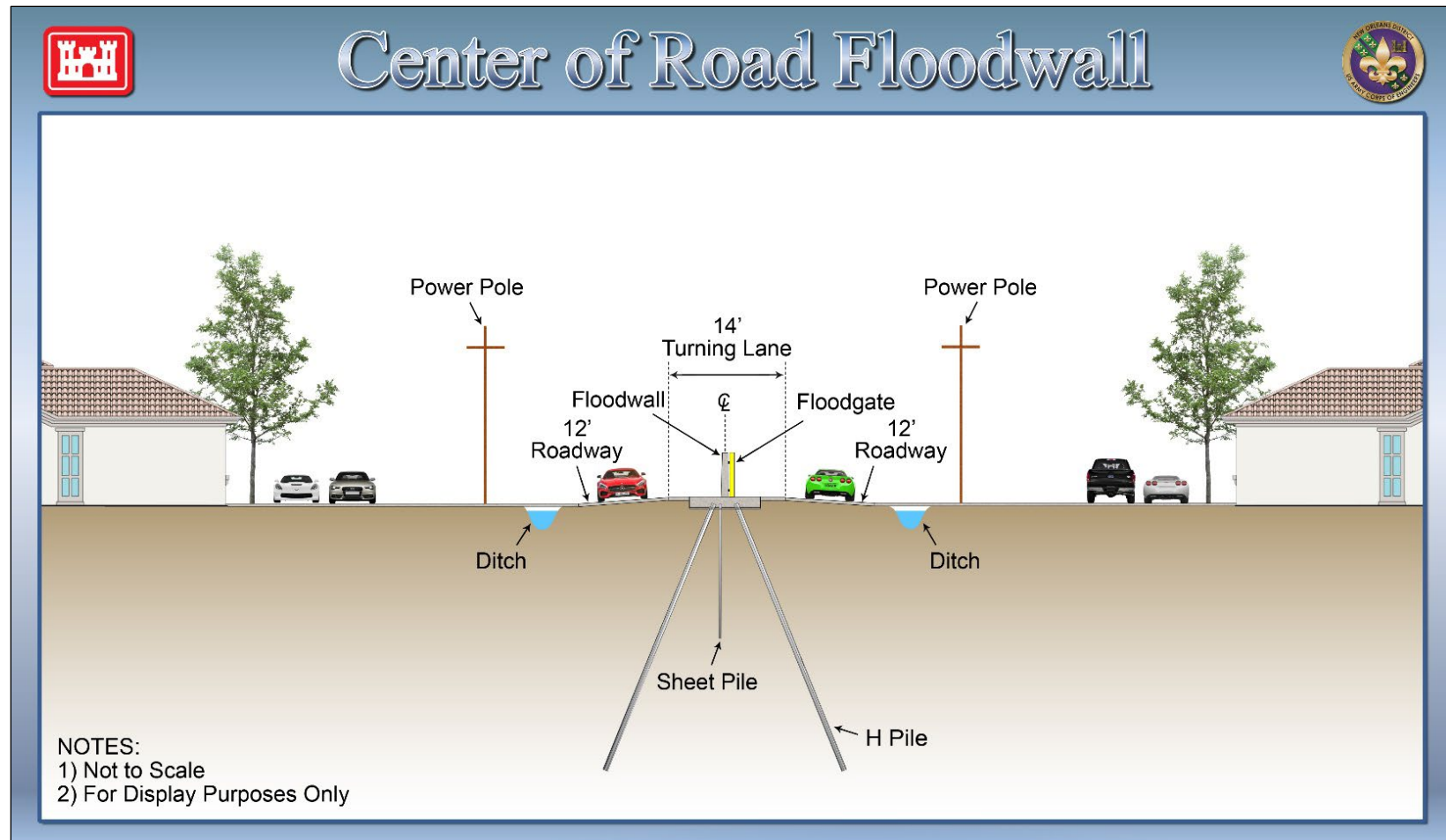


Figure 4-8. Visualization of a Typical Side View of Center of the Road Floodwall Along the Turning Lane (Center) of Military Road

4.4.1.3 Investigation Regarding a USACE Military Road Alignment (Screened)

In addition to the Military Road alignment proposed by stakeholders, CEMVN also investigated an alignment in the proximity of Military Road (USACE Military Road Alignment) to reduce concerns expressed by LA DOTD as described above. By moving the alignment to the side of the road, traffic issues would be minimized on the southern half of U.S. Highway 190. This USACE Military Road Alignment would provide risk reduction to the Cypress Cove Elementary school and the Honey Island Elementary school. The urban area to the north is so densely populated that the alignment was moved closer to Highway 190. The alignment would require a large number of vehicular gates and also create access issues for business and driveways. The number and size of the structures needed for this alignment and the urban environment location led the PDT to conclude that the alignment would not be practical, effective, or efficient. See Figure 4-9.

A post-and-panel style deployable floodwall system was considered for the approximately 2 mile reach of floodwall along Military Road. The stem system would only be in place during a high-water event. However, there many impracticalities associated with this option, including labor requirements, erection lead time, high maintenance, system width, and storage requirements. This system would also prevent emergency access from unprotected areas.

Any levee and floodwall alignment that traverses the existing right of way of a state and/or federal highway would require coordination between the appropriate state and federal agencies to determine the obligations for operation, maintenance, repairs, rehabilitation, replacement, inspections, repairs to the features of the Optimized TSP, flood-fighting and other similar concerns.

The USACE Military Road Alignment has similar impacts to the pine savanna/hardwood and wetland habitat as described under the Military Road alignment. Fragmentation of this habitat would result in impacts to terrestrial wildlife and avian species that require larger tracts of forested habitat to thrive.

The USACE Military Road alignment was considered impractical and screened out.

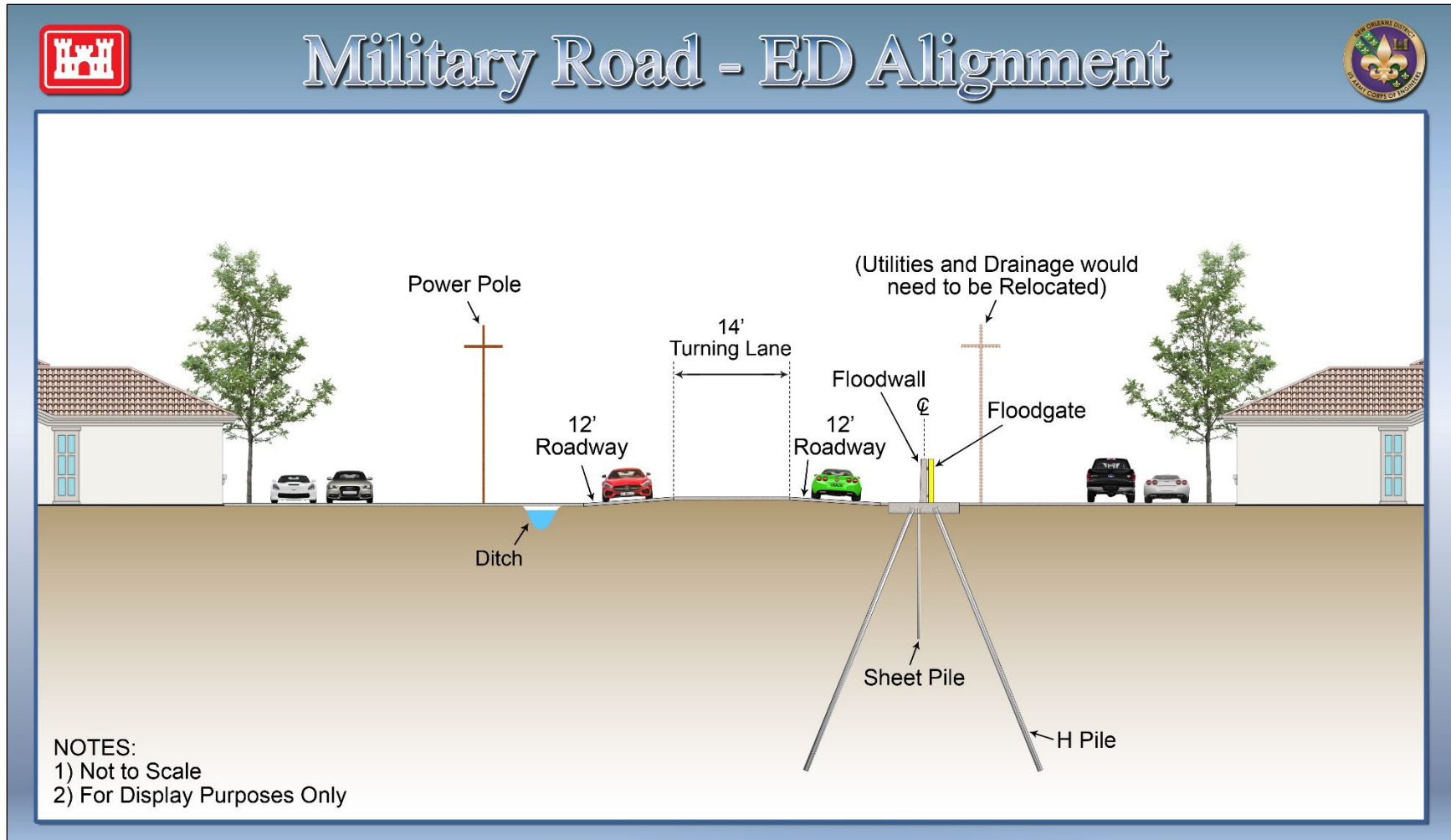


Figure 4-9. Visualization of USACE Military Road Alignment

Note: Each property would require a gate for access

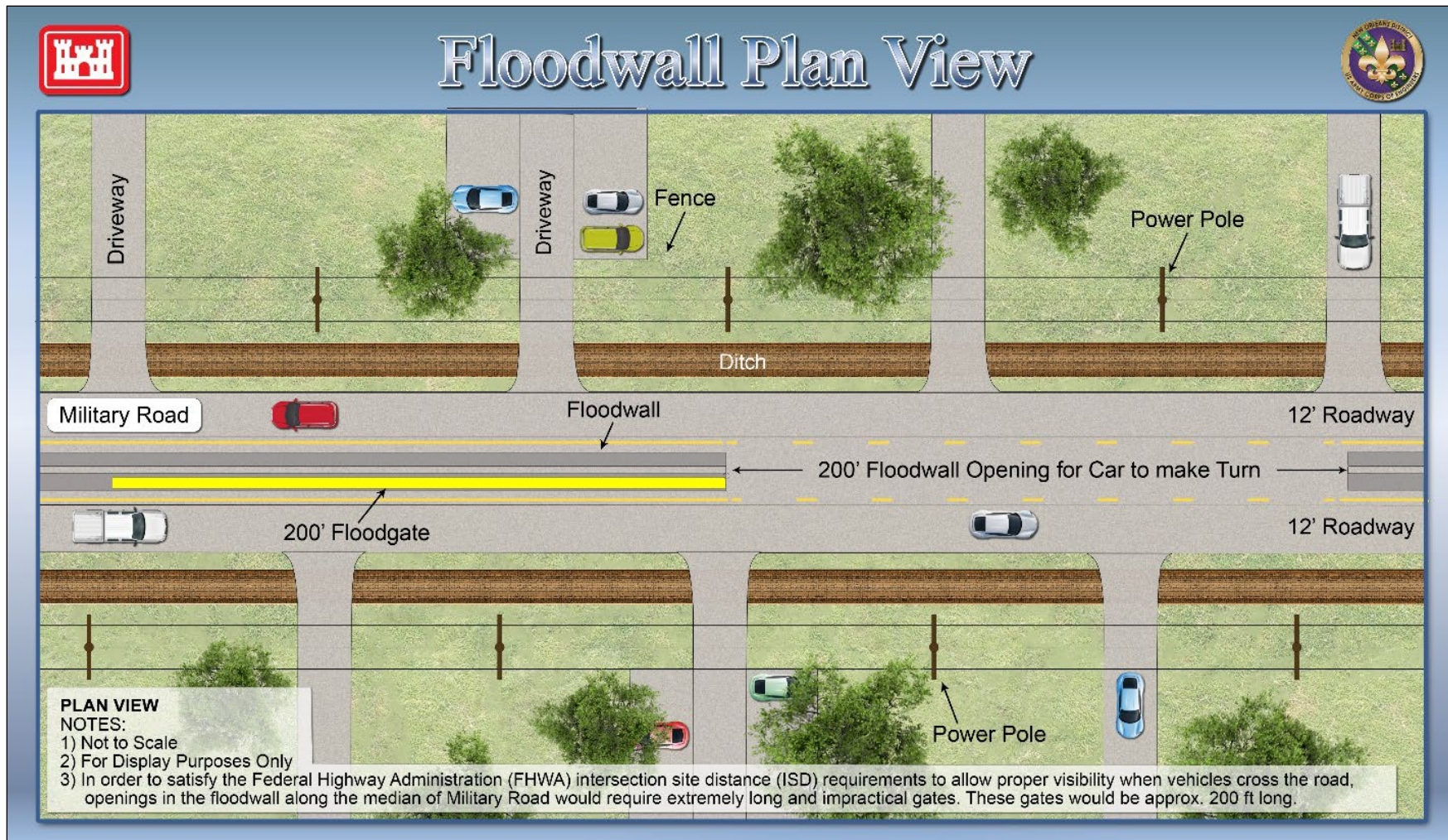


Figure 4-10. Visualization of a Typical Plan View of an Alignment Running Alongside of Military Road

4.4.1.4 Investigation Regarding East Slidell Utility Alignment (Screened)

Subsequent to the screening of the stakeholder proposed Military Road Alignment and USACE Military Road alignment, the PDT proposed an alignment on the eastside of Military Road (East Slidell Utility alignment) to incorporate the communities in the vicinity of Military Road and avoid the highway and densely populated areas. This alignment would provide risk reduction to more properties when compared to the Draft TSP and the other Military Road alignments. This is a densely populated area, with hundreds of homes that would be disturbed by the construction of a floodwall and other features. There is a significant safety risk with this alignment as communities closer to the Pearl River to the south and east of the alignment (flood side of the alignment) would not be able to evacuate when the floodgates are closed. Therefore, a bridge or ramp would be necessary to provide emergency access over a floodwall during a high-water event.

Any levee and floodwall alignment that traverses the existing right of way of a state and/or federal highway would require coordination between the appropriate state and federal agencies to determine the obligations for operation, maintenance, repairs, rehabilitation, replacement, inspections, repairs to the features of the Optimized TSP, flood-fighting and other similar concerns.

This East Slidell Utility alignment would traverse along the Pearl River resulting in impacts to bottomland hardwoods, wetlands, and adversely affect aquatic and terrestrial wildlife utilizing the habitat impacts requiring compensatory mitigation. Any impacts to the Pearl River are designated critical habitat for threatened Gulf sturgeon and would require Section 7 formal consultation.

The East Slidell Utility alignment was ultimately screened out due to the large construction cost and environmental impacts of an emergency access bridge or ramp.

Induced Flooding – All of the proposed Military Road alignments (Military Road and USACE Military Road alignments, and the East Side Utility Corridor alignment), are close to the Pearl River, which is a main source of flooding for St. Tammany Parish. The riverine inducements outside of the Draft TSP alignment would be greater for the Military Road variations when compared to the optimized alignment. Additionally, inducements on the flood side due to surge might be greater with all Military Road variations because they are in closer proximity to the source of surge (Gulf of Mexico and Lake Pontchartrain) than the eastern extent of the optimized alignment.

Relocations (electrical, water and sewage) – For all alignments including the Draft TSP and the alignment in the Optimized TSP, there would be potential complications with utilities due to the large number of structures; however, this was not a deciding factor in selection of the Optimized TSP.

Social Impacts – All alignments on the eastern end including the Draft TSP alignment and the alignment of the Optimized TSP, would have various degrees of social impacts associated with having an intrusive floodwall in the near vicinity of properties. Social impacts include, but are not limited to:

- Impacts from real estate buyouts affecting community cohesion;
- Increased safety risks from road closures, traffic delays, congestion, reduced visibility, and access;
- Ingress/Egress concerns resulting from numerous access gates;
- Impacts resulting from relocations of utilities;
- Noise impacts resulting from construction equipment.

Floodplain Impacts – The analysis showed that 75 percent of the structures in the communities to be protected by the Military Road alignment, the USACE Military Road alignment, the Draft TSP alignment, and the East Side Utility Corridor alignment are already outside of the 100-year floodplain and these alignments would not provide any extra flood risk reduction by being included in the structural plan. About 21 percent of structures within the 100-year floodplain elevation, and about 4 percent of structures are within the 50-year floodplain. These structures are included in the NS plan of the Draft TSP, Optimized TSP and RP.

Critical Infrastructure – Risk related critical infrastructure in the area including schools, hospital and electrical substations was identified and evaluated in connection with the proposed eastern end refinements. Three electrical substations and critical infrastructure in the area were examined to determine their floodplain elevation. The electrical substations would be included in the NFS and the USACE Military Road alignments and the East Side Utility Corridor alignment, but only one substation is incorporated into the Optimized TSP (two of the three substations are already elevated).

Cultural Resources – Potential impacts to cultural resources did not factor into the decision-making regarding these alignments since cultural resource surveys have not been conducted at this phase of the study.

Environmental Justice (EJ) – Figure 4-11 shows the Draft TSP alignment intersecting 16 census block groups, but in particular, six Census Block Groups that are considered areas of EJ concern; including Block Groups numbered 408062, 408063, 408064, 408072, 411061, 412133. Figure 4-11 also shows the location of the 18 residential structures that would be acquired, represented by a red dot. Four of the 18 residential structures potentially being acquired are in block group numbers 408062 and 408072, areas of EJ concern. The 14 other residential structures are in Block Groups that are not majority minority or low-income.

The USACE Military Road alignment, also passes through the same census block group (408062) just to the east of the Draft TSP alignment. Impacts to housing along this stretch of the Optimized TSP levee alignment appear minimal. Once the USACE Military Road alignment crosses U.S. Highway 190, there are no EJ communities of concern. It is expected that there would be more residential acquisitions along the Military Road alignments (north of U.S. Highway 190) compared to the Draft TSP, but in terms of EJ, these acquisitions are not in an area of EJ concern. Ultimately, the analysis showed that the Military Road alignments may have fewer impacts on EJ, but more potential impacts from housing acquisition. The Optimized TSP alignment is expected to require more mitigation for the potential impacts of residential acquisition.

Real Estate – For the Military Road and USACE Military Road alignments, it is anticipated that additional acquisition costs would be required for damages incurred at individual properties. The Military Road and USACE Military Road alignments and the Eastern Slidell Utility alignment, could result in the induced flooding of a large number of structures as a result of the implementation of the project. As a result, real estate acquisition costs and the number of properties to be included in the NS plan could increase significantly.

Principles and Guidelines (P&G) Criteria: Effectiveness, Efficiency, Completeness and Acceptability – The variations in alignments were considered using the P&G criteria. All of the alignments would be constructed in a densely populated urban area with major design, construction, operation and maintenance issues. The practicality, timeliness, and ability to successfully implement the project features in this setting, varies based on how densely populated the area along the alignment is. All of the alignments would require vehicular access gates, the number of which depending on the density of the structures.

The East Side Utility Corridor alignment is not acceptable due to the safety concerns related to the blockage of evacuation routes. The Military Road and USACE Military Road alignments are not acceptable due to safety and implementation concerns associated with this highway. Further, the Military Road alignments (stakeholder and USACE alignments, and the East Side Utility Corridor alignment) are not cost effective and are not efficient. There was a significant cost increase resulting from the shift in the alignment east to Military Road, thereby necessitating the construction of additional length of floodwall and ancillary engineering structures. Table 4-19 shows the number of water control structures and vehicular gates in the location where the Draft TSP and the optimized alignment split from the Kings Point levees, as compared with the Military Road and USACE Military Road alignments. The optimized alignment is less costly and requires five fewer water control structures and eight fewer vehicular gates than the Military Road and USACE Military Road alignments.

Table 4-19. Comparison of Structures–Military Road Alignments and the Draft and Optimized TSP Alignment

	Military Road Alignment	Military Road USACE MVN ED Alignment-	Portion of Draft TSP (Kings Point to USACE Eastern Terminus)	Portion of Optimized TSP (Kings Point to USACE Eastern Terminus)
Water control structures (sluice gate or lift gate)	8	9	2	4
Vehicular gates	14	15	5	7

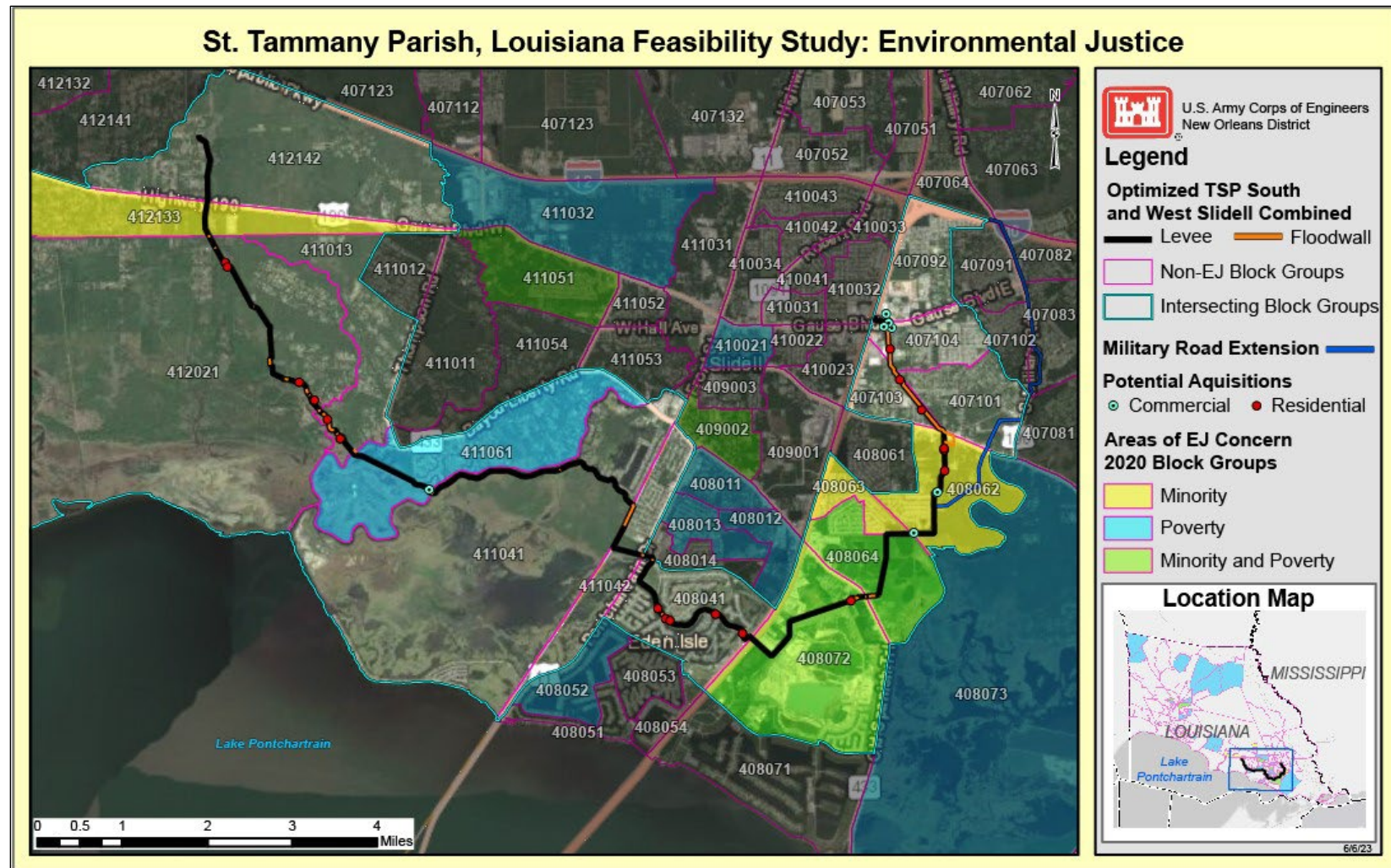


Figure 4-11. Census Block Groups along the South Slidell and West Slidell Alignments

4.4.1.5 Investigation Regarding Old Spanish Trail LA Highway 433 (Southeast) Communities (Screened)

The area depicted in Figure 4-12 was also investigated by the PDT to determine the benefits and impacts associated with including additional communities in the east of Old Spanish Trail. The potential extension was evaluated to determine what additional features would be needed and the potential benefits estimated. This alignment extension as shown in Figure 4-12 would require approximately 1.78 miles (9,400 feet) of alignment to be added to the system, it would also require a drainage gate to cross the Spanish Trail borrow canal to maintain hydraulic connectivity. No pumping is required for the system when it is closed at this location. The canal is fed predominantly by backflow from Lake Pontchartrain and overland flow from the northeast. Therefore, its flooding sources are cut off when the alignment is in place. This potential alignment also requires two lift gates: one at an existing ditch near Mayfair Drive and a second lift gate at a topographic depression near Lank Street.

This area was also evaluated to determine if there would be concerns regarding emergency evacuation with the potential extension. Mayfair Drive would be cut off from evacuation. Residences on LA Highway 433 South could evacuate to U.S. Highway 190 and to the I-10. In addition to the engineering aspects, moving the alignment from the location of the Draft TSP to include the extension around the neighborhoods would result in additional direct impacts to BLH forest and wetland habitat. The alignment would skirt along the BBMNWR property resulting in additional indirect impacts to refuge property. The potential for additional direct and indirect impacts would require additional compensatory mitigation. Potential impacts to cultural resources did not factor into the decision to eliminate this alignment since cultural resource surveys have not been conducted at this phase of the study.

The cost to extend the length of the levee and incorporate the necessary structures exceeds the estimated damages in this area. Incorporating an extension of the levee and floodwall system would not be efficient.

This alignment would also incorporate an EJ community into the protected side of the system, that is not included in the Draft TSP, thereby resulting in an additional benefit to this EJ community that is located to the south along Old Spanish Trail.

Although revising the levee alignment to incorporate the structures into the structural plan (West and South Slidell Levee and Floodwall System) was not cost-efficient, these areas were considered in the NS plan and those houses that would incur flooding in the 2 percent AEP event are included in the NS plan.

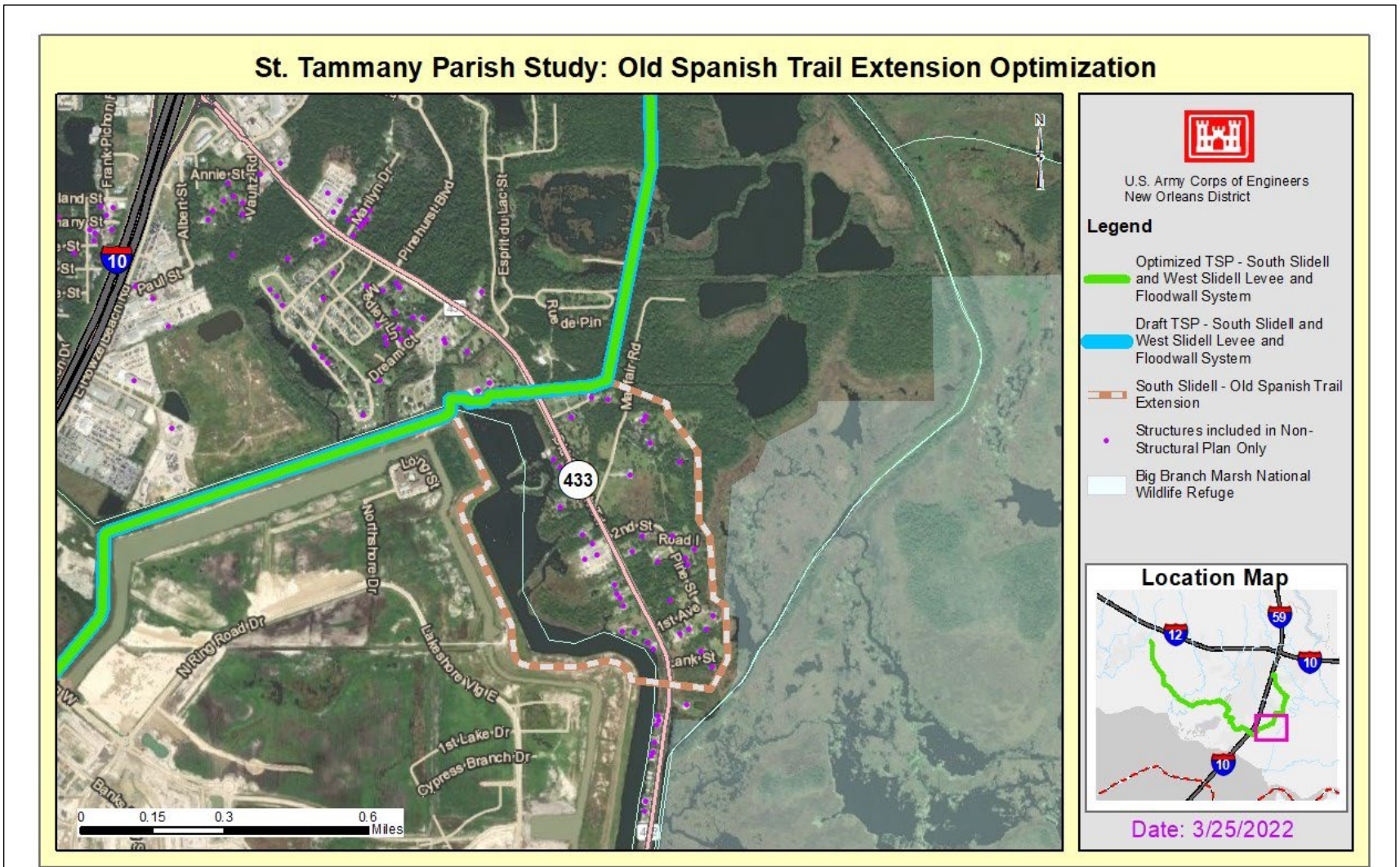


Figure 4-12. Alignment Considered during Optimization of the Old Spanish Trail Extension (Southeastern Portion of the Levee and Floodwall System)

4.4.1.6 Investigation Regarding Optimization of the Levee and Floodwall Alignment Based on Comments Received During the Public Comment Period on the DIFR and DEIS

Resource agencies expressed concerns over the proposed levee alignment in the BBMNWR and avoiding and minimizing impacts to wetlands. In coordination with the resource agencies, efforts were made to identify ways to avoid and minimize impacts to wetlands and pine savanna/pine hardwood habitat as well as refuge property. During the optimization and refinement of the Draft TSP, the PDT worked with the resource agencies to identify potential ways to avoid and minimize impacts to the BBMNWR from the Draft TSP footprint. Figure 4-13 illustrates the various alignment changes investigated along with the Draft TSP alignment (shown in solid blue) and the optimized alignment (shown in green) that was selected. The options explored to reduce impacts are described below.

4.4.1.7 Investigations into Proposed Bayou Paquet Road-Adopted

A few alignments changes were proposed in the vicinity of Bayou Paquet Road with the main purpose of avoiding impacts to the BBMNWR. See Figure 4-13.

4.4.1.8 Investigations into Proposed Bayou Paquet/Bayou Liberty Alignment (Dashed Blue Alignment) (Screened)

Changes in the alignment from the Draft TSP westward north of Bayou Paquet Road and south along Bayou Liberty were identified through H&H modeling to be more hydraulically efficient. The proposed changes to the Draft TSP alignment would reduce the need for two pump stations to only one pump station/floodgate complex which in turn, would reduce the construction, operation and maintenance costs and also cause less disruption to existing aquatic habitat. Although this change in the alignment would be more efficient, it would increase the direct footprint of the levee on BBMNWR beyond what was proposed in the Draft TSP. Therefore, these changes in the Draft TSP alignment were rejected due to these additional direct impacts on the BBMNWR. See Figure 4-13.

4.4.1.9 Alignment along Big Branch Marsh National Wildlife Refuge (BBMNWR)

To avoid impacts to the BBMNWR and reduce the number of required structures (i.e. pump stations etc.) required to construct along waterways, the Draft TSP alignment was moved further east thereby removing 0.1 miles (824 ft) of direct alignment along the boundaries of the BBMNWR and another 1.0 miles (5,280 feet) that ran along the border of the refuge. In addition to moving the footprint off and away from the BBMNWR, this optimized alignment resulted in the following benefits:

The Draft TSP alignment enclosed the waterways leading to Bayou Paquet, which disrupted floodplain connectivity for the small tributary to Bayou Liberty. Enclosure of the waterway could potentially increase flood risk because the reduction in floodplain area gives rainfall runoff less area to dissipate and causes water stages to increase in the remaining floodplain. The alignment change to the east minimized the enclosure of Bayou Paquet in the protected

side of the alignment. Furthermore, the Draft TSP necessitated two major pump station/floodgate complexes (at Bayou Liberty and at Bayou Paquet) that were very close to each other. There were concerns about high construction, operation and maintenance costs associated with this alignment. There were also concerns on how the operation of one pump station/floodgate complex would affect the other. The green alignment was incorporated into the Optimized TSP.

The Bayou Paquet sluice gate was changed in optimization to sector/navigable gate to not impact recreational navigation. The Optimized TSP alignment crosses Bayou Paquet at two different locations, whereas the previous alignment crossed the Bayou Paquet waterway at three different locations. Optimizing the alignment would lead to a reduction of one water control structures. The fewer waterway crossings also reduces disruption to existing aquatic habitat. Since the primary driver of the green Optimized TSP alignment (shown in Figure 4-13) was to keep the levee off of the BBMNWR, the alignment does not follow high ground and intersects low lying segments of the Bayou Paquet floodplain. Potential limited induced flooding is expected along the segments of low-lying terrain the green alignment intersects.

With this optimization focused on avoiding refuge impacts, there are eight structures that would be excluded from the levee and floodwall system which are represented with the purple dots in Figure 4-13. The removed structures would be considered eligible for participation in the NS feature of the Draft TSP.

Although these segments were not included in the Optimized TSP and the RP under this study authorization, they may be suitable for consideration for implementation by State or local government entities under non-federal authorizations or programs.

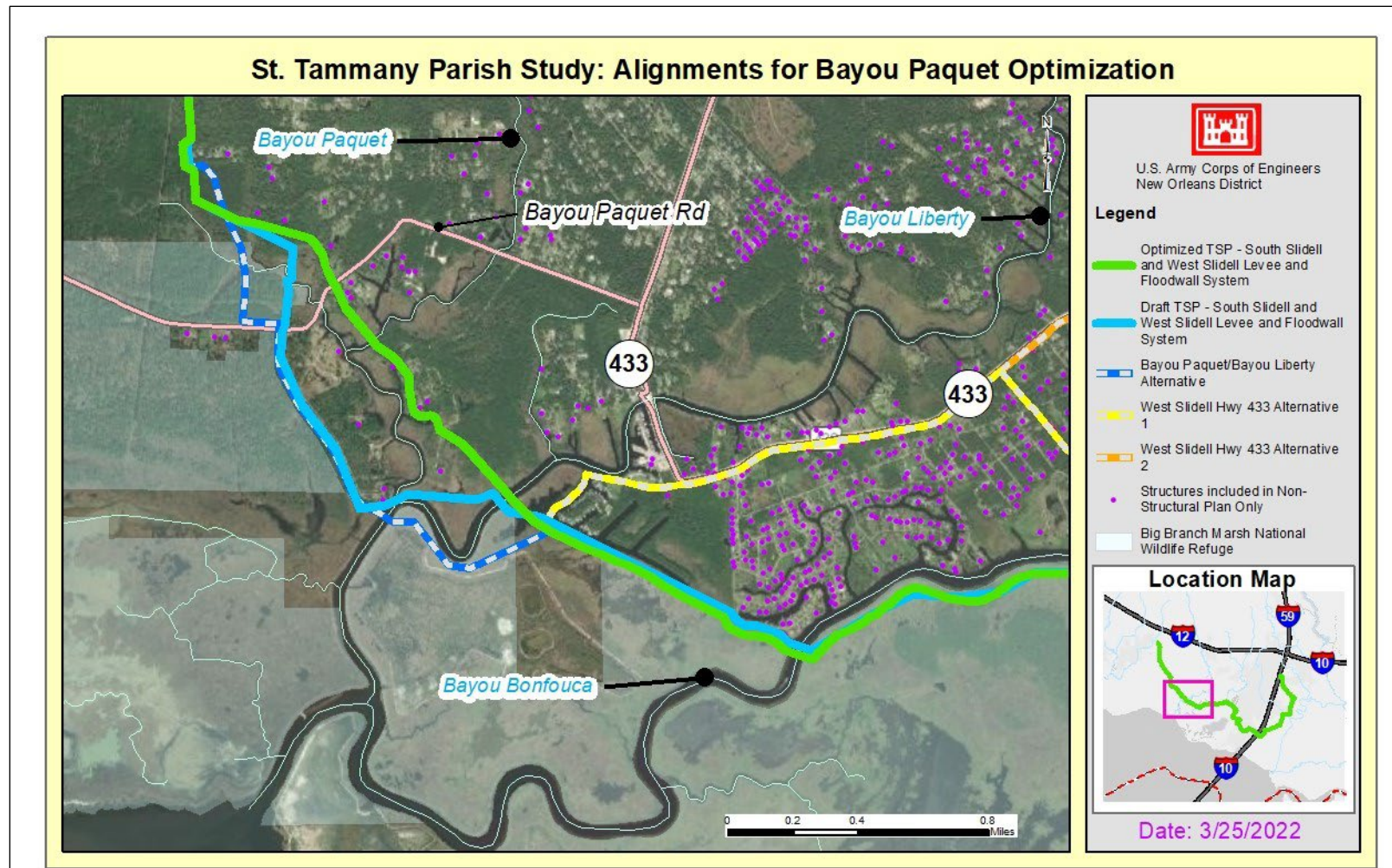


Figure 4-13. Alignment Variations Considered at Bayou Paquet

*4.4.1.10 Investigations into West Slidell LA Highway 433, Alignments 1 and 2
(Screened)*

To further avoid direct impacts to the BBMNWR, two additional alternatives (West Slidell LA Highway 433, Alignment 1 and Alignment 2) were considered to remove the levee and floodwall footprint from the BBMNWR. Refer to Figure 4-14 and the yellow and orange alignments in the proximity of LA Highway 433 in West Slidell. These alignment variations considered would require construction of features along the well-developed areas along LA Highway 433 necessitating access at each intersection of a driveway or road as illustrated in Figure 4-15. These potential adjustments were not adopted based on engineering and constructability considerations. The major factors considered are included below.

Levee and Floodwall Alignment – There were limited options for the alignment of the levee and floodwall system for either Alignment 1 or 2 along LA Highway 433. See Figure 4-16. There is insufficient highway right-of-way along LA Highway 433 for a levee without the need to purchase or significantly impact a large quantity of properties. (An example of significant impact: a levee in someone's front yard whose driveway must be realigned to go over the levee and back onto LA Highway 433). The lack of available space would require construction of a floodwall rather than a levee. The floodwall would have a higher cost per liner foot than a levee.

The alignment of a floodwall system along LA Highway 433 was also considered. A floodwall in the middle of the road cuts off visibility entirely traveling along LA Highway 433. It would require extremely long (roller or swing gates more than 100 feet wide) and impractical sizes for gates. These gates would be needed to satisfy Federal Highway Administration (FHWA) intersection sight distance requirements to allow proper visibility when a vehicle is crossing the road. Larger gates are not practical from a cost, construction, safety, and operation and maintenance perspective. CEMVN coordinated with LA DOTD for feedback on traffic and other transportation challenges related to the potential alignment.

A floodwall on either side of the road is not practical. This alignment would need smaller openings when compared with a floodwall in the middle of the road but would prevent access to properties in the neighborhood for emergencies. Such an alignment would create potential safety issues for storm events. Once the floodgates are closed, people would not be able to evacuate. This safety issue removed this from further consideration. If a floodwall was constructed on the south side of the LA Highway 433, the property owners would not have risk reduction in place but would have to cede property for construction purposes.

Constructing a road on top of levee was also considered and determined not to be a practical choice for an alignment. Access gates or ramps would be required at each driveway and roadway to complete the system.

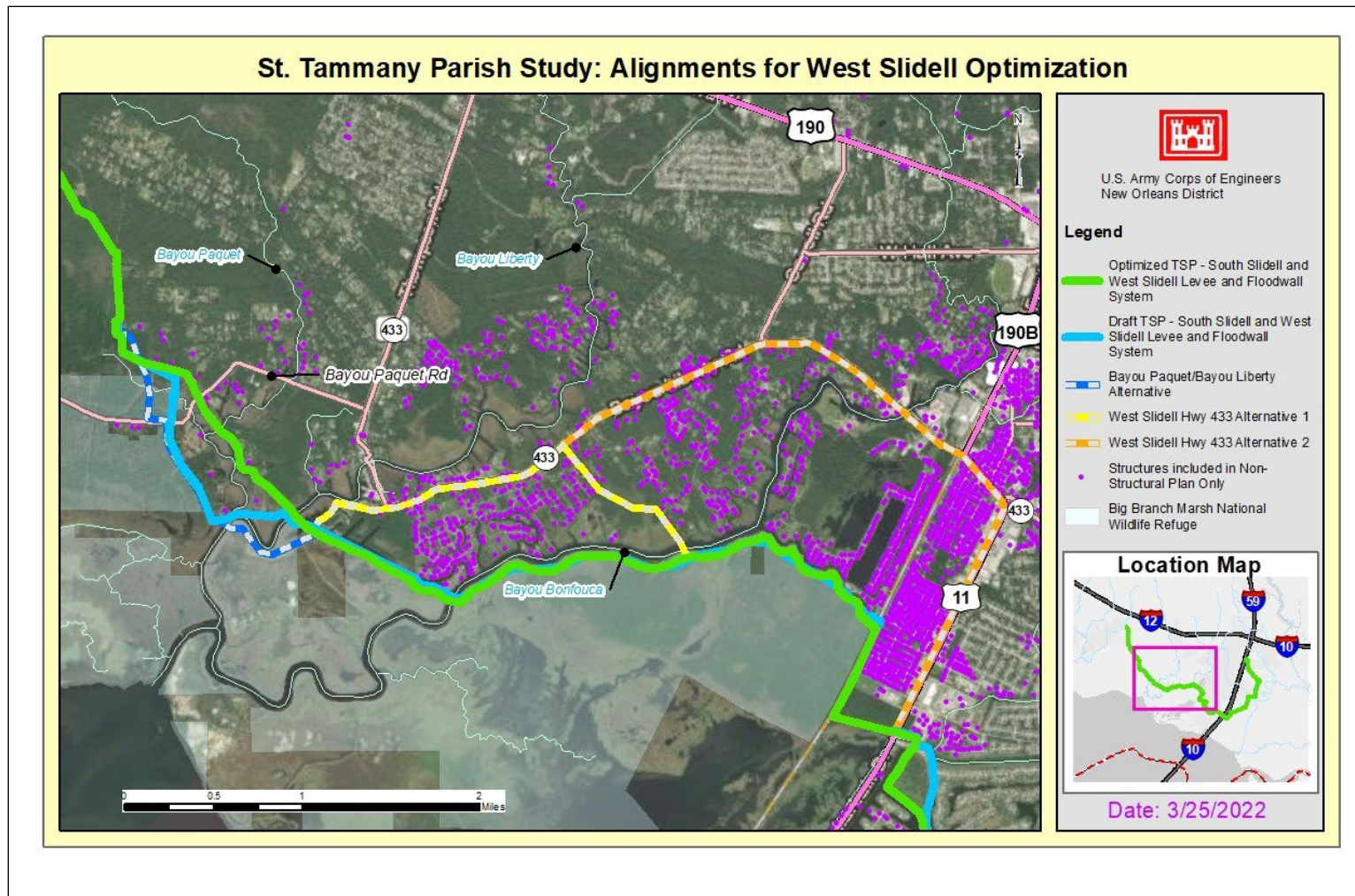


Figure 4-14. Alignments Considered during Optimization in West Slidell for the Levee and Floodwall System

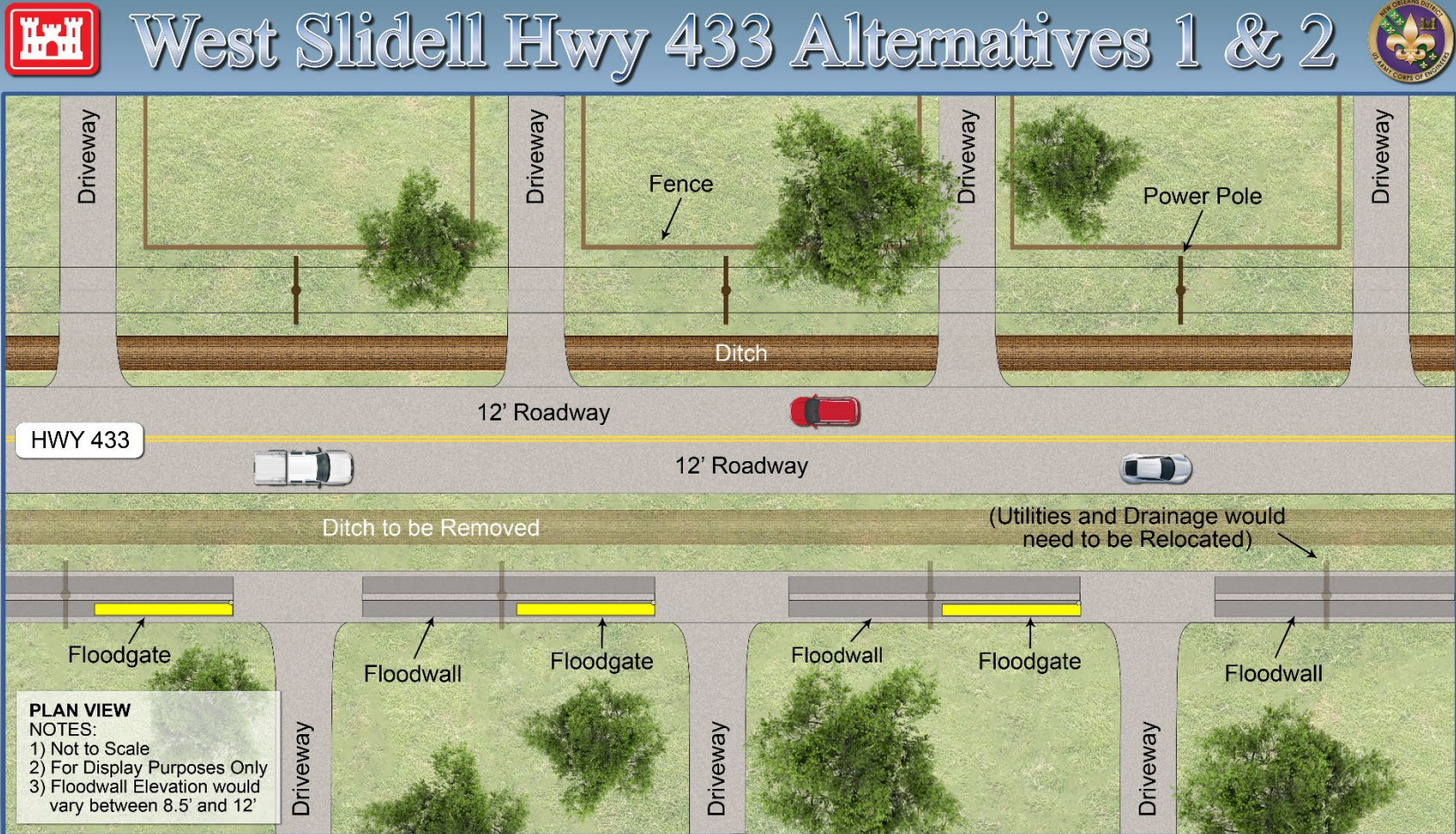


Figure 4-15. Visualization of a Typical Plan View of an Alignment Running on the side of LA Highway 433



West Slidell Hwy 433 Alternatives 1 & 2

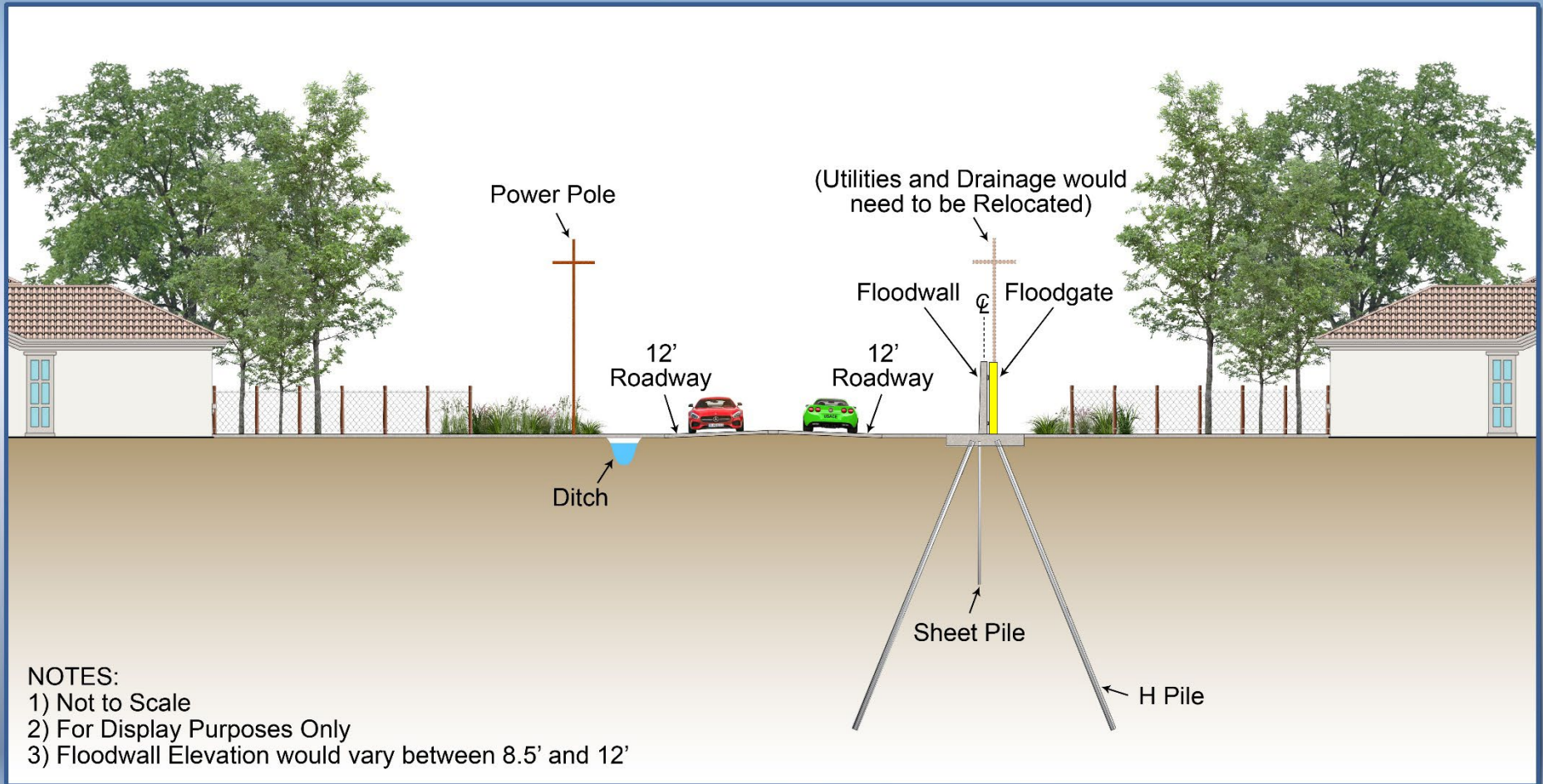


Figure 4-16. Visualization of a Typical Plan View of an Alignment Running on the side of LA Highway 433

Note: Each property would require a gate for access

Engineering Features

West Slidell LA Highway 433, Alignment 1 (yellow and white alignment) – Analysis shows that if a floodwall was placed on the south side of LA Highway 433, additional structures would be needed. These structures would be as follows: seven vehicular gates for road access and eight driveways that would need vehicular access. If the wall was placed on the north side of LA Highway 433, there would be additional road gates and access to driveways needed. West Slidell LA Highway 433, Alignment 2 (orange and white alignment) – Preliminary analysis shows that if a floodwall was placed on the south side of LA Highway 433, additional structures would be needed. These structures would be as follows: 36 road gates and 81 driveways that would need access. If the wall was placed on the north side of LA Highway 433, there would be additional road gates needed.

Induced Flooding – Both West Slidell Alignments 1 and 2 are located in close proximity to structures on the flood side, whereas the Optimized TSP alignment does not have urban development located on the flood side. Using best engineering judgement, it was presumed that the West Slidell LA Highway 433, Alignments 1 and 2 would likely cause inducements on the flood side of the alignment directly impacting properties outside of the risk reduction features.

Relocations (electrical, water and sewage) – For both West Slidell Alignments 1 and 2, considered it is expected that there are potential complications with utilities due to the large number of structures.

Social Impacts – Social and Economic Concerns include impacts from real estate buyouts disrupting community cohesion. Increased safety risks resulting from road closures, traffic delays, congestion, reduced visibility during construction as well as egress concerns resulting from the numerous rollover gates across driveways/access points. There would be disruption to daily lives resulting from impacts of utility relocations.

HTRW – There would be an increase in HTRW concerns with these two alignments since they would both be constructed in a heavily developed area.

Cultural Resources – Potential impacts to cultural resources did not factor into the decision to eliminate these alignments since cultural resource surveys have not been conducted at this phase of the study.

Economic Analysis – The West Slidell LA Highway 433, Alignment 2 would remove approximately 1,000 structures from the protection of the levee and floodwall risk reduction system. These structures are depicted by purple dots in Figure 4-14. This would equate to approximately 10 percent of the benefits being removed from the entire levee and floodwall alignment. The removed structures would be considered eligible for participation in the NS plan feature of the Draft TSP.

Environmental Justice – Moving the Draft TSP alignment north along LA Highway 433 would exclude more residential structures on the unprotected side of the system. Even though this area is not an EJ concern, it is likely that there are smaller pockets of EJ

households that would be included, but this is not a disproportionate impact since non-EJ households would be exposed too. The community just north of LA Highway 433 is an area of EJ concern (poverty) and would likely feel construction impacts which would be require mitigation through best management practices (BMP).

Real Estate – Adoption of the West Slidell LA Hwy 433, Alternatives 1 and 2 could result in induced flooding of a large number of structures. This would result in a significant increase in properties to be included in the NS plan, and potential buyouts when induced flooding results in a complete taking. Costs for real estate acquisitions would increase significantly with these two alternatives. Additionally, the eastern end of Alternative 2 would impact properties along Pontchartrain Drive, a large commercial corridor. Real estate cost estimates were not prepared as a part of the analysis of these alternatives, but it is anticipated that the increase in cost for acquisition of LER would be significant.

P&G Criteria: Effectiveness, Efficiency, Completeness and Acceptability – The West Slidell LA Hwy 433, Alternatives 1 and 2 variations were considered under the context of the P&G criteria and in light of the fact that construction would take place in a community that is densely populated presenting design, construction, and operation and maintenance concerns. These two alignments would require gates to allow access and the number of gates depends on the number of properties.

The West Slidell LA Highway 433, Alignments 1 and 2 are not acceptable due to the safety concerns with the alignments blocking evacuation routes. These two alignments also carry a high risk of not being cost effective due to the significant cost increase from levee to floodwall along with the anticipated large number of access gates and RE acquisitions required. Both of the West Slidell LA Highway 433 alignments have constructability, engineering concerns, and would exclude up to 1,000 structures at a high risk for induced flooding. These two alignments are also at high risk for not being efficient as compared to the Optimized TSP and, as a result, both were screened from consideration.

Although these segments were not selected as the Optimized TSP or RP under this study authorization, they may be suitable for consideration for implementation under other non-federal authorizations or programs.

Second Iteration of PDT Investigations into East Slidell Terminus of the West and South Slidell Levee and Floodwall System

After the initial investigation into the West and South Slidell Levee and Floodwall System in 2022, the PDT received additional comments in 2023 from stakeholders requesting further consideration of the East Slidell alignment options as a comprehensive alternative rather than an increment. As noted in the sections (4.4.2.1.2-4.4.2.1.4) above, the PDT looked at three alignments in the Military Road area as increments (shown in Figure 4-7). Continued evaluation and screening was done on these alignments and found to not be incrementally justified produced fewer net benefits and demonstrated potential for significant constructability issues and increased mitigation costs, which would further reduce the net benefits.

To address the additional stakeholder comments, the PDT considered the Military Road alignment (shown on Figure 4-7) and a combination of the Military Road Alignment and East Slidell Utility Corridor Alignment as alternative end reaches. The combination alternative is referred to as the East Slidell Alignment as shown on Figure 4-17. For the second iteration, the PDT used the results of the initial investigations for these alignments and the costs developed for the Draft TSP. An economic analysis was conducted to determine the additional damage reduction benefits each alignment would incorporate and the cost that the alternative construction could support. The Military Road alignment could support approximately \$230 million in construction costs with the additional damage reduction benefits provided. The East Slidell could support approximately \$250 million in additional construction costs. The estimated construction cost of the levee and floodwall alignment incorporating Military Road and the East Slidell segments were both above the estimated additional costs and both were thus confirmed not to be the NED plan.

The East Slidell Alignment had a BCR greater than 1, but had lower net benefits than the Optimized TSP. The East Slidell Alignment also carries greater risks related to cost increases due to the constructability along the development and wetland interface, and its required mitigation costs in comparison to the Optimized TSP.

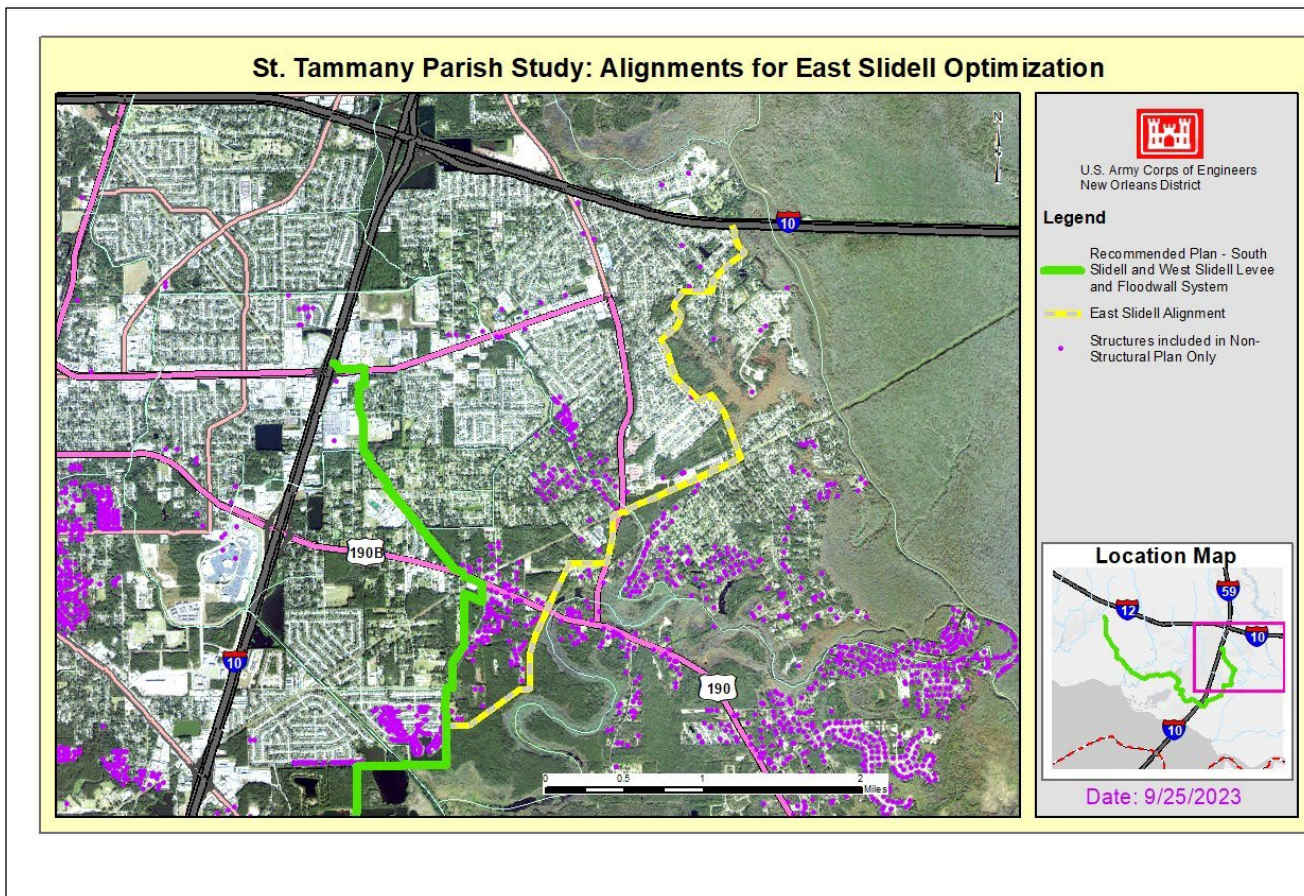


Figure 4-17. Comparison of Optimized and East Slidell Alignment

Per ER 1105-2-100 the NED plan recommending federal action is to be the alternative plan with the greatest net economic benefit consistent with protecting the Nation's environment, which remains the Optimized TSP. Although these segments were not selected as the NED plan under this study authorization, they may be suitable for consideration for implementation by state or local government entities under non-federal authorizations or programs.

Table 4-20 gives a summary of the potential increase in risk associated with the various alignments investigated in Section 4.4 as compared to the Optimized TSP alignment.

Table 4-20. Summary of the Potential Increased Risk Associated with the Alignment Shifts Investigation as Compared to the Optimized TSP Alignment

	Increased Risk related to Constructability and Practicality Concerns	Increased Safety Risk	Increased Flood Risk	Increased Risk for Habitat and Species Impacts	Increased Risk for Relocations	Increased Risk for EJ	Increased Risk for Cultural Resources	Increased Risk to Violate Effectiveness Criteria	Increased Risk to Violate Efficiency Criteria	Increased Risk to Violate Completeness Criteria	Increased Risk to Violate Acceptability Criteria	Additional length required for floodwall and levee system	Increased Engineering Structures required	Increased RE Acquisitions	Increased environmental mitigation cost	Status
Military Road NFS Alignment	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Screened
Military Road CEMVN ED Alignment	Yes	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Screened
East Slidell Alignment (as shown in Figure 13)	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Screened
Eastern Slidell Utility Alignment	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Screened
Spanish Trail Extension	No	No	No	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Screened
Bayou Paquet/Bayou Liberty CEMVN ED Alignment	No	No	No	Yes	No	No	No	No	No	No	Yes	No	No	No	Yes	Screened
West Slidell Alignment 1	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	No	No	Yes	Yes	No	Screened
West Slidell Alignment 2	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	No	Yes	Yes	Yes	No	Screened
Alignment along BBMNWR	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	Adopted and incorporated into the Optimized TSP/RP

Subsequent to the release of the DIFR-EIS, the PDT conducted additional engineering, economic, and environmental investigations on the separate measures of the Draft TSP. Information gathered through these additional investigations, together with the consideration of comments received from the public, stakeholders, the USFWS and the NMFS assisted in further refining the design of the Draft TSP. The following items were investigated in optimizing the Draft TSP:

1. Optimization based on Feasibility level of Design.
 - a. Revisions based on Future with Project modeling included.
 - i. changes to minimize induced flooding.
 - ii. identification of hydraulic efficiencies.
 - iii. adjustment to tie-in locations and heights.
 - iv. refinement of locations, capacities and dimensions of various structures (i.e., gates, pump stations, etc.). including optimization of structures to meet/not restrict current navigational flow. The 10-year frequency event was selected as the feasibility study interior rainfall design event because at the time of the analysis the existing St. Tammany Parish drainage was functioning at a 10-year level of capacity and interior drainage systems for leveed systems in Southeast Louisiana are typically designed to convey the 10-year event during tropical storms which require closing of the surge protection system. The interior drainage design recurrence interval was determined based on historical observations and practice and not based on probability of occurrence of coincident hydrologic interior and exterior conditions to be consistent with current best practices.
 - b. Refinements to incorporate critical infrastructures.
 - c. Real Estate refinements to the levee and floodwall alignment to avoid impacts to roads and structures.
 - d. Investigations into elevating road surface of the I-10 to ramp over the new levee section and stay above the hydraulic design elevation for year 2082.
2. Optimization of the levee and floodwall alignment based on comments received during the Public Comment period on the DIFR-EIS.
 - a. Investigations regarding Military Road (eastern portion of Draft TSP alignment).
 - b. Investigations regarding Old Spanish Trail/LA Highway 433 (southeast portion of Draft TSP alignment).
3. Optimization of the levee and floodwall alignment to avoid, minimize, and reduce impacts to BBMNWR.
 - a. Investigations to avoid, minimize, and reduce impacts to BBMNWR near Bayou Paquet Road.
 - b. Investigations to avoid, minimize, and reduce impacts to BBMNWR near LA Highway 433 (West Slidell).
4. Additional investigations into East Slidell terminus of the West and South Slidell Levee and Floodwall System.

The Notice of Availability for the DIFR-EIS was published in the Federal Register on 11 June 2021, initiating the 45-day public review period for the study. The comment period closed on 26 July 2021. During the comment period, members of the public raised questions and concerns regarding the sections of the levee and floodwall alignment, including the Military Road and Old Spanish Trail/LA Highway 433 locations. Many residents who lived in communities outside of the proposed levee and floodwall alignment, questioned why their neighborhoods had been excluded from the alignment and requested that the USACE reconsider the alignment to incorporate additional structures within the area to receive risk reduction. The PDT evaluated potential incremental adjustments to the alignment to incorporate the communities along Military Road and Old Spanish Trail/ LA Highway 433. The additional investigations revealed that shifts or adjustments to the alignment (to include these areas) would not provide effective or efficient benefits. Furthermore, many of the variations in the alignment which were the subject of these additional investigations, also had adverse environmental, social or real estate impacts and therefore, these variations in the alignment were screened from further consideration. Also, although certain structures remain outside the levee and floodwall system, these structures were considered for eligibility in the NS plan. Structures that would incur flooding in the 1 percent, 2 percent and 4 percent event are included in the NS plan based on subaggregation that was completed during feasibility level design.

4.4.2 FRM Measure- Formulation of an Optimized Mile Branch Channel Improvements Measure (after the release of the DIFR-EIS and prior to the release of the RDIFR)

The Mile Branch Channel Improvements Measure was optimized after the release of the DIFR-EIS and therefore represents another difference between the Draft TSP and the Optimized TSP. Subsequent to the release of the DIFR-EIS in June 2021, the PDT conducted further analysis of the Mile Branch Channel Improvements Measure of the Draft TSP, including the refinement of the PDT's assumptions and analysis for the replacement of bridges required for this Measure. The DIFR-EIS contained an assumption that there is no existing bridge to connect both sides of the Mile Branch Channel on W. 18th Avenue in Covington and as such, the W. 18th Avenue bridge was eliminated as a required bridge replacement. It was identified that there is a pedestrian bridge (part of Tammany Trace Bike Trail) on W. 27th Avenue that crosses the Mile Branch. This location was added as a potential bridge replacement.

Refinements were conducted to the ROW assumptions for the channel improvements, which included identifying staging areas and assuming that one of the staging areas would become a stream mitigation area after project completion. Information on the existing utilities for Mile Branch was received from the NFS, which was used to perform analysis and provide assumptions for disposition of the relocations to include in the cost effort. Table 4-21 shows a comparison between the Draft TSP and Optimized TSP Mile Branch Channel Improvements.

Table 4-21. Comparison of Mile Branch Channel Improvements Measure in Draft TSP and Optimized TSP

Attribute	Mile Branch Channel Improvements Draft TSP 2021	Mile Branch Channel Improvements Optimized TSP 2023
Total Length of improvements	2.15 miles (11,341 feet)	2.15 miles (11,341 feet)
Material to be Mechanically Dredged	130,000 cubic yards	130,000 cubic yards
Access Roads for both clearing and for bridge replacement	0	0
Number of staging areas for clearing and grubbing and mechanical dredging and for bridge replacement	Not developed for clearing and grubbing, 7 for bridge replacements.	18 (7 for bridge replacements, 10 for clear and grubbing and mechanical dredging and one that becomes a backwater area)
Number of Bridge Replacements of Culverts	7	7
Temporary ROW	34 acres for clear and grubbing and mechanical dredging	7.3 acres (2.2 acres for bridge replacements and 5.1 acres for clear and grubbing and mechanical dredging)
Permanent ROW	None developed at the time of the Draft TSP	38.8 acres (34 acres for clear and grubbing and mechanical dredging and 4.8 acres for one staging area that becomes a backwater area)

4.4.3 FRM Measure-Bayou Patassat Clearing and Snagging

During refinement and optimization of this measure, additional HEC-RAS H&H modeling was conducted, and it was determined that the clearing and snagging of Bayou Patassat would not be effective in reducing water surface elevations and reducing flood damages. An updated economic analysis of the measure yielded a BCR of 0.5. As a result, the measure was removed as part of the Optimized TSP.

4.4.4 NS Measure- Refinement and Optimization

The NS measures, reduce flood damages without significantly altering the nature or extent of flooding. Damage reduction from NS measures is accomplished by changing the use of the floodplains, or by accommodating existing uses to the flood hazard. NS measures differ from structural measures in that they focus on reducing the consequence of flooding for a specific structure rather than reducing the probability of flooding in that area (for example elevating a structure in an area that is flooded to reduce damages rather than reducing the flooding source). A combined structural and NS measure based was retained and included in the Draft TSP presented in the DIFR-EIS. The Draft TSP included floodproofing and structure raising to reduce damages from the flood hazard were considered for the entire parish in areas of documented flood damage.

During feasibility level of design, the NS feature of the Draft TSP was further examined and divided into 20 sub-aggregates based on combinations of structures that had the same source of flooding and community characteristics. See Table 4-22 and Figure 4-18. This included consideration of underserved communities as identified by the Justice 40 criteria.

An incremental floodplain or flood frequency analysis was then conducted for each of the 20 developed aggregates. The results showed that 16 of the 20 aggregates were economically justified up to the 4 percent (25 year) AEP Floodplain (Table 4-22), Coastal Slidell was economically justified up to the 2 percent (50 year) AEP Floodplain and coastal Lacombe, coastal Mandeville, and coastal Madisonville were economically justified up to the 1 percent (100 year) floodplain. The Optimized NS Plan includes 6,684 structures that would reduce flood risk and coastal storm damage to structures that are not included in the areas benefitted from the structural measures. A depiction of the structures included in the NS plan are included in Figure 4-18.

Nonstructural measures considered included acquisitions, flood proofing, relocations, and structure raising. In the early phases of the study, elevations and floodproofing were evaluated based on existing cost information to develop the cost estimates for the nonstructural measures during the analysis of the final array of alternatives, since elevations and floodproofing were considered the most cost effective based on earlier USACE study analysis in South Louisiana at that time (Southwest Coastal Storm Risk Management Project).

During feasibility level of design this assumption was revisited and confirmed by more recent USACE analysis conducted under the Amite River and Tributaries Feasibility Study and the South Central Coastal Studies in which acquisitions and relocations were further confirmed not to be cost effective for implementation in south Louisiana.

Secondly, no individual subaggregates were identified during the logical aggregation method for relocation and buyouts. As part of optimization the study area was subaggregated into 20 subaggregates based on combinations of structures that had the same source of flooding and community characteristics based on USACE policies and guidance using the USACE logical aggregation method (vs a structure by structure analysis). Each subaggregate was evaluated and no individual entire subaggregates were identified as efficient for relocation or acquisitions since an entire subaggregate would have to be acquired or relocated rather than just select structures. This was another supporting factor to move forward with a plan to implement voluntary elevations and floodproofing beyond not being cost effective.

Furthermore, a 100 percent voluntary participation plan for acquisition and relocation is not considered a complete plan and is not acceptable for USACE participation (ER 1105-2-103). The NFS does not support a plan that mandates the acquisition and permanent evacuation of private property from the study area floodplain as a nonstructural measure.

Table 4-22. Aggregate Name and Floodplain

Aggregate Name	Percent AEP Floodplain
Abita River Rural	4%
Bayou Castine	4%
Bayou Chinchuba	4%
Bogue Chitto River	4%
Lacombe Bayou	4%
Rural Bogue Falaya	4%
Rural Little Bogue Falaya	4%
Rural Pearl River	4%
Rural Tchefuncte	4%
Tchefuncte	4%
Urban Abita River	4%
Urban Bogue Falaya	4%
Urban Little Bogue Falaya	4%
Urban Pearl River	4%
Urban Tchefuncte	4%
Western Tchefuncte	4%
Coastal Slidell	2%
Lacombe Coastal	1%
Coastal Mandeville	1%
Coastal Madisonville	1%

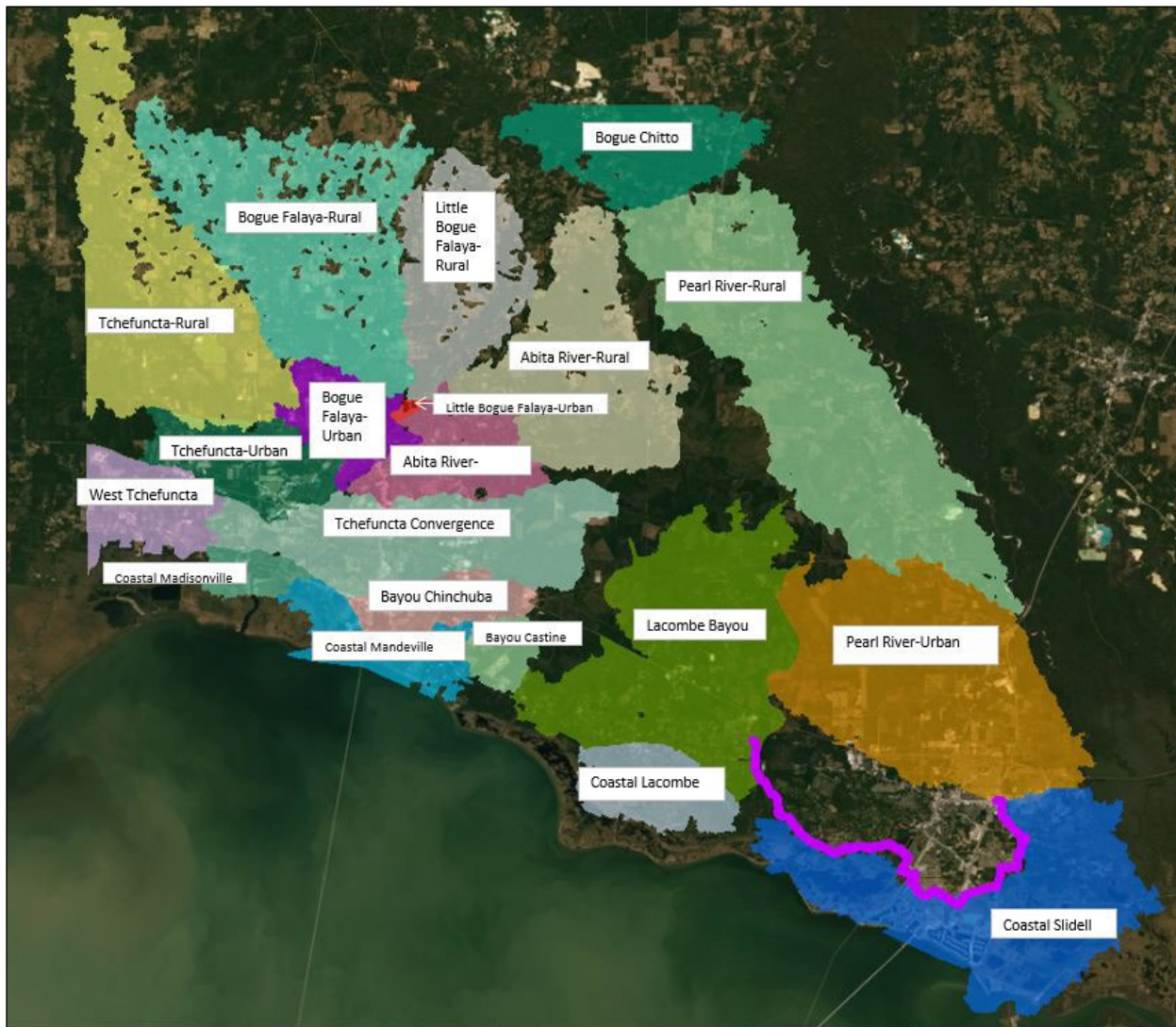


Figure 4-18. NS Sub Aggregates

4.4.5 Revised Optimized TSP Cost Estimates

Between the release of the DIFR-EIS and the preparation of the RDIFR-EIS, the PDT further investigated and refined the total project first costs and estimated annual costs for the measures in the Optimized TSP. The cost estimates include planning, engineering and design, construction, construction management, real estate, and environmental and cultural mitigation costs, all of which include contingencies. Refer to Appendix D: Engineering for Cost Annexes 8-11 and Table 4-24.

This analysis led to the formulation of the Optimized TSP, which was summarized in the RDIFR as including the West and South Slidell Levee and Floodwall System, the Mile Branch Channel Improvements Measure, and the NS plan, which consists of elevating 5,583 residential structures not to exceed 13 feet above the existing grade and dry floodproofing of

827 nonresidential structures up to 3 feet. Each measure is economically justified and contributes to the overall net benefits of the Optimized TSP plan, which has an overall benefit to cost ratio of 2.4 (shown in Table 4-24).

A revised construction schedule was developed for the Optimized TSP. For the NS component, construction would occur from 2025-2037. For the levee and floodwall system, construction would occur from 2025-2076. Additional levee lifts would occur three times post initial construction at 5-7 years, 15-20 years, and 30 years. For the Mile Branch Channel Improvements Measure, construction would occur from 2025-2032. The first levee lifts would be overbuilt and allowed to settle for several years before the later levee lifts are constructed. Assumptions regarding scope of subsurface investigations for the study may be underestimated due to the lack of subsurface investigations available. The current assumptions for levee are based on typical sections. During PED, design would consider potential stability or seepage berms, geotextile reinforcement, and/or ground improvements, which may need additional real estate procurement. The design life of hydraulic steel structures is 100 years which applies to the pump stations and gates for this study. The design of hydraulic steel structures would follow ETL 1110-2-584.

Structural feature costs for the West and South Slidell Levee and Floodwall System were updated based on the refined engineering design and quantities developed for the Optimized TSP. Specific changes were previously described in 4.4.1 and 4.4.2.

Mitigation costs due to unavoidable habitat impacts were calculated for the impacted habitats. Professional judgment and experience with similar structural systems, and engineering assumptions of right-of-way (ROW) footprints were also used to aid in development of the mitigation costs. Mitigation cost estimate estimates for the RP can be found in Section 7 and in Appendix I: Mitigation Plan.

Real estate costs were updated based on the revised acreages of the Optimized TSP and the estimated number of affected ownerships, available sales data was utilized to estimate the values of the real property rights required for the structural features of the project, including damages to remainder properties (if any) in partial acquisitions, the estimated values of any affected improvements, residential and non-residential relocations, and acquisition and administrative costs. The estimated damages account for compensable diminutions in the fair market values of remainder properties caused by the Government's acquisition of the affected ownerships. For the non-structural features, the associated acquisition, administrative, and residential relocation costs were revised based on the revised estimate of the number of eligible structures. Further information on the development of the real estate is contained in Appendix G: Real Estate Plan.

For the structural measure, cultural archaeology survey is estimated at \$382.03 per acre and mitigation assumes 10 percent surveyed is NRHP eligible. Architectural survey is \$589.90 per built resource located within the project footprint. Architectural mitigation assumes 10 percent surveyed is NRHP eligible. Borrow survey is estimated to be \$598.66 per acre.

NS costs were revised due to real estate and cultural updates. Cultural NS costs were developed by using archaeological/architectural survey is \$1769.00 per structure (6,410). Archaeological mitigation assumes 10 percent surveyed is NRHP eligible. The architectural mitigation assumes mitigation can be grouped into historic areas within the study area; a total of seven areas are projected for total architectural mitigation with each area estimated at \$150,000. See Appendix G: Real Estate Plan for updated real estate costs.

Table 4-23. Estimated Costs for Optimized TSP (in 1,000s)

Alt	Relocations	Fish and Wildlife Relocations	Roads, Railroads & Bridges	Buildings, Grounds & Utilities	Cultural Resource Preservation	Levees and Floodwalls	Pumping Plant	Channels and Canals	Floodway Control & Diversion Structure	*Lands and Damages	PED	CM	Total Cost
Alt 2 – NS Plan	-	-	-	\$1,248,027	\$13,523,219	-	-	-	-	\$223,243	\$63,329	\$25,332	\$15,083,150
Alt 6c – South Slidell and West Slidell Levee and Floodwall System	\$23,916	\$80,734	-	-	\$5,134,884	\$861,892	\$742,725	-	\$116,611	\$47,471	\$374,314	\$200,851	\$7,583,398
Alt 8 – Mile Branch Channel Improvements	\$863	\$153	\$20,177	-	\$101,297			\$13,239		\$25,645	\$7,056	\$3,786	\$172,216

*The term “damages” as used in Table 4-23 means the diminutions in the fair market values of remainder properties resulting from the Government’s acquisition of the affected ownerships for which just compensation must be paid.

4.4.6 Economic Analysis for the Optimized TSP

The HEC-FDA Version 1.4.3 USACE-certified model was used to calculate the damages and benefits for the Final Array of Alternatives for the DIFR-EIS. An updated BCR analysis was conducted to evaluate the economic feasibility of the Optimized TSP for the RDIFR-EIS. Expected annual benefits for 50-year period of analysis from 2032 and 2082 were converted to an equivalent annual value using the FY23 federal interest rate of 2.5 percent.

The updated H&H model outputs on the Optimized TSP and the economics functions were fed into the HEC-FDA, (<https://www.hec.usace.army.mil/software/hec-fda/>) and those results were tabulated and compared. The economic and engineering inputs necessary for the model to calculate damages and benefits include the structure inventory, contents-to-structure value ratios, vehicles, FFEs, and depth-damage relationships, ground elevations, and without-project stage probability relationships. The uncertainty surrounding each of the economic and engineering variables was included. Either a normal probability distribution, with a mean value and a standard deviation, or a triangular probability distribution, with a most likely, a maximum, and a minimum value, was entered into the model to quantify the uncertainty associated with the key economic variables. A normal probability distribution was entered into the model to quantify the uncertainty surrounding the ground elevations. The number of years that stages were recorded at a given gage was entered for each study area reach to quantify the hydrologic uncertainty or error surrounding the stage-probability relationships.

Table 4-24. Net Benefit Summary of the Optimized TSP, FY23 Price Level, FY 23 Discount Rate, \$1,000s

Measure	Slidell Levee	Mile Branch Channel Improvements	NS	Optimized TSP
Project First Cost	\$2,440,973	\$77,002	\$1,934,084	\$4,452,059
Interest During Construction	\$105,378	\$6,433	\$5,979	\$117,790
Total Investment Cost	\$2,546,351	\$83,435	\$1,940,063	\$4,569,849
AA Investment Costs	\$86,564	\$2,942	\$68,403	\$157,909
AA O&M Costs	\$7,609	\$162	\$0	\$7,771
Total AA Costs	\$94,173	\$3,104	\$68,403	\$165,680
Without Project EAD	\$572,971	\$572,971	\$572,971	\$572,971
EAD Reduced Benefits	\$165,014	\$3,472	\$236,702	\$405,188
Net Benefits	\$70,842	\$368	\$168,300	\$239,510
B/C Ratio	1.8	1.1	3.5	2.4

4.4.7 Life Safety Risk for Optimized TSP

In an effort to develop a consistent way to recommend projects that warrant funding based on risk to life safety, USACE developed the LSRI tool, which provides a relative representation of the life risk (average annual life loss) that would be reduced if a given structural or non-structural flood damage reduction project was constructed. The LSRI is intended to serve as a budget tool to prioritize studies and projects starting with the FY25 budget development process. (For more information on the USACE budget development process, see the latest [Budget Engineer Circular](#) and [Program Development Manuals](#)). The LSRI builds off of and replaces the Life Safety Hazard Index (LSHI) tool by incorporating not just consequence information, but also likelihood of the consequences.

The West and South Slidell Levee and Floodwall System that is part of the Optimized TSP was modeled using the LSRI software. These results are the same for the RP since there were not changes in the levee and floodwall system between the Optimized TSP and RP. The results of which show an LSRI value of 6.682 which means that if this project was not

built, the area protected by this measure would experience an average annual life loss of 6.682 people per year. Additionally, the cost per statistical life saved (CSSL) for St. Tammany is \$10,623,109 annually. To arrive at these values, the maximum storm surge event the West and South Slidell Levee and Floodwall System is designed to protect against, 14 feet, was used. The LifeSim model allowed for 8 to 24 hours of warning time before the first structure got wet. The population of the proposed area was developed using the default NSI 2022 values. Further detail on the Life Safety Analysis on the levee and floodwall feature in the Optimized TSP and RP can be found in Appendix F: Economics.

A Potential Failure Mode Analysis (PFMA) was also performed to qualitatively describe potential failure mechanisms and life safety incremental risk for the proposed levee and floodwall system. Further detail on this analysis is contained in Appendix D: Engineering Annex 11.

4.5 REFINEMENTS OF THE OPTIMIZED TSP AFTER RELEASE OF RDIFR-EIS LEADING TO THE RECOMMENDED PLAN

The RDIFR-EIS underwent public, policy, and agency technical review (ATR) in July of 2023 and as a result, refinements were made to the Optimized TSP to address those comments and to reach a Recommended Plan for the FIFR-EIS. The PDT also conducted further investigations project costs and refined the total project first costs and estimated annual costs for the measures in the RP. This section describes the refinements and changes made to the Optimized TSP to reach the final Recommended Plan. Revisions/Refinements Levee and Floodwall System.

The total project first costs and estimated annual costs for the measures were revised after the public comment period for the RDIFR-EIS was concluded and after receipt and review of ATR comments. Refer to Appendix D: Engineering for Cost Annexes 8-11 and Table 4-24. Cost revisions related to the levee and floodwall system were completed due to an increase in price quote updates and mark up adjustments. In addition, an internal review of projects risks was conducted, which resulted in the finding that the risk due to lack of Geotech information, cross-section changes, and uncertainties in attaining full ROW width should be increased in the estimates. Cost revisions related to the NS component were completed due to receiving updated price quotes. In addition, review comments received stated it is common cost engineering practice to model the high variance cost parameter for a triangular distribution in the Cost Schedule Risk Analysis (CSRA) at a lower percentage. The comment was discussed with ATR reviewer and adjustments were made to Crystal Ball program causing the contingency to increase. Further review of the PED and S&A contingencies were completed, and it was determined these contingencies were too low and adjustments were made to capture the risk and uncertainty more accurately.

Construction Schedule: A revised construction schedule was developed for the NS component, construction would occur from 2025-2037; the timeframe for implementation was changed from 5 years to 12 years.

4.5.1 Revisions/Refinements Mile Branch Channel Improvements

The total project first costs and estimated annual costs for the measures were revised after the public comment period for the RDIFR-EIS was concluded and after receipt and review of ATR comments. Refer to Appendix D: Engineering for Cost Annexes 8-11 and Table 4-21.

Mitigation costs due to unavoidable habitat impacts were calculated for the impacted habitats. the costs of habitat mitigation in the final Mitigation Plan were increased by roughly \$4 million for additional costs to mitigate for fish and wildlife impacts that would result from the implementation of the Mile Branch Channel Improvements Measure. There were no other changes to mitigation costs from the Optimized TSP to the RP.

In addition, review comments received stated it is common cost engineering practice to model the high variance cost parameter for a triangular distribution in the Cost Schedule Risk Analysis (CSRA) at a lower percentage. The comment was discussed with ATR reviewer and adjustments were made to Crystal Ball program causing the contingency to increase. This increased the contingency on the Mile Branch Channel Improvements measure implementation cost estimate by 11 percent. Further review of the PED and S&A contingencies were completed, and it was determined these contingencies were too low and adjustments were made to capture the risk and uncertainty more accurately.

4.5.2 Revisions/Refinements NS Plan

The total project first costs and estimated annual costs for the measures were revised after the public comment period for the RDIFR-EIS was concluded and after receipt and review of ATR comments. Refer to Appendix D: Engineering for Cost Annexes 8-11 and Table 4-25. Cost revisions related to the NS component were completed due to receiving updated price quotes. Information and pricing for home elevation was received from local shoring companies. St. Tammany Parish, and Jefferson Parish. St. Tammany and Jefferson Parish provided square footage prices based on past contracts and bid results documentation of multiple bidders from contracts earlier in the year.

For NS cost estimates a 3-foot flood planking system was used to estimate costs. The system is composed of gasketed aluminum planks and steel posts which are quickly mountable and watertight. It is erected when flooding is imminent and then easily disassembled and stored, leaving an unobstructed view of the area with no protrusions.

In addition, review comments received stated it is common cost engineering practice to model the high variance cost parameter for a triangular distributions in the Cost Schedule Risk Analysis (CSRA) at a lower percentage. The comment was discussed with ATR reviewer and adjustments were made to Crystal Ball program causing the contingency to increase. Further review of the PED and S&A contingencies were completed, and it was determined these contingencies were too low and adjustments were made to capture the risk and uncertainty more accurately.

The cost estimate for the NS component of the RP assumes 100% participation by the owners of eligible residential structures, so the overall total project cost has inherent conservatism.

4.5.3 Economic Analysis for the RP

An updated BCR analysis was conducted to evaluate the economic feasibility based on the revised cost estimates discussed in the previous section, the results are presented in Table 4-25.

Table 4-25. Net Benefit Summary of the RP, FY24 Price Level, FY 24 Discount Rate, \$1,000s

Net Benefit Summary of the Recommended Plan FY24 Price Level and Discount Rate, \$1,000s				
Measure	Slidell Levee and Floodwall	Nonstructural	Mile Branch Channel Improvements	Recommended Plan
Project First Cost	\$2,881,740	\$3,012,488	\$88,350	\$5,894,229
Interest During Construction	\$136,083	\$10,233	\$7,908	\$146,316
Total Investment Cost	\$3,017,823	\$3,022,721	\$96,258	\$6,040,544
AA Investment Costs	\$107,443	\$111,964	\$3,566	\$219,407
AA O&M Costs	\$7,753	\$0	\$166	\$7,753
Total AA Costs	\$115,196	\$111,964	\$3,732	\$227,160
Without Project EAD	\$537,780	\$537,780	\$537,780	\$537,780
EAD Reduced Benefits	\$159,036	\$213,455	\$3,428	\$372,491
Net Benefits	\$43,840	\$101,491	-304	\$145,331
B/C Ratio	1.4	1.9	0.9	1.6

4.5.4 Screening of Mile Branch Channel Improvements Measure after Release of RDIFR-EIS

The updated economic analysis based on the revised cost estimates determined that the cost to implement the Mile Branch Channel Improvements Measure exceeded the flood damages avoided.

As a result of the increase in costs, the BCR for the Mile Branch Channel Improvements Measure dropped from a BCR of 1.1 to a BCR of 0.9 and was no longer economically justified and was removed from consideration and the final RP.

4.5.4.1 Re-evaluation of Structures in Mile Branch to Determine if they are Eligible for Inclusion in the NS Plan

After the Mile Branch structural measure was removed from the RP, an evaluation was conducted to determine if the structures previously receiving flood risk reduction from the Mile Branch Channel Improvements could be included in the NS Plan. When the Mile Branch Channel Improvements Measure was previously included in the Draft TSP and the Optimized TSP, there were 250 structures that were preliminarily eligible for inclusion in the NS component of the TSP. After the Mile Branch Channel Improvements Measure was screened, there were 80 additional structures that were identified as preliminarily eligible for inclusion in the NS component of the RP. The investigation revealed that these 80 additional structures are located in the 25-year floodplain and are a subset of the original 250 structures that benefitted from the channel improvements at Mile Branch. The PDT compared the damages, which were a proxy for benefits, for the 80 additional structures to the average cost of implementing NS measures for 80 structures. This analysis identified that the increment of the 80 additional structures was not economically justified and therefore these structures were not added to the NS Plan.

4.6 RECOMMENDED PLAN INCLUDED IN THE FIFR-EIS

Based on the information presented in Section 4.4, and 4.5, the West and South Slidell Levee and Floodwall measures from Alternatives 5 and 6c and the comprehensive NS plan from Alternative 2 were confirmed as the Recommended Plan. These measures have the lowest total cost (including mitigation), the highest BCR, and the highest net benefits. In conclusion, the RP was confirmed as the plan that maximizes NED benefits while protecting the nation's environment, pursuant to national environmental statutes, applicable EOs, and other federal planning requirements. The RP is the USACE plan for flood risk reduction in the area and is intended to be a part of the overall flood risk reduction efforts that are ongoing or planned by other federal, State, and local governments and programs.

The RP is summarized below and provided in more detail in Section 6. The RP (NED Plan) is a parish-wide plan to address flooding which includes the following structural and NS measures:

CSRM and FRM NS flood risk reduction for eligible structures in St. Tammany Parish not covered by structural measures of the RP.

- Voluntary Program including approximately 6,410 structures (5,583 residential to be elevated) and (827 nonresidential to be floodproofed). For additional details refer to Appendix F: Economics for analysis and Appendix H: NS Implementation Plan for preliminary implementation guidance.

Although sections of current USACE Guidance (P.B. 2019-03 and P.B. 2016-01) provide that a plan that recommends the acquisition, relocation, and permanent evacuation of structures within a floodplain, must retain the use of eminent domain for a complete and an implementable project, those provisions do not apply to the subject Recommended Plan. In addition to the construction of structural flood risk management measures, the

Recommended Plan includes a voluntary nonstructural floodproofing component that consists of the elevation of eligible residential structures and the dry floodproofing of eligible non-residential structures. The Recommended Plan does not provide for, and shall not be construed as, including the acquisition, relocation, and permanent evacuation of structures from within the existing floodplain. Consequently, there is no provision in the Recommended Plan for either the mandatory or voluntary acquisition of private structures and property within the floodplain. However, if the Commander, Headquarters, U.S. Army Corps of Engineers, deems it advisable in the exercise of his sole discretion, to modify the Recommended Plan to include the acquisition, relocation, and permanent evacuation of structures from within the existing floodplain, then the implementation of the Recommended Plan will likewise be modified to include the use of eminent domain, together with the applicable costs for permanent relocation assistance pursuant to P.L. 91-646.

CSRM Structural flood risk reduction – West and South Slidell Levee and Floodwall System

- The West and South Slidell Levee and Floodwall System is comprised of approximately 18.5 miles of levee and floodwall. There would be eight pump stations, 13 culverts/sluice gates/lift gates, 18 vehicular floodgates, 1 pedestrian floodgate, 1 railroad floodgate, and six road ramps. The I-10 road surface would be raised to construction elevation 22.0 ft to ramp over the new levee section to stay above the hydraulic design elevation for year 2082, to ensure the entire pavement section remains above the hydraulic design elevation across the interstate. For additional details refer to Section 4.4.1, Alternative 6; Appendix D: Engineering.

Table 4-26. Estimated Costs for RP (in 1,000s)

Alt	Relocations	Fish and Wildlife Relocations	Roads, Railroads & Bridges	Buildings, Grounds & Utilities	Cultural Resource Preservation	Levees and Floodwalls	Pumping Plant	Channels and Canals	Floodway Control & Diversion Structure	Lands and Damages	PED	CM	Total Cost
Alt 2 – NS Plan	-	-	-	\$2,295,896	\$19,338	-	-	-	-	\$187,903	\$324,132	\$185,219	\$3,012,488
Alt 6c – South Slidell and West Slidell Levee and Floodwall System	\$32,162	\$86,705	-	-	-	\$988,010	\$912,064	-	\$131,713	\$53,630	\$440,884	\$236,572	\$2,881,740

*The term “damages” as used in Table 4-26 means the diminution in the fair market values of remainder properties resulting from the Government’s acquisition of affected ownerships for which just compensation must be paid.

SECTION 5

Environmental Consequences

5.1 ENVIRONMENTAL CONSEQUENCES

In accordance with NEPA, this section includes the scientific and analytic basis for comparison of the RP and the “No-Action” Alternative. The alternatives are assessed for their potential impacts on the relevant resources discussed in Section 3. Measures within each of the alternatives were analyzed together, where possible, due to similar impacts for each resource. The terms “RP” and “proposed action” are used interchangeably in this section (and elsewhere in this FIFR-EIS).

The impact analysis includes an analysis of potential beneficial and adverse effects on the resources including a discussion of direct, indirect, and cumulative impacts, the relationship between short-term uses and long-term productivity, and any irreversible or irretrievable commitments of resources. Reference Table 5-1 for a summary of alternative impacts by resource.

Table 5-1 Summary Environmental Consequences by Resource and Alternatives

Resource	Recommended Plan	Alt 2: Non-Structural Plan	Optimized TSP Structural *
Wetlands–Fresh/intermediate Marsh	122.5 acres 40 net acres -47.5 AAHU	Minimal indirect	122.5 acres 40 net acres -47.5 AAHU
Wetlands-Pine Savanna/ Flatwood Forests	441 acres 150 net acres -75.12 AAHU	Minimal indirect	441 acres 150 net acres -75.12 AAHU
Wetlands - Riparian Habitat	0 acres	Minimal indirect	35 acres
Uplands	-1,103 acres	Indirect	-1,103 acres
Aquatic Resources/ Fisheries	Direct & indirect impacts	No impact	Direct & indirect impacts
Essential Fish Habitat (EFH)	Direct & indirect impacts	No impact	Direct & indirect impacts
Wildlife	Direct & indirect impact	Indirect impacts	Direct & indirect impacts

Resource	Recommended Plan	Alt 2: Non-Structural Plan	Optimized TSP Structural *
T&E; Protected Species	NLAA T&E or their critical habitat; potential impacts to protected species	Limited indirect impacts	NLAA T&E or their critical habitat; potential impacts to protected species
Cultural Resources	PA agreement	PA agreement	PA agreement
Recreation Resources	Direct & Indirect Impacts	No Impact	Direct & Indirect Impacts
Aesthetics	Direct & indirect Impacts	Indirect Impacts	Direct & indirect Impacts
Air Quality	In Attainment	In Attainment	In Attainment
Water Quality	Temporary	Temporary	Temporary
Prime and unique Farmland	Direct Impacts	No impact	Direct Impacts
Noise Quality	Temporary	Temporary Impact	Temporary Impact
Socioeconomics	Direct & Indirect impacts	Direct & Indirect impacts	Direct & Indirect impacts
Navigation	Temporary Impacts	No Impact	Temporary Impacts

*Refers to all features of Optimized TSP except the NS plan

The June 2021 DIFR-EIS included an assessment of the Final Array of Alternatives and proposed a Draft TSP. Several of these measures and alternatives have since been eliminated following the evaluation as summarized in Section 4.2.10-4.2.11. Those that were screened for having a negative BCR are not included. The June 2021 DIFR-EIS evaluated the following Alternatives and measures in the Final Array.

- Alternative 1: No Action Alternative
- **Alternative 2: Non-structural**
 - 2-Nonstructural (Standalone Parish Wide) 100 year
 - 2-Nonstructural (Standalone Parish Wide) 50 year
 - 2-Nonstructural (Standalone Parish Wide) 25 year
 - 2-Nonstructural (Standalone Parish Wide) 10 year
- Alternative 4: Lacombe
 - 4a Lacombe Levee
 - 4a.1 Lacombe Levee Short
 - 4b Lacombe Levee Combined with West Slidell Levee
- Alternative 5: Bayou Liberty/Bayou Vincent/Bayou Bonfouca
 - West Slidell
 - Bayou Bonfouca Detention Pond
 - Bayou Liberty Channel Improvements
 - **Bayou Patassat Channel Improvements – Clearing and Snagging**

- Alternative 6: South Slidell Storm Surge Risk Reduction
 - 6a South Slidell Levee (S-075, S-076)
 - 6b South Slidell and Eden Isle Levee (S-070, S-075, S-076)
 - **6c South Slidell and West Slidell Levee (S-081, S-075, S-076)**
- Alternative 7: Eastern Slidell
 - Pearl River Levee
 - Doubloon Bayou Channel Improvements – Dredging
 - Poor Boy Canal Channel Improvements – Dredging
 - Gum Bayou Diversion – Channel Improvements
- Alternative 8: Upper Tchefuncte/Covington
 - **Mile Branch Channel Improvements (S-05)**
 - Later A Channel Improvements (S-121)
- Alternative 9: Mandeville Lakefront
 - 9a Mandeville Lakefront – Seawall Passive Drainage
 - 9b Mandeville Lakefront – Seawall and Pump Stations
 - 9c Mandeville Lakefront – 18-ft

The DIFR-EIS underwent concurrent public, policy and agency technical reviews in June 2021. Following public review, due to the significance of the comments received on the DIFR-EIS, the report was revised and refinements were made to the TSP to identify the Optimized TSP. Features carried forward to form the Optimized TSP and that were a part of the RDIFR/EIS impact assessment released for public review in July, 2023 included the following:

- Nonstructural Plan (NS)
- 6c West and South Slidell Levee and Floodwall System (S-081, S-075, S-076)
- Mile Branch Channel Improvements (S-057)

NS Plan of the Optimized TSP. The NS measures reduce flood damages without significantly altering the nature or extent of flooding. Damage reduction from NS measures is accomplished by changing the use of the floodplains, or by accommodating existing uses to the flood hazard. NS measures differ from structural measures in that they focus on reducing the consequence of flooding for a specific structure rather than reducing the probability of flooding in that area.

Approximately 5,583 eligible residential structures would be elevated to the future 100-year flood stage up to 13 feet, and 827 eligible nonresidential structures would be floodproofed up to 3 feet. Eligible structures must have a first-floor elevation (FFE) at or below the 25, 50, or 100 -year storm surge floodplain (depending on location within the study area), based on hydrologic conditions predicted to occur in 2032 (the beginning of the 50-year period of analysis). The analysis and aggregation of the NS plan was refined from the Draft TSP, which was based on the 50-year flood plain. This sub-aggregation was based on combinations of structures that had the same source of flooding and community characteristics. This included consideration of underserved communities as identified by the

Justice 40 criteria. An incremental floodplain or flood frequency analysis was conducted for each of the aggregates. The results showed (Table 4-22) that 16 of the 20 aggregates were economically justified up to the 4 percent (25 year) AEP Floodplain, coastal Slidell was economically justified up to the 2 percent (50 year) AEP Floodplain and coastal Lacombe, coastal Mandeville, and coastal Madisonville were economically justified up to the 1 percent (100 year) floodplain.

6c West and South Slidell Levee and Floodwall System

This measure is a 18.5 mile levee and floodwall alignment with a combination of earthen levees and floodwall. The I-10 road surface would be raised to elevation 22.0 to ramp over the new levee section to stay above the hydraulic design elevation for year 2082, to ensure the entire pavement section remains above the hydraulic design elevation across the interstate by constructing ramps to the preliminary design elevation of 15 feet. Permanent right-of-way required for the construction of the levee alignment would be 45,083 acres and would require approximately 7.2 million cubic yards of fill over the 50-year period of analysis. There would be 8 pump stations, 13 culvert/sluice gates/ lift gates, 18 vehicular floodgates, 1 pedestrian floodgate, 1 railroad floodgate, 6 road ramps, and 5 floodgates.

Borrow sources considered were the same for each of the alternatives formulated and would be obtained from five identified sites. The borrow sites MS-1 and MS-2 are commercial operating sources that were evaluated in Individual Environmental Reports (IER) #19, #23, and #31 for the Lake Pontchartrain and Vicinity Hurricane and Storm Damage Risk Reduction System (HSDRRS) projects. The discussion, analysis and documentation of environmental compliance pertaining to MS-1 (called the Pearlington Dirt borrow site in IER 19, Pearlington Dirt Phase II borrow site in IER 23) and MS-2 (called the Port Bienville borrow site in IER 31) contained in those IERs are incorporated by reference herein. The remaining three borrow sites are STP-5, STP-6, and STP-9.

Mile Branch

This measure consists of channel improvements on the lower 2.15 miles (11,341 feet channel) of Mile Branch in Covington, Louisiana. The proposed work would consist of approximately 21 acres of channel that would be cleared and grubbed prior to mechanical dredging. The mechanical dredging would consist of a maximum of 130,000 cubic yards of fill dredged from the channel. For the channel improvements, approximately 38.8 acres of permanent ROW would be needed. This area would include 25 feet on each side of the Mile Branch channel. Included in the 38.8 acres, there would be 4.8 acres for a staging area that would become a backwater area after construction is complete. For the channel improvements, approximately 5.1 acres temporary ROW would be needed.

There are no surveys available for this area for this study. The existing elevations used for the hydraulic analysis and design of the Optimized TSP were obtained from the LIDAR raster dataset. Designs are based on existing information gathered from reports provided by the non-federal sponsor as shown on Table 1-2.

Design refinements were planned to occur during PED based on field data collections. For example, future surveys would determine the final channel section and bridge replacements. Based on data collected, the design would be refined to minimize impacts to aquatic and riparian habitat and real estate. Riparian Zone bioengineering techniques and nature-based-solutions (NBS) would be incorporated as appropriate during PED in coordination with the NFS and resource agencies. One of the staging areas would become a backwater area after construction activities are completed. The conceptual backwater area has been proposed by MVN Environmental for Mile Branch. This concept would have to be further developed during PED. MVN Engineering has not performed any design of this concept during the study phase.

The Mile Branch Channel Improvements would include seven bridge replacements. Approximately 2.2 acres would be required as temporary ROW for staging along the various areas of the bridge replacements.

After review of the comments received on the RDIFR-EIS, the PDT conducted an updated economic analysis on the measures in the Optimized TSP, which included the Mile Branch Channel Improvements (structural FRM) Measure. As a result of this analysis, the cost estimate for this measure was revised. The new implementation cost for the Mile Branch Channel Improvements Measure far exceeded the amount of damage reduction that the Mile Branch measure would be expected to provide and it therefore was not economically justified. Consequently, the Mile Branch Channel Improvements measure was screened and was not carried forward into the RP See Section 4.5.4 of this report. Based on this change, the Optimized TSP Alternative assessment has been modified from what was in the RDEIS-EIS to reflect an impact assessment for the RP (see the RDIRF/EIS for the optimized TSP assessment)

Features carried forward to form the RP included the following:

- NS Plan
- 6c West and South Slidell Levee and Floodwall System (S-081, S-075, S-076)

5.1.1 Relevant Resources

In this section, anticipated impacts of the No Action and the RP are evaluated.

5.1.1.1 Wetlands Resources

Initially, features within the Final Array of Alternatives were assessed remotely utilizing GIS surveys, the National Wetland Inventory and USGS data for Hydrologic Unit Codes (HUC) 08090201 and 0318004. Following the release of the DIFR-EIS and as a result of comments received from resource agencies, the anticipated impacts from measures within Optimized TSP were further assessed utilizing the USACE certified wetland value assessment (WVA) model for Fresh/intermediate marsh and specific species models utilizing the Habitat Evaluation Procedures (HEP) for Pine Savanna/Flatwood habitat. See Appendix C: Environmental for a data map generated from USFWS National Wetland Inventory and the habitat model assessments.

Alternative 1: No Action Plan

Direct, Indirect, and Cumulative Impacts: Wetland resources would continue to be threatened by sea level rise and subsidence into the future. Continued development would both directly and indirectly affect wetlands through direct removal or indirectly by segmentation, changes in hydrologic patterns and changes to water quality. Current development trends would be expected to continue in the floodplains, converting wetlands to uplands. Current trends and patterns of wetland loss and conversion to open water would be expected to continue into the future. The riparian habitat along the Mile Branch would continue to be threatened by encroachment of development. The stream would continue to be subject to the erosive forces of the fast-moving water during storm events.

Other local, state and regional efforts would be expected to continue to restore important wetland resources through programs such as CWPRRA, the State Master Planning and Watershed initiatives.

Nonstructural Plan (Alternative 2)

Direct, Indirect, and Cumulative Impacts: Flood-proofing, structure raising, and relocations are all options under this alternative. Flood-proofing and structure raising is not anticipated to result in direct impacts to wetlands. There may be indirect impacts resulting from runoff from construction sites. Relocations could result in both adverse and beneficial impacts. Home (yards) relocations could convert to natural areas over time if not part of a restoration program to return the area to natural habitat. Wetlands could develop in these areas overtime if the drainage patterns, hydrology are conducive to wetland development as well as the continue trends of subsidence and sea level rise. Relocating residents to other neighborhoods and communities could result in wetlands in other locations being converted for development of homes or indirectly impacting wetlands by changes in drainage patterns and hydrology resulting from residential development in other areas.

West and South Slidell Levee and Floodwall System (Alternative 6c):

Implementation of this alternative would result in both direct and indirect impacts to wetlands and pine savanna habitat. Table 5-2 presents the details on habitat impacts to both the BBMNWR property and to private property. Total direct losses to the BBMNWR are anticipated to be approximately 21 acres (1.2 net acres) of pine savanna and 77 acres (29 net acres) of fresh/intermediate marsh impacts and indirect impacts to 30 acres (.25 net acres) of PS habitat. Pine savanna habitat and fresh/intermediate marsh within the proposed levee footprint would be converted into an earthen levee. Lands directly removed from the management of the BBMNWR would be compensated through a land exchange with property in the BBMNWR acquisition boundary that is of equal dollar value, habitat type and quality. The land exchange would be further developed during PED.

The habitat evaluation team (comprised of habitat specialist from the Interagency team) conducted a wetland value assessment utilizing the certified model approved for regional use for Civil Work projects. To quantify impacts to pine savanna fish and wildlife resources the HET utilized the species-specific HEPs in the absence of a pine savanna community model. The HEP models are similar to the WVA model, in that habitat quality and quantity are measured for baseline conditions and predicted future conditions for the proposed action. The USFWS expressed concerns for utilizing the HEP approach as the HEP models are species-based models and only quantify habitat quality associated with a single species instead of measuring the overall health of the ecosystem and its ability to support a diversity of fish and wildlife resources. The Service chose the red-cockaded woodpecker (RCW) (Tirpak et al. 2009) and the pine warbler (USFWS 1982) to measure impacts to pine savanna habitats in the project area.

Based on the WVA and HEP analysis, there would be total direct impacts to 441 acres of pine savanna/flatwood habitat and 122.5 acres of fresh/intermediate marsh; There would be no indirect impacts to marsh habitat and approximately 230 acres of indirect impact to pine savanna/flatwood habitat from project induced hydrologic changes near the levee/floodwall alignment and flood gates.

Direct impacts to BBMNWR for fresh/intermediate marsh are anticipated to be approximately - 33 AAHU's and direct impacts to pine savanna/flatwood habitat are anticipated to be -10 AAHU for red-cockaded woodpeckers and -3 AAHUs for pine warblers. Indirect impacts are anticipated to be -7 AAHUs for red-cockaded woodpeckers and -2 AAHUs for pine warblers.

Based on the HEP analysis there would be a direct loss of approximately 150 net acres of pine savanna habitat (-10 AAHU for RCW and -46 AAHU for pine warbler). Net acres equate to the difference between future without project conditions and future with project conditions at the end of the 50-yr period of analysis. There would be losses to approximately 40 net acres of fresh/intermediate marsh habitats (-48 AAHUs).

Table 5-2. Habitat Impacts

Refuge Impacts	Direct *			Indirect			Total Net Acres	Total Net AAHU	Total Impact Acres
	Acre Impact	Net Acres	AAHU	Acre Impact	Net Acre	AAHU			
Fresh/ Intermediate Marsh	-77	-29	-33	0	0	0	-29	-33	-77
Pine Savanna/ flatwood	-21	-1.19	RCW 10	-36	-0.25	RCW -7	-1.44	RCW -17	-57
			PW 3			PW -2		PW -5	
Private Impacts	Direct			Indirect			Total Net Acres	Total Net AAHU	Total Impact Acres
	Acre Impact	Net Acres	AAHU	Acre Impact	Net Acre	AAHU			
Fresh/ Intermediate Marsh	-45.5	-11	-14	0	0	0	-11	-14	-46
Pine Savanna/ flatwood	-171	-145	PS RCW 0 RCW- 0 PW -43	-201	0	PS RCW 0	-148	PS RCW 0	-373
					-3	PS PW 11		RCW 0	
						RCW 0		PS PW -11 PW -45	
						PW -2			

PS-protected side of levee alignment, PW – Pine Warbler; RCW – Red-Cockaded woodpecker

* Direct impacts on the BBMNWR are exchanged with land of equivalent value, habitat type and quality via a Land exchange

Mitigation

As a result of anticipated impacts discussed above, mitigation for the loss of habitat is required to be in full and replaced in-kind for the habitat lost. Reference Appendix I Mitigation plan for the detailed discussion regarding mitigation planning. The non-refuge pine savanna impacts would be compensated for by purchasing credits from a mitigation bank within the watershed for that habitat type. Fresh/intermediate marsh would be offset by the construction of a mitigation site identified as M2. The M2 marsh mitigation site is located on the north shore of Lake Pontchartrain, east of the Causeway Bridge near Lacombe. This alternative is shown in the Engineering Appendix D on Plate number C-04 and C-05. The proposed site would be approximately 200 acres. The assumed existing elevation is -1.65 feet NAVD88. This would be verified during PED. Initial target elevation for dredge fill would be to approximate elevation +2.5 NAVD88, to ultimately hit a target marsh elevation of +1.0 NAVD88. At this 35 percent design level, total perimeter retention would be required to retain dredge material and allow for vertical accretion. Approximately 14,718 linear feet of new retention dike would be required along the perimeter of the marsh creation footprint. The dike would be built with borrow from within the footprint. The dike would be built with a 5 feet crown width to elevation +4.8 feet NAVD88, to provide one ft of freeboard during pumping operation and allow for settlement. This dike would be degraded in year 1, upon

settlement and dewatering of the created marsh platform. The degraded material can be disposed of in the original borrow canal if settlement allows or cast into the open water immediately outside of the project footprint. Spill boxes or weirs would be constructed at pre-determined locations within the retention dike to allow for effluent water release from within the marsh creation area. If deemed necessary by the construction contractor, low level interior weir or baffle dikes can be constructed to assist in vertical stacking of dredged material.

Marsh creation would require approximately 2,200,000 cubic yards of borrow material. A 134 acre borrow site has been identified just off the north shoreline of Lake Pontchartrain. There would be a 2000 ft buffer between the existing shoreline and the borrow area limit. Borrow material would not be obtained deeper than 10 ft below the existing lake bottom, except that a tolerance of 1-foot below this target elevation will be provided the contractor to account for inaccuracies in the dredging process. To assure adequate borrow, the fill quantity was doubled to account for unsuitable materials, unknown utilities, unidentified anomalies, and/or unsighted cultural finds. An access corridor of approximately 7,340 linear feet would be necessary to pump material from the lake to the proposed marsh creation site. The access corridor would serve as a pipeline corridor and to offload equipment as necessary, to transport personnel to and from the worksite. The contractor would be instructed to minimize usage and damage within the access corridor, by using existing waterways for daily transportation of supplies and personnel where possible.

Levee Borrow Sources: The borrow sources are either existing commercially operating borrow sites or open fields/agricultural land (evaluated further below). However, a wetland jurisdictional determination would be conducted during PED to determine whether any wetland sources existing within the sites identified for borrow. Should there be an identification and delineation of wetlands, those areas would be avoided, and a buffer would be established around the wetland perimeter to preserve the integrity of the wetland habitat. The CEMVN has a long-standing policy of avoiding impacting wetlands for borrow sources and would continue to maintain that policy into the future. Therefore, there would be no impact to wetland resources as result of borrow excavation.

5.1.1.2 Upland Resources

Alternative 1: No Action Alternative Plan

Direct, Indirect, and Cumulative Impacts: There would be no impacts to uplands resources if the proposed action did not take place. Forested uplands in the project area would continue to be directly and indirectly impacted by the present natural and anthropogenic factors (e.g. development, invasive species) into the future. Erosional forces from major flood events would continue to permanently adversely impact upland resources. Long-standing water (approximately 1 mo.) due to flooding on upland forests could result in stunting the growth of the habitat. As upland trees are lost due to erosional forces from high river flows or mortality from inundation or saltwater intrusion, less desirable species could take over.

Recommended Plan - Nonstructural Plan (Alternative 2) and West and South Slidell Levee and Floodwall System (Alternative 6c)

Nonstructural Plan (Alternative 2)

Direct, Indirect, and Cumulative Impacts: Elevating homes would not directly impact vegetation outside the construction footprint in any surrounding areas, although the shading could potentially result in shifting plant communities. Construction activities related to elevating homes and connecting utility lines would cause direct impacts to lawns and flowerbeds and landscaped areas.

West and South Slidell Levee and Floodwall System (Alternative 6c)

The levee and channel clearing (not part of RP) structural measures would be constructed in a manner that allows for drainage following flood events. Complete mortality of flood-sensitive species within upland forests is not anticipated as the gates and pumps would be constructed and operated in a manner that allows upland areas to drain following flood events. Some mortality could result with a transition to the more flood-tolerant species over time.

Elevating homes would not directly impact vegetation in surrounding areas beyond the immediate areas surrounding the homes' footprints, although the shading created by raising the structures could potentially result in shifting plant communities. In cases where a home or land acquisition may take place, this could indirectly impact visual resources by removing a viewer from a given area. In areas where there is public access from a street or roadway, these NS elements would not change the view shed. Houses being raised are currently present, their elevation would change, but the site is still occupied either way. In the case of a home acquisition, if a home is removed and open land is created, this could be considered as a benefit to drivers looking for natural scenery or a loss to an established neighborhood.

Levee Borrow Sources: The borrow sources are either commercially operating borrow sites or open fields/agricultural land. Approximately 1,103 acres of grassland could be adversely impacted by the conversion of open fields to borrow pits.

5.1.1.3 Soils: Prime and Unique Farmlands

Alternative 1: No Action Plan

Direct, Indirect, and Cumulative Impacts: This alternative would not have an effect on prime and unique farmland. Soil would continue to experience both anthropogenic and natural impacts.

Recommended Plan - Nonstructural Plan (Alternative 2) and West and South Slidell Levee and Floodwall System (Alternative 6c)

Nonstructural Plan (Alternative 2)

Direct, Indirect, and Cumulative Impacts: Implementing NS measures such as elevating and floodproofing would have no direct or indirect impacts on prime and unique farmlands. The relocation of households could potentially adversely affect prime and unique farmlands if it increased residential development on those soils.

West and South Slidell Levee and Floodwall System (Alternative 6c)

Approximately 143 acres of prime and unique farmlands would be impacted by construction of a levee on top of the soils. Farmland would be directly adversely impacted within approximately 13 percent of the levee footprint and associated staging areas.

Borrow Sources: Borrow sites MS-01 (Pearlington, Figure 5-4) and MS-02 (Bienville, Figure 5-5) in Mississippi are not currently listed as having prime and unique farmlands. These sites are operating as commercial businesses selling sell borrow material. Borrow site STP-5 (Figure 5-1) would impact approximately 62 acres, STP-6 (Figure 5-2) would impact less than 1 acre, and STP-9 (Figure 5-3) would impact approximately 5 acres. Impacts to prime and unique farmlands would require coordination with the Natural Resources Conservation Service. Table 5-3 lists the potential borrow sources and the specific borrow needs from each site.

Table 5-3. Potential Borrow Site Identification for the St. Tammany Parish Feasibility Study

Site #	Site Name	Location	Estimated Borrow Pit Acreage	Estimated Fill Volume (cubic yards)	Prime and Unique Farmland Soil
STP-5	Cleared Site 5	Lacombe, LA	73	1,817,700	62 acres
STP-6	Cleared Site 6	Slidell, LA	10	249,000	<1 acre
STP-9	Cleared Site 9	Slidell, LA	17	423,300	5 acres
MS-1	Pearlington Dirt, Pearlinton Dirt Phase II (IER 19,23)	Hancock County, MS	326	8,000,000	None
MS-2	Port Bienville (IER 31)	Hancock County, MS	677	16,857,300	None

St. Tammany Parish Feasibility Study: Potential Borrow Locations

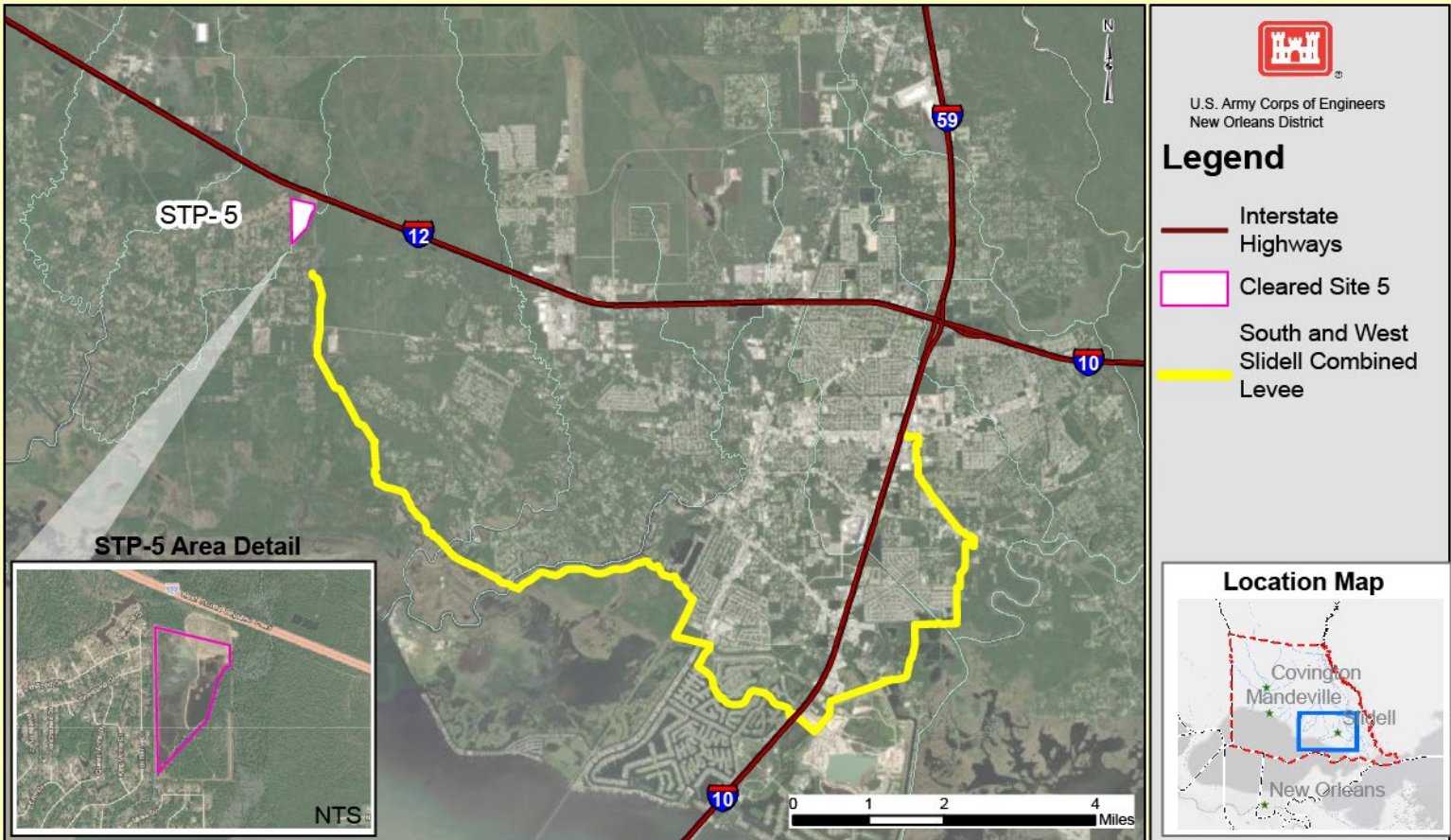


Figure 5-1. Borrow Site STP - 5

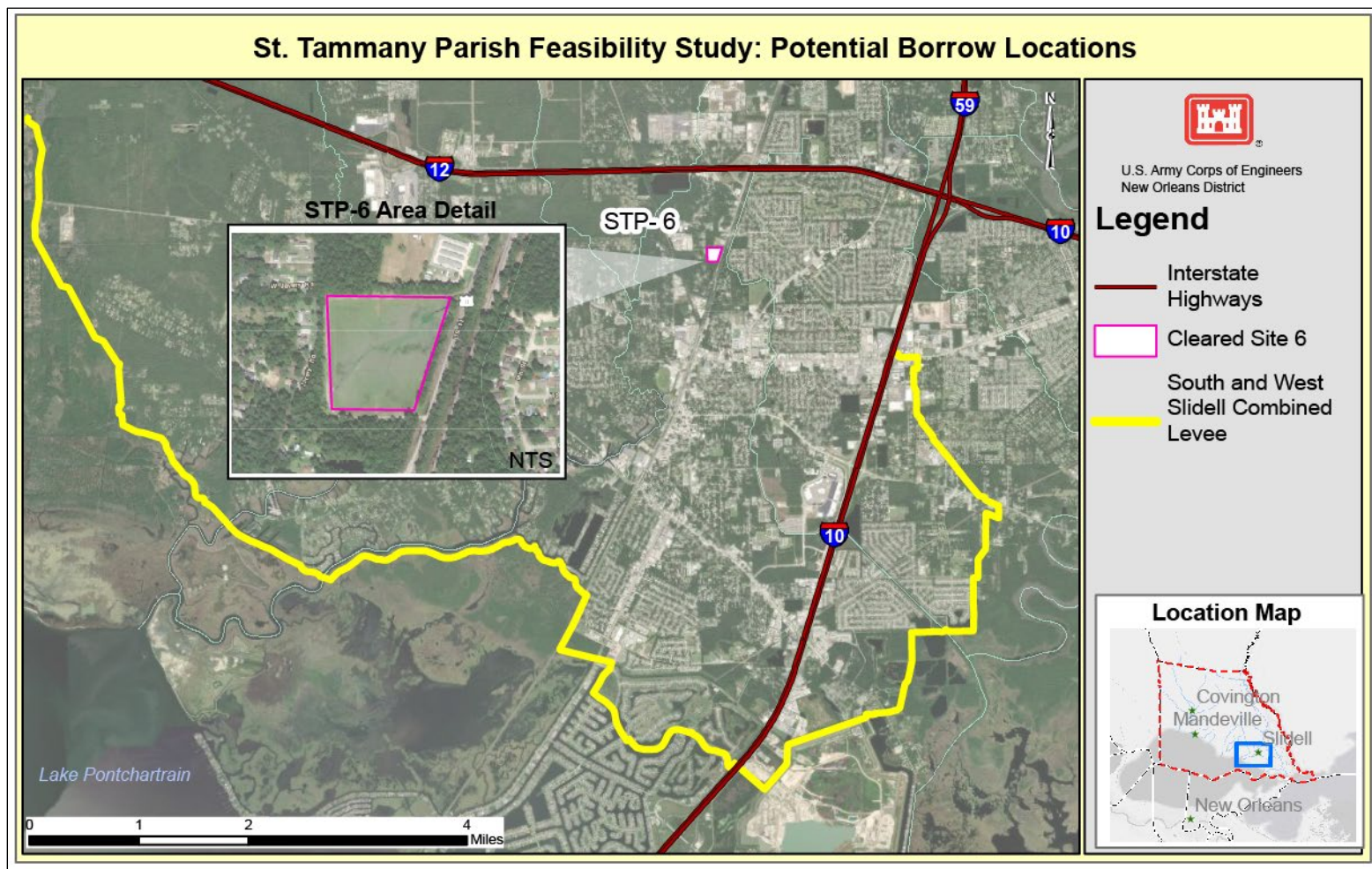


Figure 5-2. Borrow Site STP-6

St. Tammany Parish Feasibility Study: Potential Borrow Locations



Figure 5-3. Borrow Site STP-9

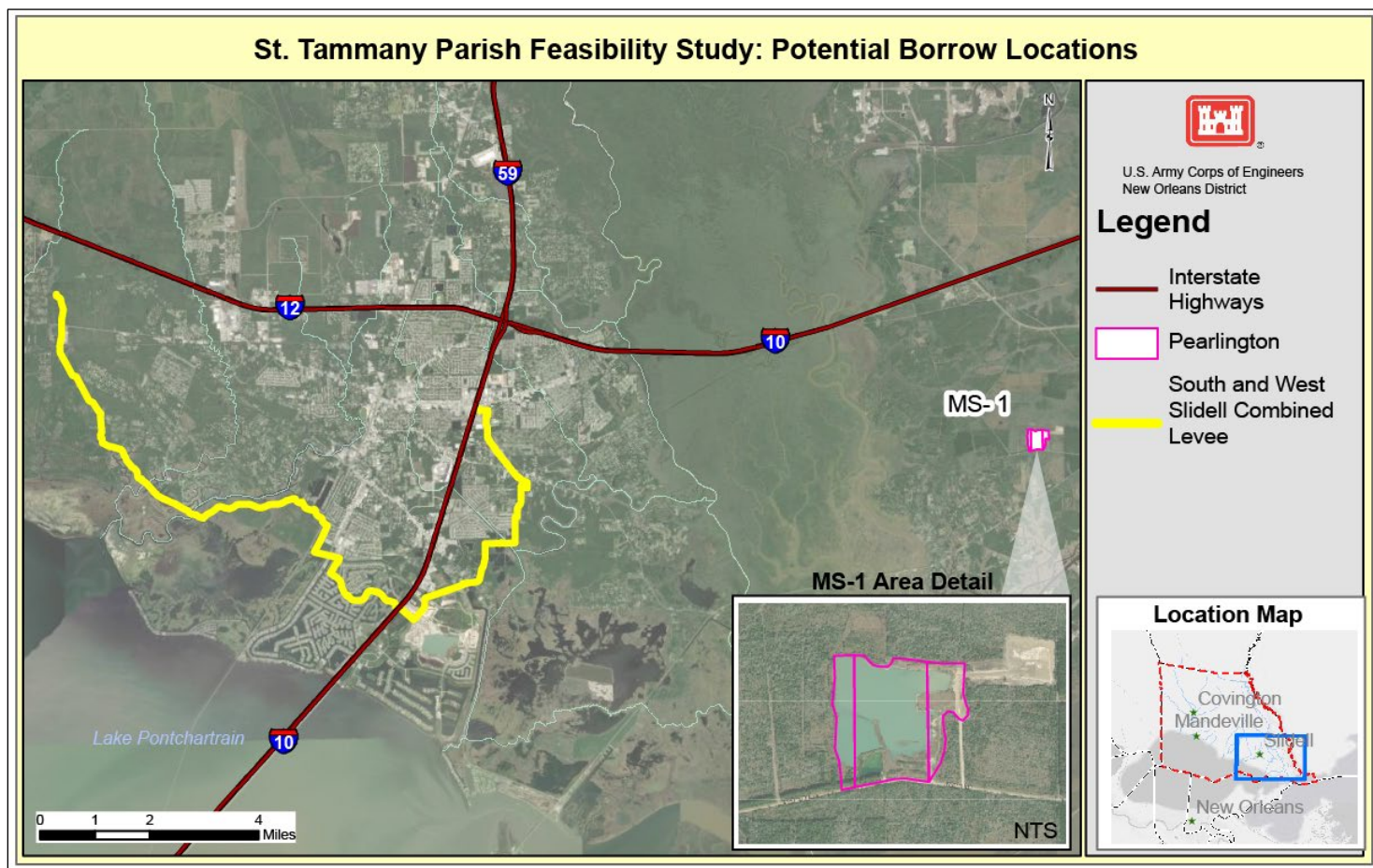


Figure 5-4. Borrow Site MS-1(Pearlington Dirt (IER 19), Pearlington Dirt, Phase II (IER 23))

St. Tammany Parish Feasibility Study: Potential Borrow Locations

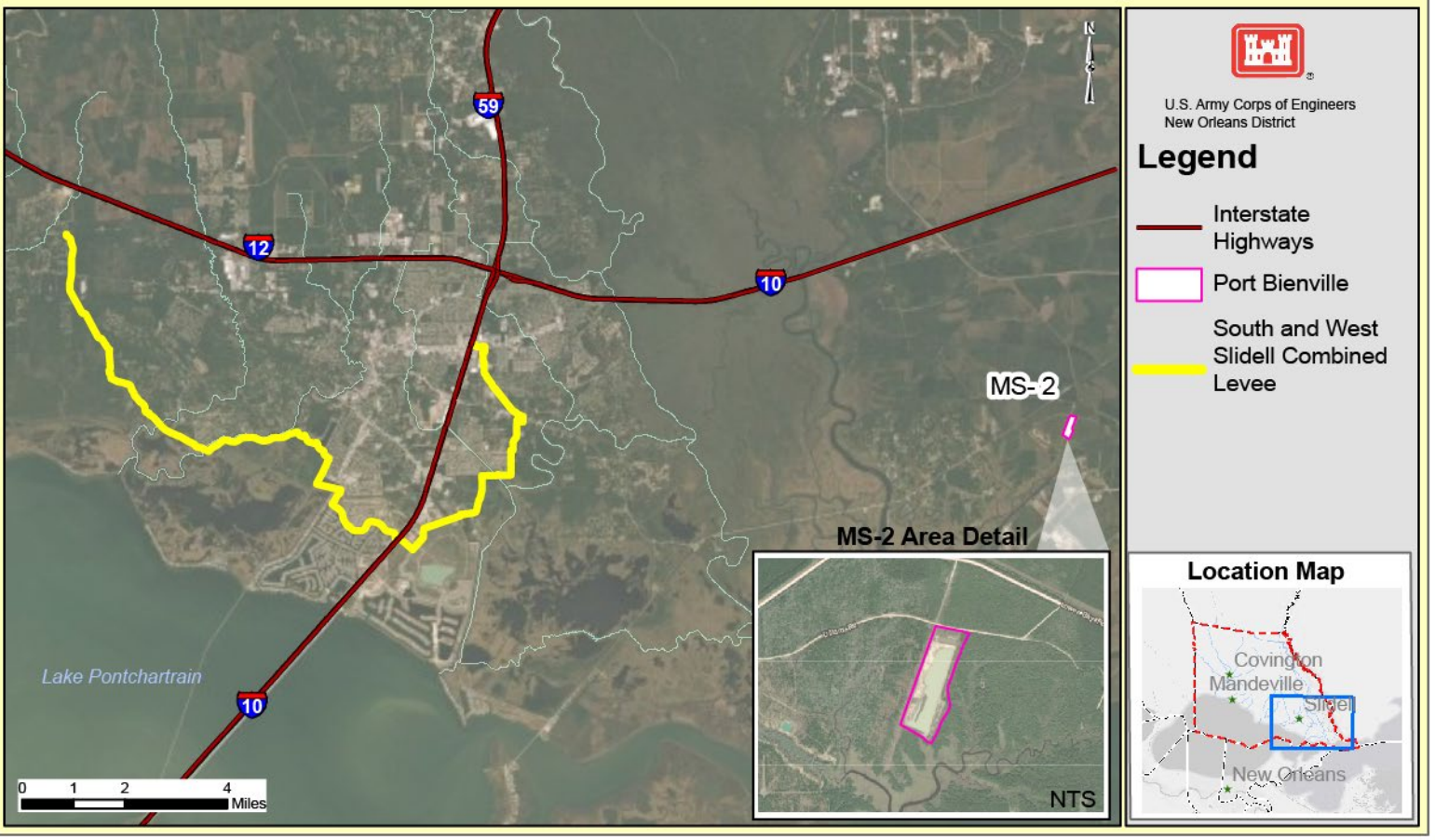


Figure 5-5. Borrow Site MS-2 (Port Bienville (IER 31))

5.1.1.4 Aquatic and Fishery Resources

Alternative 1: No Action Plan

Direct, Indirect, and Cumulative Impacts: Without implementation of the proposed action, aquatic resources and fisheries in the study area would continue to be directly and indirectly impacted by the present natural and anthropogenic factors. These include ongoing issues related to stormwater management, increasing development, and nutrient runoff that negatively impact aquatic resources and fisheries.

Recommended Plan - Nonstructural Plan (Alternative 2) and West and South Slidell Levee and Floodwall System (Alternative 6c)

Nonstructural Plan (Alternative 2)

Direct, Indirect, and Cumulative Impacts: Flood-proofing, structure raising, and relocations are all options under this alternative. Implementation would have no impact to aquatic resources within the study area.

West and South Levee and Floodwall System (Alternative 6c)

West and South Slidell Levee: Implementation of this levee measure would have direct impacts to migration and spawning aquatic species. Any aquatic species on either side of the levee footprint would likely experience direct impacts from construction and alterations of drainage and flow into Lake Pontchartrain. Indirect impacts would be shifts in vegetative communities related to changes in hydrology, with construction impacts being only temporary. Vegetative communities provide foraging and refugia for aquatic species that can be used for spawning and shelter.

The portion of the earthen levee that parallels and then crosses Bayou Bonfouca, crosses Bayou Liberty and Bayou Pacquet, the sluice gate #2 located at Minor tributary off Bayou Bonfouca and sluice gate #3 off Bayou Paquet would be expected to affect migration patterns of estuarine dependent marine organisms, such as Brown shrimp, White Shrimp, and other aquatic species to and from coastal habitats adversely affecting fish production. Navigable gates such as the Bayou Pacquet, Bayou Liberty and Bayou Bonfouca would be expected to affect aquatic species and fish migration as a result of changes in water patterns and velocity during certain periods of the year. The operations plans of the various sector gates, lift gates, and sluice gates would not be closed until certain conditions are met. No structure can be closed or re-opened when the pressure head differential exceeds the structure design capability. No structure can be re-opened until storm force winds have dropped to a level safe for personnel to access the area and operate the machinery. The Preliminary Draft Operating plan located in Environmental Appendix C, Annex Q is considered preliminary for the purpose of assessing potential impacts to fisheries. The preliminary plan would be further refined during PED. The Further H&H modeling and design consideration for fish friendly structures, such as consideration of sloped ramps to the floodgate sill, would be further considered during PED. Both behavioral and physical responses govern migration and affect passage of fishery and aquatic organisms through structures. These responses may vary by species and life stage of the aquatic organism. Most marine fishery species are relatively planktonic in early life stages and are dependent on tidal movement to access coastal marsh nursery areas. For this reason, in general, the greater the flow through a structure into a hydrologically affected wetland area, the greater the marine fishery production functions provided by that area (USFWS DCAR, 2023). The design of the floodgates would incorporate nature-based features. These features would be further developed during PED.

Cumulative impacts would be the additive impact of converting approximately 123 acres of fresh/intermediate marsh to uplands resulting in permanent vegetation shifts. These permanent habitat shifts also impact spawning and migration patterns of aquatic species that rely upon the waterways disrupted by the placement of levees and structures. Noise and vibration from construction activities would be expected to only cause a temporary impact by potentially scaring away those present in the immediate vicinity, though they would be

expected to return upon completion. Operations of any pump stations would contribute to noise and vibration during high water events. Further details regarding these operations can be found in Appendix D: Engineering.

Mitigation: Restoring a fresh/intermediate marsh area would increase spawning, nursery, forage, and cover habitat for fisheries resources over the long term. For approximately 5 years after project construction the project area would be above daily tidal inundation and only partially vegetated, so maximum fisheries benefits would not be realized until after this 5-year period has elapsed. Turbidity during borrow excavation and fill placement would temporarily impair visual predators and would impact filter feeders, but these impacts are expected to cease after construction and benthic species would rebound once construction is complete. Fish access to this area would be extremely limited until the material consolidated and settled to an elevation conducive to natural emergent marsh habitats. It is expected this “lag” time would be approximately 5 years. Once the success criteria have been achieved, this area would once again serve its traditional functional role in the local ecosystem. It is probable that crab fishermen sometimes place crab traps within the proposed borrow area as the practice is common throughout Lake Pontchartrain. Shrimp fishermen may venture into the area either pulling trawls or pushing “skimmer” nets. The fishermen and their gear would be temporarily displaced during project construction, and the borrow area may be less productive for up to a year after project construction due to loss of benthic animals from the dredging operation. The depth restriction on the borrow pit, preventing it from being more than 10 feet in total depth, would minimize the chance that the area would suffer from low oxygen conditions post construction.

Levee Borrow Sources: There would be no impact to aquatic and fishery resources as result of borrow excavation as described in 5.3.

5.1.1.5 Essential Fish Habitat (EFH)

Alternative 1: No Action Plan

Under the future without project conditions there would be no impact to EFH resulting from taking no action. Current water quality trends impacting fisheries would continue. Subsidence and sea level rise would continue to result in the loss of wetlands, which would affect EFH.

Recommended Plan - Nonstructural Plan (Alternative 2) and West and South Slidell Levee and Floodwall System (Alternative 6c)

Nonstructural Plan (Alternative 2)

No impact on EFH. Current water quality trends impacting fisheries would continue. Subsidence and sea level rise would continue to result in the loss of wetlands, which would affect EFH.

West and South Slidell Levee and Floodwall System (Alternative 6c)

Estuarine wetlands are the primary type of EFH that would be impacted with construction of the levee. The NS component would have no effect on EFH. Construction of the levee and channel clearing measures would directly impact estuarine emergent wetlands by changing hydrology in the area, thus affecting post-larval and sub-adult brown and white shrimp, as well as post-larval and sub-adult red drum. Brown shrimp, white shrimp, and blue crabs may be directly impacted through the filling of shallow open water areas with dredged materials, but these species could potentially benefit indirectly from the abundance of introduced detritus. Where tidal waters designated as EFH would be converted to a non-tidal elevation, loss of EFH would result. Cumulatively, these impacts would be considered minimal due to the large size of the basin, and similar EFH located within the parish. An operations and maintenance plan for structures included in the RP (Figures 5-6 and 5-7) would be developed during PED. A mitigation plan has been formulated and can be found in Appendix I: Mitigation Plan.

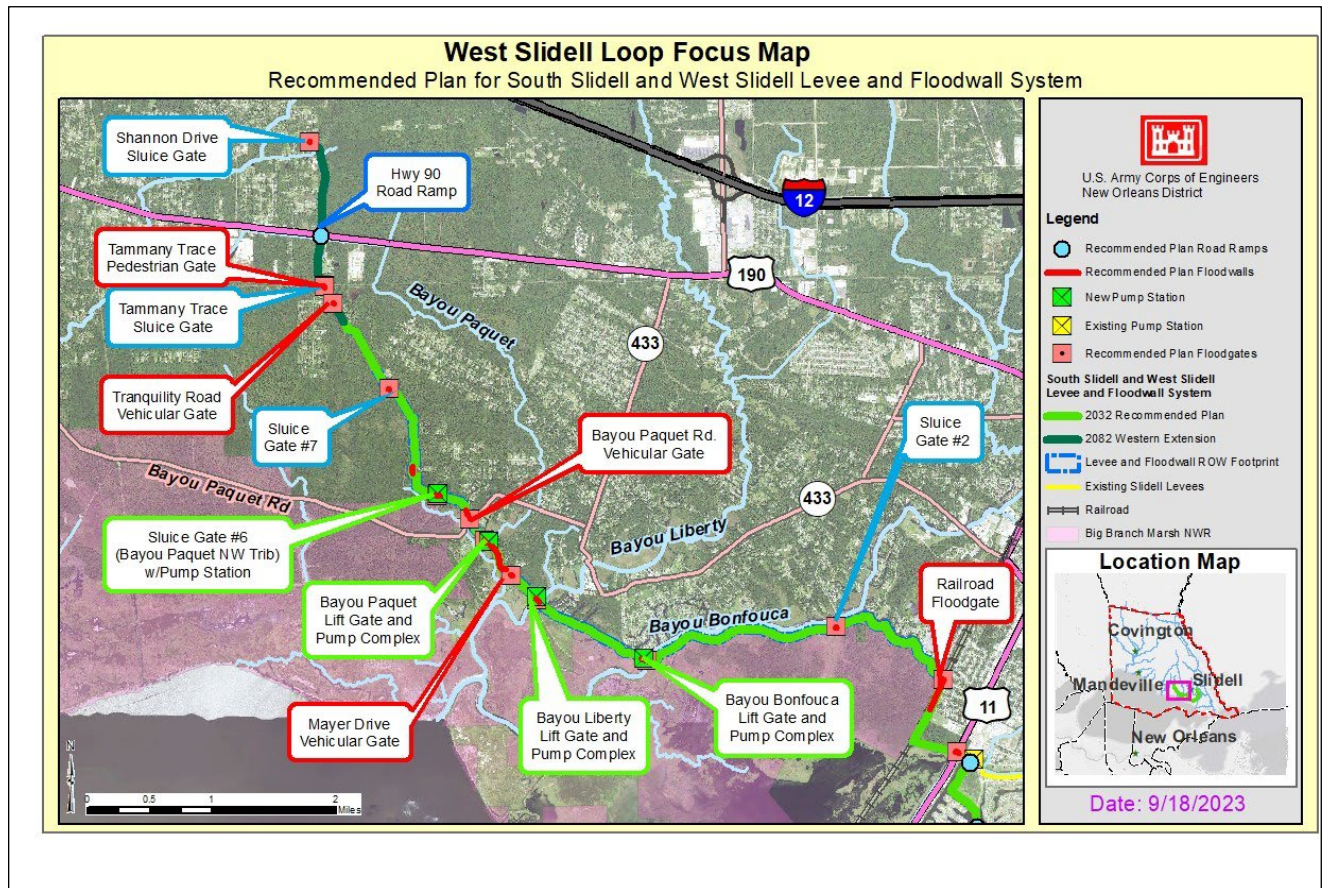


Figure 5-6. From Appendix D: Engineering Figure D:10-4 West and South Slidell Levee and Floodwall System – Optimized Tentatively Selected Plan Focus with Structures

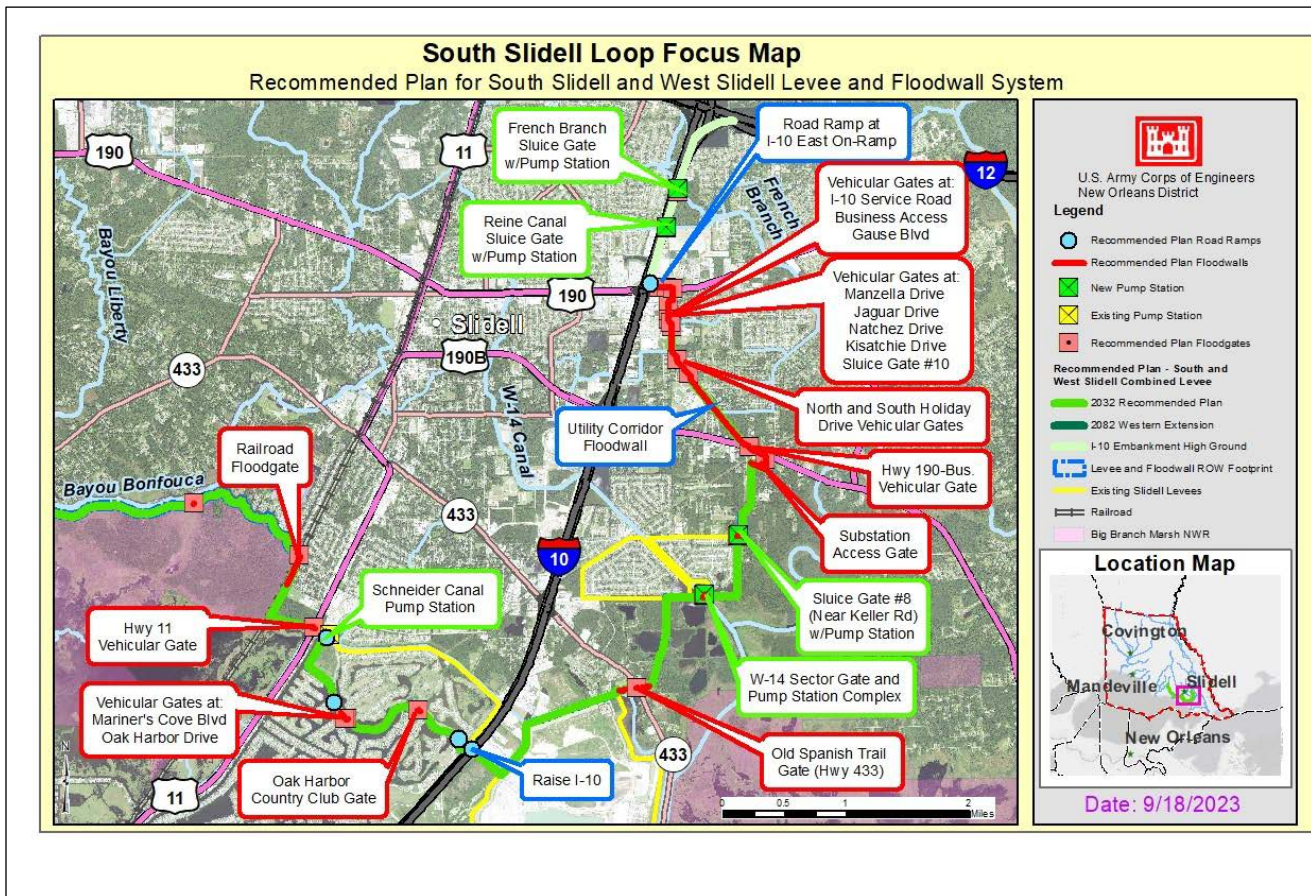


Figure 5-7. From Appendix D: Engineering Figure D:10-6 West and South Slidell Levee and Floodwall System-Optimized Tentatively Selected Plan Focus with Structures

Mitigation: The existing essential fish habitat at the M2 mitigation site includes estuarine water bottom, estuarine water column, and submerged aquatic vegetation. These habitats would be largely converted to another type of essential fish habitat – estuarine intertidal herbaceous wetlands (marsh). Benthic resources within the borrow site would be lost until they can re-colonize the borrow area. The borrow area would not be excavated more to more than 10 feet deep thereby minimizing the possibility of anoxic conditions. Fisheries access to the marsh mitigation area would be extremely limited during the initial 3-5 years of the project life while the pumped-in sediments are dewatering and subsiding. The M2 area was once a functional marsh system that provided nursery and feeding habitat to local fisheries. Over time, the proposed actions would result in an increase of functional marsh and associated shallow water habitat thereby accomplishing the required level of mitigation and offsetting adverse impacts to certain categories of EFH. The adverse impacts to essential fish habitat that would result from the proposed actions may affect, but should not adversely affect, managed species considering the small acreage involved relative to Lake Pontchartrain, plus the project would provide long-term benefit to the managed species by providing intertidal wetlands, a valuable type of essential fish habitat.

Indirect impacts to managed species include increased turbidity and disturbance of Lake Pontchartrain in the vicinity of the borrow area. These species may be temporarily displaced.

Implementation of the proposed action would result in sufficient EFH habitat improvement to offset adverse impacts to fresh/intermediate marsh EFH and open water designated as essential fish habitat from the construction of the proposed action.

Levee Borrow Sources: There would be no impact to essential fish habitat resources as result of borrow excavation as described in 5.3.

5.1.1.6 Wildlife

Representative species found in the area, and impacted by each alternative, are analyzed here and can be found in Appendix C: Environmental. Annex P,

Alternative 1: No Action Plan

Direct, Indirect, and Cumulative Impacts: Without implementation of the action alternative, terrestrial habitat loss as the result of continued flooding, erosion, and coastal storm surge damage would likely continue at the present rate, resulting in a reduction of diversity and availability for resident wildlife.

Recommended Plan - Nonstructural Plan (Alternative 2) and West and South Slidell Levee and Floodwall System (Alternative 6c)

Nonstructural Plan (Alternative 2)

Direct, Indirect, and Cumulative Impacts: Flood-proofing, structure raising, and relocations are all options under this alternative. Flood-proofing and structure raising would only temporarily directly impact terrestrial and arboreal wildlife habitat during construction, but the anthropogenic factors related to ongoing development within the parish negatively impacting terrestrial wildlife would continue. Relocations would entail residents moving out of their existing homes, and this could be considered a cumulative benefit to wildlife resources if the area is allowed to revegetate and go undeveloped.

West and South Slidell Levee and Floodwall System (Alternative 6c)

West and South Slidell Levee: Implementation of this levee measure would directly result in the loss of marsh and forested habitat for terrestrial wildlife species with the potential for species mortality and displacement for species present during construction. Conversion of marsh to uplands would reduce use and function of these areas for brown pelicans, seabirds, dabbling and diving ducks, coots, and gallinules and other species that feed in the shallow open waters, it is anticipated they would utilize adjacent areas of open water habitat that are abundant in close proximity to the proposed features. Indirect impacts would be on adjacent habitats that would experience a burden due to displacement of wildlife to those adjacent areas. Where there is a permanent loss of habitat resulting from construction, the affected species would not return or utilize the affected habitat in the same manner. Mobile wildlife would be impacted by the construction noise and vibration and likely leave the area.

These impacts are expected to be temporary, and the wildlife would return once construction activities are complete. There could be adverse impacts to adjacent habitat resulting from the wildlife migration if the carrying capacity is already weakened or threatened with over population. Less mobile species would suffer from the construction activity and likely suffer death from the placement of dirt directly on them or from being run over by construction equipment. Noise and vibration from construction activities would be expected to only cause a temporary impact by potentially scaring away those present in the immediate vicinity, though they would be expected to return upon completion.

Cumulatively, these levee measures play a role in converting habitat from one type to another. Some wildlife species could benefit more from conversion of a habitat from one type to another and other species could be adversely impacted. Stabilizing stream banks via engineering methods serves a similar function as the riparian habitat but results in loss of vitally important riparian habitat that provides other functions such as shade to the stream system thereby benefiting dissolved oxygen, wildlife corridor providing food and shelter. These same methods could serve to benefit the streambanks by reducing erosive forces resulting from high velocity water movement. The reduction in streambank erosion would also benefit aquatic species through reduced sedimentation and turbidity.

Nonstructural: Flood-proofing and structure raising would only temporarily directly impact terrestrial and arboreal wildlife habitat during construction, but the anthropogenic factors related to ongoing development within the parish negatively impacting terrestrial wildlife would continue. Relocations would entail residents moving out of their existing homes, and this could be considered a cumulative benefit to wildlife resources if the area is allowed to revegetate and go undeveloped.

Mitigation: Direct impacts to wildlife would result from the conversion of shallow open water to emergent marsh habitat. This conversion would reduce use and function of these areas for brown pelicans, seabirds, dabbling and diving ducks, coots, and gallinules and other species that feed in the shallow open water in this location, but it is anticipated they would utilize adjacent areas of open water habitat that are abundant in close proximity to the proposed features. It is anticipated that the project areas would experience improved overall wetland habitat functions once construction and establishment of the proposed marsh are achieved.

These actions would create or enhance emergent marsh habitat for terrestrial and semi-aquatic species such as nutria, muskrat, mink, river otter, and raccoon. Reptiles including the American alligator, western cottonmouth, water snakes, speckled kingsnake, rat snake, and eastern mud turtle are likely to utilize and populate the proposed marsh area as well. Amphibians expected to colonize the area include the bullfrog, southern leopard frog, and Gulf coast toad. The edges and small areas of open water that would form over time would also provide feeding habitat for common wading bird species including great blue heron, green heron, tricolored heron, great egret, snowy egret, yellow-crowned night-heron, black-crowned night-heron, and white ibis. Incidentally created mudflats and shallow-water areas would provide habitat for numerous species of shorebirds and seabirds. Shorebirds expected to use such areas include American avocet, willet, black-necked stilt, dowitchers,

and various species of sandpipers. White pelican, brown pelican, black skimmer, herring gull, laughing gull, and several species of terns would be expected to forage in and near the project area. Migratory and resident non-game birds, such as the boat-tailed grackle, red-winged blackbird, seaside sparrow, northern harrier, belted kingfisher, and marsh wrens, would also use the project areas. Game birds using the area would include the clapper rail, sora rail, Virginia rail, American coot, common moorhen, and common snipe in addition to resident and migratory waterfowl. Indirectly, species that utilize shallow open water habitats would be displaced by the habitat conversion. However, these species would have the opportunity to utilize adjacent shallow open water areas. Many species utilizing the current habitat type would thrive with the additional foraging, cover, and resting habitat the project would create. A rise in turbidity at the borrow site could immediately reduce water quality in the area; however, those effects would be temporary and would be reduced by movement of the tides. This project would help to offset an overall loss in the basin of intermediate and brackish marsh and BLH-Wet habitat necessary for many wildlife species.

The maintenance of pine savanna habitat on the refuge would provide habitat utilized by species such as songbirds, white-tailed deer, raccoons, squirrels, and rabbits.

These projects, when added to other past, present, and reasonably foreseeable ecosystem restoration and mitigation projects in the basin, would prevent the net loss of intermediate, brackish and BLH wetland function and overall decline of wildlife species within the basin and would be beneficial in both preserving the species bio-diversity and combating the current trend of conversion of coastal marsh to open water, which would be accelerated due to sea level rise.

Levee Borrow Sources: Each of the five borrow sources currently consists of land cleared of vegetation, and two are specifically commercial borrow sites. Wildlife that have remained in the general vicinity would be impacted by noise and vibration during construction activities, displacing to adjacent properties. Utilization, likely foraging, of the sites by any remaining wildlife in the cleared fields would be changed to more tolerant wildlife species of noise and constant disturbance.

5.1.1.7 Threatened, Endangered, and Protected Species

Impacts associated with construction activity, such as impacts to water quality, near spawning areas are known to negatively affect Gulf sturgeon and need to be taken into account when considering the construction schedule. The USFWS has provided a series of lifecycle features in their planning aid letter to USACE that details physical biological features to consider aiding in scheduling. Critical habitat for Gulf sturgeon is found in the study area and could be affected by each structural alternative in a similar manner.

Each of the five borrow sources currently consist of land cleared of vegetation, and two are specifically commercial borrow sites. Of the listed species that have been identified, the gopher tortoise is known to be drawn to cleared land, and there may be bald eagles and red-cockaded woodpecker clusters in adjacent forested land. Surveys performed by the LDWF, USFWS and USACE biologist determined no evidence of gopher tortoises or their burrows

are located within the project area. Therefore, the proposed action is not likely to adversely affect tortoises. In addition, a USFWS foraging habitat analysis determined that red-cockaded woodpecker clusters located within the project area are not likely to be adversely affected by construction activities due to suitable habitat nearby.

Protected species that have remained in the general vicinity would be impacted by noise and vibration during construction activities, displacing to adjacent properties. Utilization, likely foraging, of the sites by any remaining wildlife in the cleared fields would be changed due to removal of vegetation during excavation.

The construction of levees can result in temporary and/or permanent impacts to migratory birds and the habitats upon which they depend for various life requisites. USFWS has concerns regarding the direct and cumulative impacts resulting from the loss and fragmentation of forest and grassland habitats, and the direct and indirect impacts that these losses would have upon breeding migratory birds of conservation concern within the West Gulf Coast Plain Bird Conservation Region (<https://www.fws.gov/migratorybirds/pdf/grants/birdsofconservationconcern2008.pdf>). Many migratory birds of conservation concern require large blocks of contiguous habitat to successfully reproduce and survive.

Alternative 1: No Action Plan

No direct impacts to endangered species or their critical habitat would occur. This includes “at-risk” species of concern for USFWS as well. Existing conditions would persist and listed species would likely continue to be subject to institutional recognition and further regulations and federal management.

Cumulative impacts of this alternative would be continued habitat loss and degradation for protected species in the coastal areas of the parish.

Recommended Plan - Nonstructural Plan (Alternative 2) and West and South Slidell Levee and Floodwall System (Alternative 6c)

Nonstructural Plan (Alternative 2)

Flood-proofing, structure raising, and relocations are all options under this alternative. This alternative would not result in direct impacts to threatened, endangered, and protected species. Limited indirect impacts could be caused by flood-proofing and structure raising during construction activities. When combined with the structural alternatives, there would be no additional impacts to this resource. This includes “at-risk” species of concern for USFWS as well. See Appendix C: Environmental for more information.

West and South Slidell Levee and Floodwall System (Alternative 6c)

This alternative would not impact the Pearl or Bogue Chitto Rivers where the Ringed Map Turtle is known to occur. Therefore, this proposed alternative would have no effect on the species.

Direct and Indirect Impacts to West Indian Manatee: Proposed construction at the M2 mitigation site would convert approximately 200 acres of shallow open water to brackish marsh. The average depth at this location is less than 2 feet and is not prime habitat for manatee foraging due to the limited amount of grass beds and access to deeper waters. The proposed borrow location would be approximately 134 acres within Lake Pontchartrain and would be more conducive to manatee moving through the area based on depth and access to deeper waters, but foraging potential is still low based on the limited amount of grass beds. During borrow excavation, increased turbidity would occur, but would be reduced by the movement of the tides. Based on the footprint and location of the borrow area in relation to the 403,000-acre lake, and implementation of standard manatee protection measures, impacts from implementation of the RP would not likely adversely affect the manatee

Indirect impacts on T&E species are effects that could occur later in time than direct impacts, but still are reasonably certain to occur. No permanent indirect impact to manatees are expected to occur from construction of the proposed project. Indirect impacts could occur due to turbidity from construction which would be minimized by utilizing dikes to contain the dredged material within the brackish marsh creation area. In addition, any runoff from construction activities on land would be controlled through the use of best management practices and adherence to regulations governing stormwater runoff at construction sites and staging areas.

Procedures to Avoid Impacts to West Indian Manatee:

To minimize the potential for construction activities to cause adverse impacts to manatees, the following standard manatee protection measures, developed by the USFWS, Lafayette, Louisiana Field Office, would be implemented when activities are proposed that would impact habitat where manatees could occur: All contract personnel associated with the project would be informed of the potential presence of manatees and the need to avoid collisions with manatees. All construction personnel would be responsible for observing water-related activities for the presence of manatees. Temporary signs would be posted prior to and during all construction/dredging activities to remind personnel to be observant for manatees during active construction/dredging operations or within vessel movement zones (i.e., the work area), and at least one sign would be placed where it is visible to the vessel operator. If a manatee is sighted within 100 yards of the active work zone, special operating conditions would be implemented, including: moving equipment would not operate within 50 feet of a manatee; all vessels would operate at no wake/idle speeds within 100 yards of the work area; and siltation barriers, if used, would be re-secured and monitored. Once the manatee has left the 100-yard buffer zone around the work area of its own accord, special operating conditions would no longer be necessary, but careful observations would be resumed. Any manatee sighting would be immediately reported to the USFWS (337-291-3100) and the LDWF, Natural Heritage Program (225-765-2821).

Direct and Indirect Impacts to Gopher Tortoises. Based on the site survey conducted on 14 June 2022, half of the areas assessed appeared to be uninhabitable for gopher tortoises due to the dense forests completely covering these areas. There was no evidence of gopher

tortoises, or their burrows observed within the project area. Therefore, it was determined that the proposed project would not likely adversely affect Gopher Tortoises.

Direct and Indirect Impacts to Red-Cockaded Woodpecker: Construction of the proposed project could remove suitable RCW nesting trees. In a survey of the project area conducted by USFWS, four RCW clusters were identified. A foraging habitat analysis determined the proposed project did not significantly impact the amount of suitable habitat available to these clusters.

RCWs may be physically injured if struck by construction equipment or materials during construction. This effect is discountable due to the ability of the species to move away from the project site if disturbed. RCWs are mobile and are able to avoid construction noise, moving equipment, and placement or removal of materials during construction.

Mitigation Plan - Maintenance of the Refuge PSR-01 Pine Savanna site through routing-controlled burns would over time restore suitable RCW habitat for foraging and nesting. The controlled burns would scare away birds utilizing that area temporarily until the fire is gone and smoke clears. RCWs are mobile and are able to avoid construction noise, moving equipment, and placement or removal of materials during maintenance activities (controlled burns).

Indirect impacts from construction activities would be controlled through the use of best management practices and adherence to regulations governing stormwater runoff at construction sites and staging areas. No permanent indirect impact to RCWs are expected to occur from construction of the proposed project.

Based upon literature review, available survey data, the current status of the species, the environmental baseline for the action area, and the effects of the action, the USACE has determined that implementation of the proposed action is not likely to adversely affect RCWs.

Direct and Indirect Impacts to Gulf Sturgeon: Hypoxic and anoxic conditions can occur in deep borrow pits that tend to accumulate organic material. This accumulation would be reduced for the M2 borrow pit within Lake Pontchartrain by limiting the depth of the pit to 10 feet. Therefore, effects to Gulf sturgeon from hypoxic or anoxic conditions are discountable.

Gulf sturgeon may be physically injured if struck by construction equipment, vessels, or materials during dredging. This 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. 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 cutterhead dredging method used in 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 insignificant. 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 days of in-water construction. After the project is completed, Gulf sturgeon will be able to return to the project area.

We believe the effect to Gulf sturgeon from the potential loss of foraging habitat due to dredging will be insignificant. Gulf sturgeon are opportunistic feeders that forage over large areas and will be able to locate prey beyond the small dredging footprint (approximately 134 acres). Also, impacts to foraging resources from 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; Wilber et al. 2007).

No permanent indirect impact to gulf sturgeon are expected to occur from construction of the proposed project. Indirect impacts could occur due to turbidity from construction, which would be minimized by utilizing dikes to contain the dredged material. In addition, any runoff from construction activities on land would be controlled through the use of best management practices and adherence to regulations governing stormwater runoff at construction sites and staging areas. Based on the foregoing evaluation of potential impacts and the use of Gulf Sturgeon avoidance measures, USACE has determined that implementation of the proposed action is not likely to adversely affect Gulf Sturgeon.

Procedures to Avoid Impacts to Gulf Sturgeon:

To reduce impacts to Gulf sturgeon, a cutterhead dredge would be utilized to remove borrow material from the designated borrow area. This equipment is slower moving and has not been identified as equipment that would impact Gulf sturgeon. Additionally, Protected Species Construction Conditions will be followed by USACE contractors.

Routes of Effect to Gulf Sturgeon Critical Habitat:

On 19 March 2003, the Service and the NMFS published a final rule in the Federal Register (Volume 68, No. 53) designating critical habitat for the Gulf sturgeon in Louisiana, Mississippi, Alabama, and Florida. 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 M2 borrow area 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 will result in "No destruction or adverse modification" of Gulf sturgeon critical habitat based on these responses for the three PCEs.

- (1) Abundant prey items, such as amphipods, lancelets, polychaetas, gastropods, ghost shrimp, isopods, mollusks and/or crustaceans, within estuarine and marine habitats and substrates for subadult and adult life stages.

Dredging may remove substrates containing sturgeon prey items (PCE 1). USACE believes the effect to PCE 1 from dredging will be insignificant since the estimated impact is relatively small compared to the surrounding area available (approximately 134 acres) and prey items will still be present in the areas outside the dredging 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). The relatively species-poor benthic assemblages associated with low salinity estuarine sediments can recover in periods of time ranging from a few months to approximately one year, while the more diverse communities of high salinity estuarine sediments may require a year or longer.

- (1) 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 dredging. We believe the effect to PCE 2 from localized and temporary increased turbidity will be insignificant because:

The action area is also in a high wave/current area where we do not expect construction-induced turbidity to remain and where turbidity curtains are not practical to use.

Effects to temperature, salinity, pH, hardness, oxygen content, and other chemical characteristics of PCE 2 are not expected to result from dredging activities. Therefore, there is no effect to these aspects of PCE 2 from localized and temporary turbidity due to dredging.

- (2) 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 dredging will be insignificant. During prior consultations (BAs for SER-2010-4236 and SER-2014-14728, hereby incorporated by reference), surveys were conducted by USGS and NOAA that used remote imagery to determine bottom substrates within Lake Pontchartrain. The majority of Lake Pontchartrain bottoms were defined as having sandy composition and thus prime habitat for sturgeon.

The borrow site is approximately 2000 feet from the shoreline and likely receives fine sediment from wave induced shoreline erosion. The sandier composition areas, which are located further into the lake center, would be avoided, and thus minimizing impacts to sturgeon foraging. Given that prime habitat is available nearby, any Gulf Sturgeon that may be present would likely congregate in the ample nearby prime habitat, especially during construction. No permanent alteration of habitat composition is expected to occur within the action area. See Appendix C: Environmental for more information.

Direct and Indirect Impacts to Louisiana Quillwort: The Louisiana quillwort grows on sand and gravel bars on the accreting sides of streams and moist overflow channels within

riparian forest and bay head swamp communities. Existing data indicates the Louisiana quillwort does not utilize the project area and no direct, indirect or cumulative impacts are anticipated. Based upon literature review and available survey data, and the anticipated effects of the action, the CEMVN has determined that the Recommended Plan will have no effect on the Louisiana quillwort.

Direct and Indirect Impacts to Giant Manta Ray: Rays may be physically injured if struck by construction equipment, vessels, or materials during dredging and other in-water construction activities within Lake Pontchartrain. This effect is discountable due to the highly mobile nature of the species, which would likely move away from the project site if disturbed.

The construction activities and related construction noise may prevent or deter rays from foraging habitat within the M2 project area. However, the effect to rays from temporary avoidance of the project area would likely be insignificant. The size of the area which animals would avoid is relatively small in comparison to the available similar habitat nearby, which would be accessible to rays during construction. Disturbances and loss of habitat access would be temporary and limited to days of in-water construction. After the project is completed, rays would be able to return to the project area within Lake Pontchartrain and adjacent impacted tributaries.

Indirect impacts to giant manta rays could occur due to turbidity from construction of the M2 site (dredging and marsh creation) which would be minimized by utilizing dikes to contain the dredged material. In addition, any runoff from construction activities on land would be controlled through the use of best management practices and adherence to regulations governing stormwater runoff at construction sites and staging areas. No permanent indirect impact to rays are expected to occur from construction of the propose project and CEMVN has determined that the RP is not likely to adversely affect giant manta rays.

Direct and Indirect Impacts to Green, Kemp's Ridley, and Loggerhead Sea Turtles: Effects to sea turtles include the risk of direct physical impact from dredging and other in-water construction activities. We believe the risk of physical injury is discountable due to the species' ability to move away from the project site and into adjacent suitable habitat, if disturbed. NMFS has previously determined in dredging Biological Opinions that, while oceangoing hopper-type dredges may lethally entrain protected species, including sea turtles, non-hopper-type dredging methods, such as the cutterhead dredge proposed in this project, are slower and extremely unlikely to overtake or adversely affect them (NMFS 2007).

Sea turtles may be entangled by in-water lines and other in-water equipment. However, we believe the effects to sea turtles from entanglement will be discountable with implementation of Protected Species Construction Conditions.

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, related noise, and physical exclusion from the project area due to blockage by turbidity curtains (if turbidity curtains are utilized). We have determined that these effects will 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 days of in-water construction, after which the site conditions are expected to return to background levels and animals will be able to return.

Sea turtles may be affected by the permanent removal of habitat, which can serve as forage resources. However, this effect will be insignificant, given the availability of similar resources nearby. CEMVN has determined that the RP is not likely to adversely affect listed sea turtles.

Procedures to Avoid Impacts to Sea Turtles:

To reduce impacts to sea turtles, a cutterhead dredge would be utilized to remove borrow material from the designated borrow area. This equipment is slower moving and has not been identified as equipment that would impact protected species. Additionally, Protected Species Construction Conditions will be followed by USACE contractors.

Levee Borrow Sources: There would be no impact to threatened, endangered and protected species resources as result of borrow excavation as described in 5.3.

Migratory Bird Treaty Act

Direct and Indirect Impacts to Migratory Birds:

The optimized TSP may directly impact migratory birds of conservation concern because habitat clearing that occurs during the aforementioned primary nesting period may result in unintentional take of active nests (i.e., eggs and young) despite all reasonable efforts to avoid such take. The MBTA prohibits the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests, except when specifically authorized by the Department of the Interior. While the MBTA has no provision for allowing incidental take, USFWS recognizes that some birds may be taken during project construction/operation, even if all reasonable measures to avoid take are implemented.

5.1.1.8 Louisiana Scenic Rivers

Alternative 1: No Action Plan

There would be no impacts to Louisiana Scenic Rivers if no federal action is taken. Current trends would continue such as loss of habitat due to erosive forces of heavy stream flows during flooding events.

Recommended Plan - Nonstructural Plan (Alternative 2) and West and South Slidell Levee and Floodwall System (Alternative 6c)

Nonstructural Plan (Alternative 2)

There would be no impacts to Louisiana Scenic Rivers if no federal action is taken. Current trends would continue such as loss of habitat due to erosive forces of heavy stream flows.

West and South Slidell Levee and Floodwall System (Alternative 6c)

The Liberty Bayou Scenic Stream would be impacted by the construction of the floodgate on the Bayou. The levee alignment would cross the scenic stream impacting the scenic viewshed of the area. As the alignment crosses the scenic stream a pump station and navigable lift gate would be constructed on the stream. The pump station would have a pumping capacity of 1800 cfs. Construction of the lift gate would temporarily impact navigation of recreational vessels. A bypass channel would be constructed to allow recreational vehicles to traverse through the area. The experience of enjoying a scenic stream would be disrupted by the construction noise and potential changes in air quality resulting from operation of construction equipment. The navigable gate would be designed to mimic the existing width of the bayou as much as is as possible and would include a gradual slope so that fish and larvae may traverse the structure. This design would include smaller sluice gates on both sides of the lift gate to simulate the natural opening of the bayous. There would be direct adverse impacts to aquatic organisms and less mobile species resulting from the construction activities. There would be both direct and indirect permanent impacts to aquatic organisms resulting from higher levels of turbidity caused by construction. Best management practices would be employed to reduce the turbidity levels but it cannot be reduced completely. Aquatic organisms could be buried in silt and killed by construction equipment. Fisheries in the area would be scared away from the area as a result of the construction activity. The bypass channel would all fish to migrate the bayou. At times, the bayou does have low dissolve oxygen. This could be exacerbated by construction activities due to the higher turbidity levels expected and construction of the bypass channel.

During PED, the PDT would consider additional fish-friendly studies and input provided by the NFS, USFWS, NMFS, and LDWF criteria, including the rock arch and rock ramp designs.

Mitigation Plan: The proposed mitigation plan would not impact scenic streams.

Levee Borrow Sources: There would be no impacts to scenic streams resulting borrow excavation.

5.1.1.9 Hydrology and Hydraulics

Riverine Modeling (HEC-RAS) was performed for the 2, 5, 10, 25, 50, 100, 200, and 500-year rainfall events for existing conditions and With-Project base (year 2032) and future conditions (year 2082). Coastal storm surge and wave modeling was completed for the without-project condition (No Action Plan alternative) and future conditions the 10, 20, 50, 100, 200, 500, 1,000-year base (year 2032) and future conditions (year 2082). Water surface elevation results for each frequency were extracted and provided to the PDT for use in economic,

environmental, and engineering. The full results are presented in Appendix E: Hydrology & Hydraulics and summarized here. HEC-HMS 4.8: The latest version of the USACE Hydraulic Engineering Center's (HEC)-Hydrologic Modeling System (HMS) available at the time of model development was used for the hydrologic modeling. A new HEC-HMS model was developed for the feasibility level of design phase of the St. Tammany Parish Feasibility Study to optimize the Draft TSP. Elements from the HEC-HMS model used in the Alternative Analysis phase were carried over to the newly-developed HMS model. Further discussion on the HEC-HMS model utilized for this study may be found in Section 10 of Appendix E: Hydrologic & Hydraulics.

Advanced Circulation (ADCIRC) Model: Coastal modeling simulations used the ADCIRC v55, NAVD88 2009.55 coupled with the Simulating WAVes Nearshore (SWAN) model to develop storm surge elevations, wave heights, and wave periods. A suite of 36 synthetic tropical storms were conducted using the CSTORM modeling framework (Massey et al., 2011) and run using the Onyx supercomputer as part of the Department of Defense (DoD) High Performance Computing Modernization Program (HPCMP). ADCIRC statistics were computed using MATLAB code developed by ERDC. The coastal modeling process is discussed in more detail in Section 13 of Appendix E: Hydrologic & Hydraulics.

Sea Level Rise

To evaluate potential future changes in project performance due to relative sea level change, ER 1100-2-8162 requires planning studies and engineering designs to be formulated and evaluated considering all possible rates of Sea Level Change (SLC): low, intermediate, and high. The ER directs to the USACE Sea Level Change Curve Calculator online tool to develop the three rates. For the high-subsidence area of coastal Louisiana, the Sea-Level Calculator for Non-NOAA Long-Term Tide Gauges was used specifically, results may be seen in Figure 5-8. It should be noted the base year used for the Sea-Level Calculator is the designated base year for the project, year 2032. The tool then extends the RSLC scenarios to the 100-year adaptation time horizon, year 2132. After comparing and evaluating the rates determined by the calculator, the PDT determined that the 'intermediate' rate of sea level rise (SLR) should be used in this study for future conditions model runs in the analysis of alternatives. This topic is discussed further in Section 4.4.2.2 of Appendix E: Hydrologic & Hydraulics.

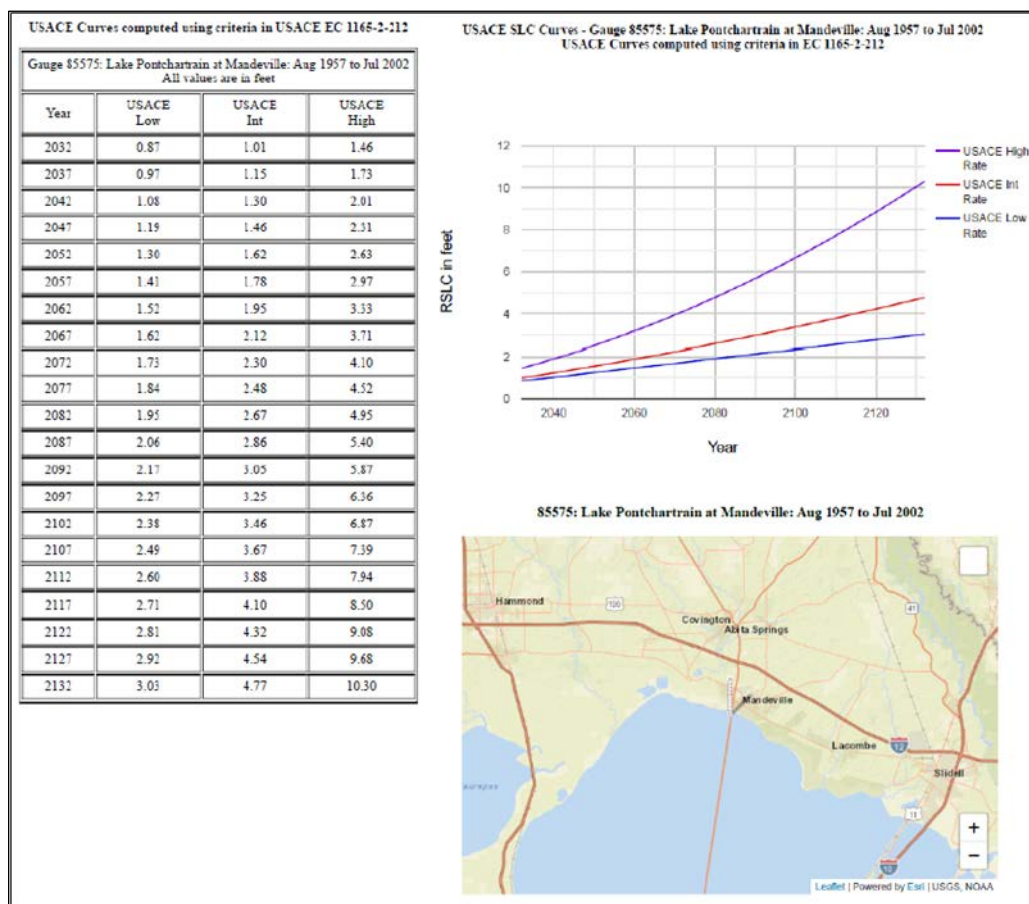


Figure 5-8. USACE Sea Level Change Curves

Impacts of varying rates of SLR can be seen further inland in locations of major waterways described in Section 3, which act as a conduit for fluctuating water surface elevations (WSEs) in Lake Pontchartrain. For example, upstream on Bayou Liberty at the Hwy 190 crossing (approximately 4.5 miles inland), there is a 0.15 foot difference in maximum WSE between low SLR (LSLR) and high SLR (HSLR) for the 100-year 2082 event. For the 10-year event, the impacts of SLR would be felt further inland, this can be seen in the H&H report, Figure E: 14- 8, which depicts the existing condition SLR difference map for the 10-year event. WSEs would be impacted for the 10-year event, from the coastline to I-12 crossing along Bayou Liberty and Bayou Bonfouca.

Relative Sea Level Change

Global, or eustatic, sea level rise and regional subsidence have affected the study area and are projected to continue affecting the area. Together, these two processes are referred to as “relative sea level change” in USACE guidance (USACE ER 1100-2-8162; EP 1100-2-1). River basins in St. Tammany Parish eventually drain to Lake Pontchartrain. Higher sea levels in the future reduce the hydraulic gradient which somewhat slows the drainage of storm runoff, increasing flooding levels from the same amount of rain. USACE guidance

provides a low, intermediate, and high rate to use for project evaluation. The intermediate rate was selected for use in the alternative evaluation phase. For planning purposes, this study assumed a project completion, or base, year of 2032. The end of the 50-year planning horizon would be 2082. Calculated changes in relative sea level by the year 2032 are 0.5 feet for the Mandeville gage and 0.4 feet for the Rigolets gage. Calculated changes in relative sea level by the year 2082 are 2.2 feet for the Mandeville gage and 1.7 feet for the Rigolets gage. These values were added on to the established downstream boundary conditions.

Alternative 1: No Action Plan

Without federal action, the current trends for riverine flooding and coastal storm surge would continue to adversely impact the area.

Recommended Plan - Nonstructural Plan (Alternative 2) and West and South Slidell Levee and Floodwall System (Alternative 6c)

Nonstructural Plan (Alternative 2)

Implementation of the NS plan would not result in direct or indirect impacts to hydrology and hydraulics.

West and South Slidell Levee and Floodwall System (Alternative 6c)

St. Tammany New Alignment and Changes to With-Project Modeling:

After the selection of the Draft TSP and during feasibility-level design, the PDT considered minor shifts of the alignment for various considerations, also referred to as optimization. This process is described in more detail in Section 4.4. Some shifts were accepted and incorporated into the final engineering analysis. The change of the new alignment was minor enough (within the distance of one ADCIRC element) to not re-run the suite of ADCIRC storms.

HEC-RAS With-Project Analysis: As previously stated, three different HEC-RAS model geometries were generated in NAVD88: without-project, with-project with pumps, and with-project with gates. The without-project geometry contains no structural projects identified in the RP. Both with-project geometries have all structural projects outlined in the RP, and a description of how they were modeled is outlined in the following sections of this FIFR-EIS. Two with-project geometries were needed because Alternative 6c3, the CSRM levee, required independent modeling of the pumping complexes and water control structures to properly size those elements of the system.

South Slidell and West Slidell Levee and Floodwall System: The RP for the levee and floodwall system consists of a combination of portions of the West Slidell levee alignment proposed in Alternative 5 and the South Slidell levee alignment proposed in Alternative 6. The two alignments would be connected by a new railroad gate across the existing Norfolk Southern Railway Corp. tracks. The initial draft of the levee and floodwall system was further refined/optimized after additional modeling, and PDT, agency and public comments to create

the RP. The RP alignment for the levee and floodwall system consists of a total of approximately 18.5 miles (96,950 feet) of levee and floodwall, with approximately 15 miles (79,100 feet) of levees constructed in separate (non-continuous) segments, and 3.4 miles (17,850 feet) of separate (non-continuous) segments of a floodwall. Refer to Figure 5-9 for the levee alignment. The RP also consists of pump stations, floodgates, vehicular floodgates, and ramps.

W-14 Floodgate/Pump Station: A new floodgate and pump complex would be required at the intersection of the Slidell Levee alignment and the W-14 canal. The 10-year flow used for capacity of pump station design is 1,200 cfs.

Schneider Canal Pump Complex: There is a pumping station at the intersection of Schneider Canal and the proposed levee alignment, which was constructed by the city of Slidell. The 1990 USACE Schneider Canal, Slidell, LA Hurricane Protection Reconnaissance Report previous report identified a capacity of 100 cfs. It is important to note that the Schneider Canal pump station was constructed by the City of Slidell at a capacity of 850 cfs. It is unlikely that additional capacity is needed there. The existing pump station does not have fronting protection, but that need has been identified in the ongoing USACE Southeastern Louisiana, Louisiana Project (SELA) Schneider Canal hurricane protection study.

Drainage Features Associated with Slidell Levee: Interior drainage estimates were performed for alternative analysis to provide estimated capacities for hydraulic infrastructure for other disciplines' analysis. No in-depth interior drainage modeling has been completed for this phase of the study.

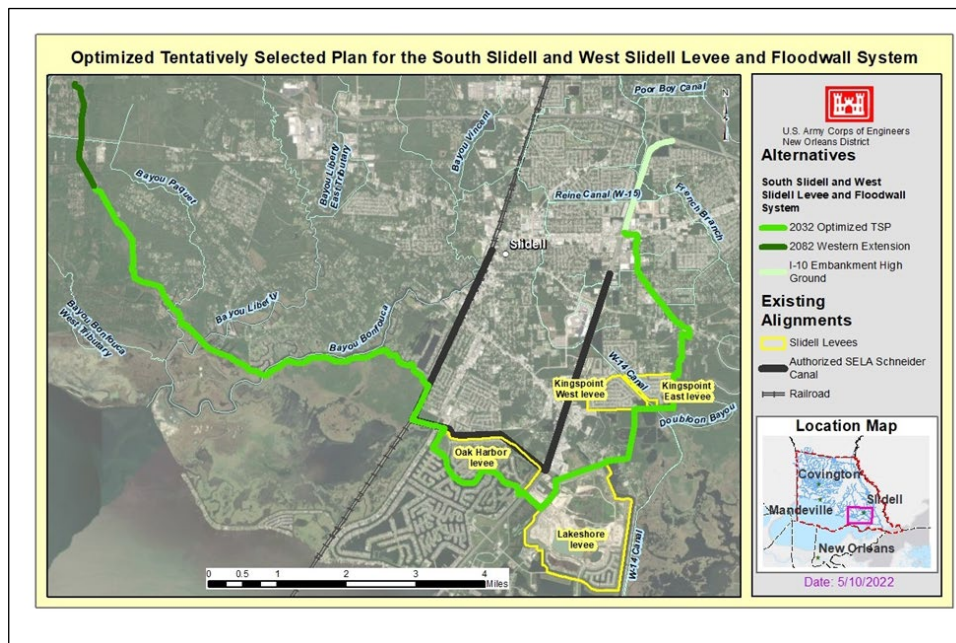


Figure 5-9. Optimized TSP for South Slidell and West Slidell Levee and Floodwall System

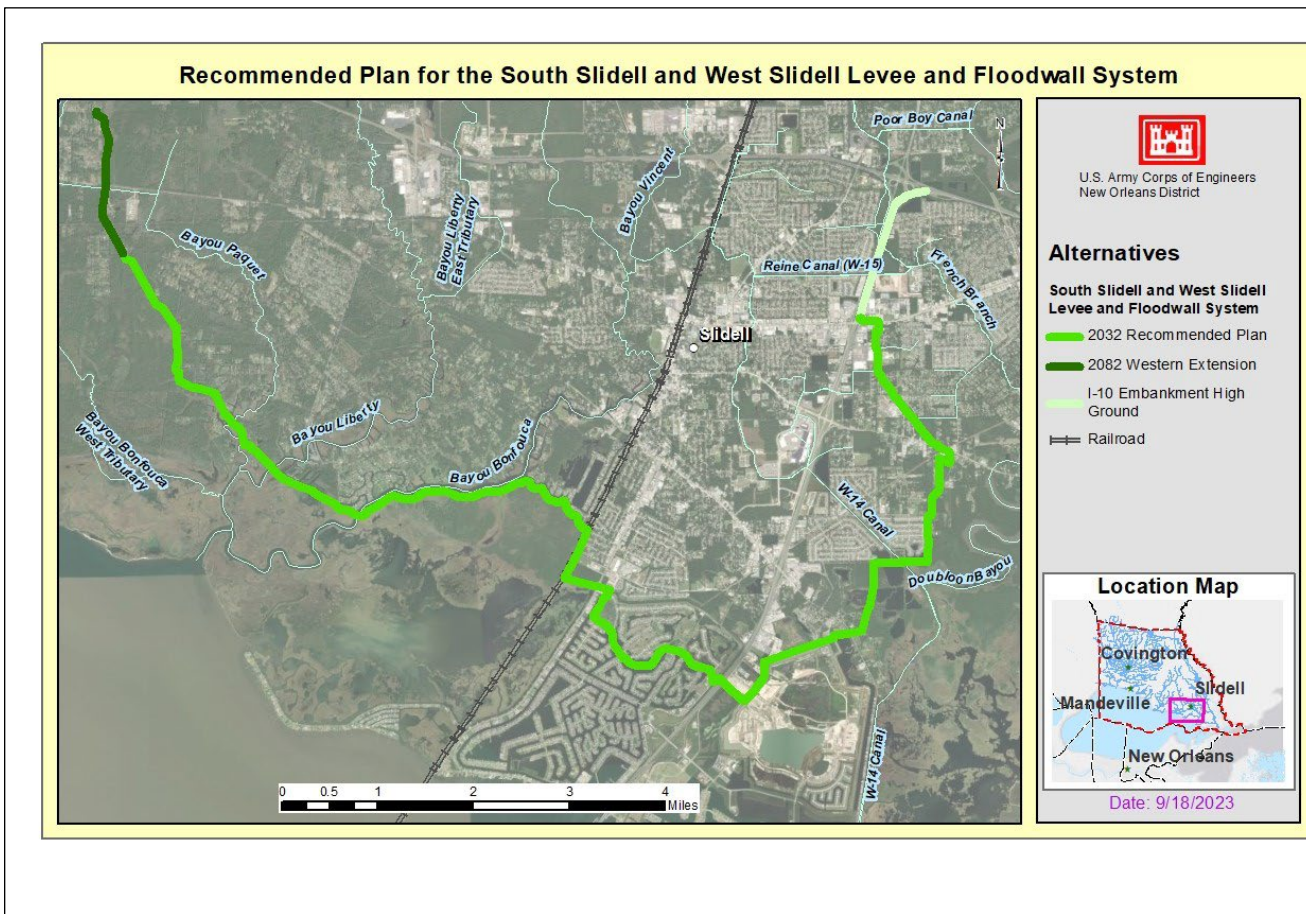


Figure 5-10. Recommended Plan for the West and South Slidell Levee and Floodwall System

West and South Slidell Levee and Floodwall System Modeling Results

ADCIRC modeling of the RP alignment for the 1 percent AEP water levels on the floodside of the alignment estimated “negligible” water surface level increases for 2032 (up to 2” for 100-year and up to 4” for 500-year) and for 2082 (up to 3” for 100-year and up to 5” for 500-year). The larger water surface elevations are on the east side of the proposed alignments with the largest being on the east side of Lakeshore Estates and Kingspoint levees up to 4 inches. The estimated impacts on the eastern side of the system are expected as these areas are closer to the Gulf of Mexico where storm surge would enter the Lake Pontchartrain basin via Rigolets. See Figure 5-11 for the difference plot of water surface elevation between 2032 with- and without-project values for the 100-year computed Water Surface Elevation (in inches) for coastal surge events at various locations surrounding the footprint. HEC-RAS modeling of the alignment related to riverine and rainfall inputs was also conducted and the results are presented in Appendix E: H&H and Figure 5-12. Further analysis of interior

drainage to handle landside runoff will be conducted in PED, refined designs will minimize interior increases in water surface elevation.

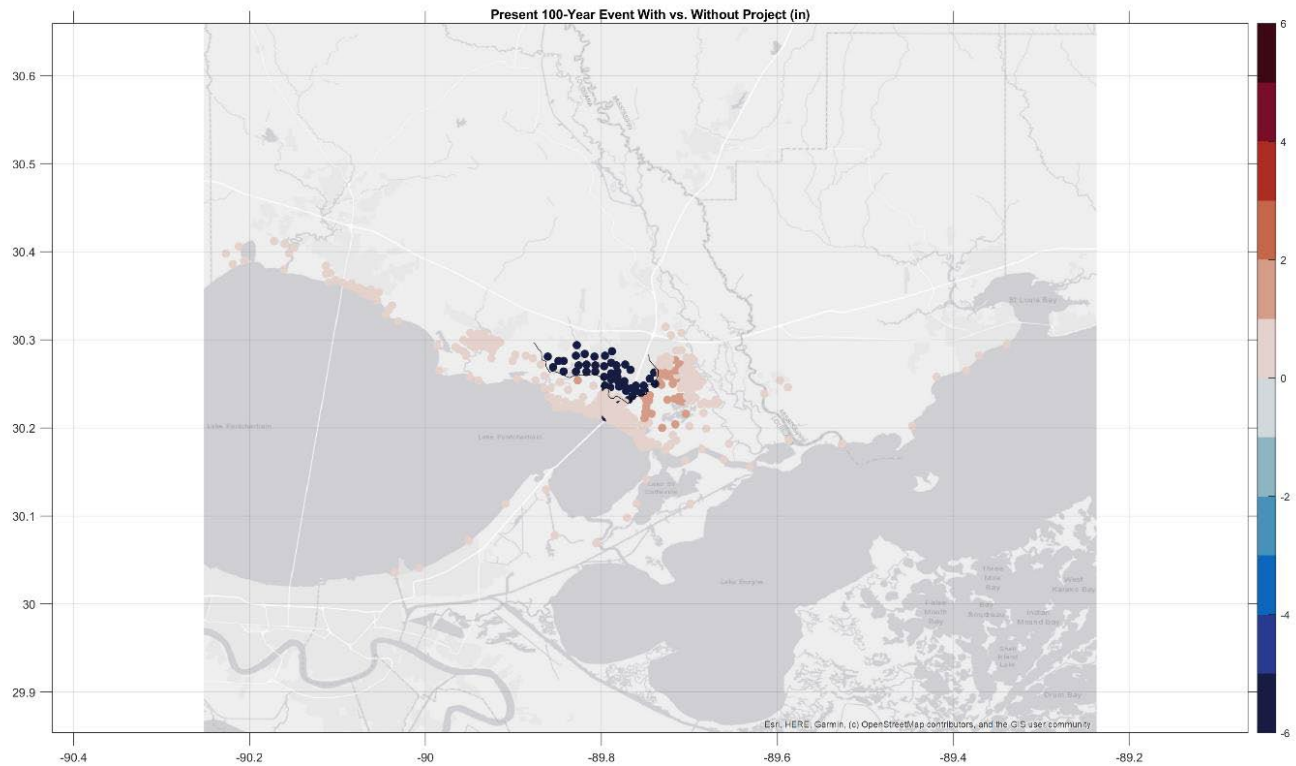


Figure 5-11. Difference plot of WSE between 2032 with- and without-project values for the 100-year computed WSE (in inches) at various locations surrounding the footprint of the levee and floodwall system. Blue-colored dots represent modeled reductions with the project in place, on the interior of the proposed system. Red dots represent potential increases.

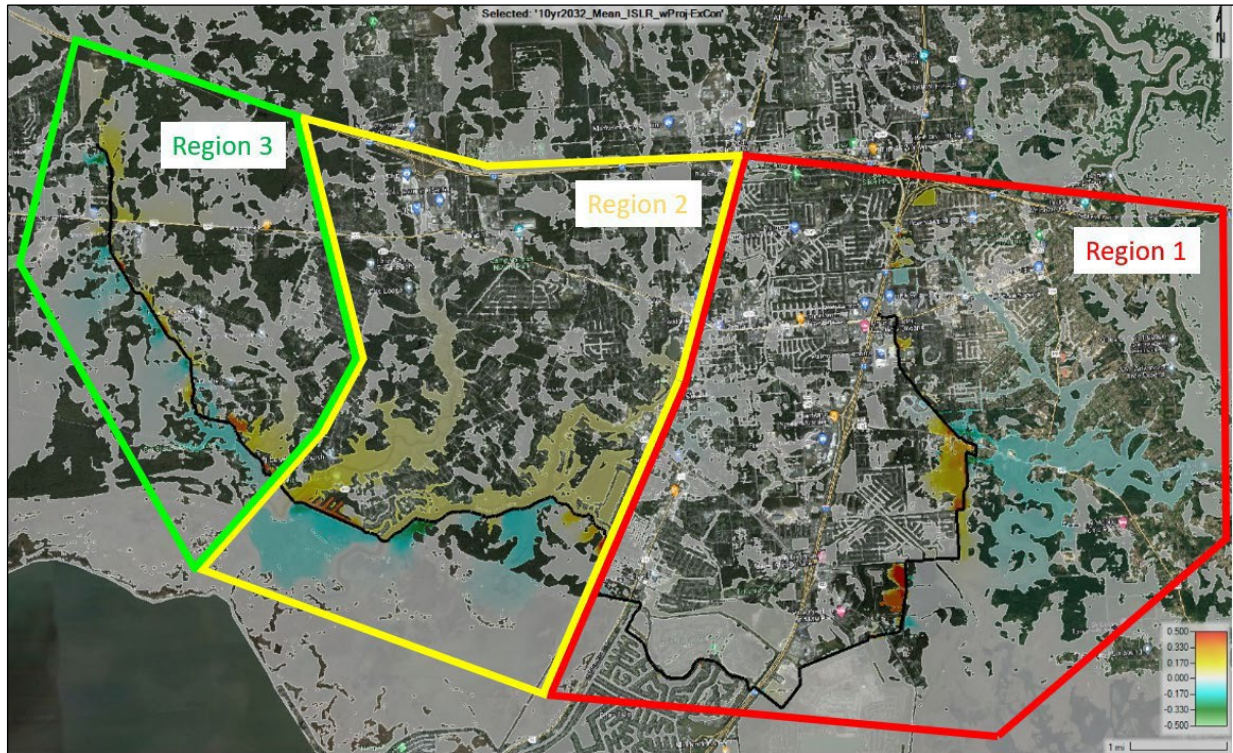


Figure 5-12. Riverine and Rainfall Modeling Results-10yr 2032 Event Difference Map Depicting WSE Increases and Lowering's for the Intermediate Rate of SLR and Mean Inflows on the Bogue Chitto River and Pearl River

HEC-RAS Modeling – Coincident Rainfall and Sea Level Rise Analysis

As discussed in the Climate Assessment, Appendix E: Hydrologic & Hydraulics Section 11, the low, intermediate, and high rates of sea level rise were all modeled in conjunction with the frequency inflows to ensure the PDT can properly evaluate impacts of sea level rise and coincident flood impacts of rainfall. The downstream boundary stages used in the SLR analysis for low, intermediate and high can be reviewed in Table E: 12-2 of Appendix E: Hydrologic & Hydraulics. To evaluate the impact of sea level rise, the RAS model domain was split into an East and West region with the unincorporated community of Lacombe, Louisiana, as the separating boundary.

East of Lacombe, LA

To conclude the analysis east of Lacombe, LA, study area contains the Pearl River Basin along with other larger waterways including Bayou Bonfouca, Bayou Liberty, and W-14 Canal. In order to evaluate the extent that SLR impacts the region, a difference grid is generated comparing the high and low rates of SLR for the 10-year and 100-year, 2032 and 2082 events for the with and without project production runs. Figures in Appendix E: Hydrologic & Hydraulics Annex C take the HSLR WSE output minus the LSLR WSE output,

resulting in a map layer displaying the WSE difference between the two SLR conditions. These difference grids are generated for both the coincident frequency and the mean inflows for the two upstream boundary conditions (Pearl River and Bogue Chitto).

The impacts of SLR with coincident frequency inflows on the Eastern side of the parish are exhibited from the coastline of Lake Pontchartrain inland approximately 4-6 miles, and varies along the extent of the coastline. In general, the impact zone of SLR remains south of I-12 along the Eastern side of the parish coastline for the 10-year and 100-year runs. Impacts of varying rates of SLR can also be seen further inland in locations of major waterways listed above, which act as a conduit for fluctuating WSEs in Lake Pontchartrain. For example, upstream on Bayou Liberty at the Hwy 190 crossing (approximately 4.5 miles inland), there is a 0.15 foot difference in maximum WSE between LSLR and HSLR for the 100-year 2082 event. For the 10-year event, the impacts of SLR will be felt further inland, this can be seen in Figure 5-13, which depicts the existing condition SLR difference map for the 10-year event. WSEs will be impacted for the 10-year event, from the coastline to I-12 crossing along Bayou Liberty and Bayou Bonfouca.

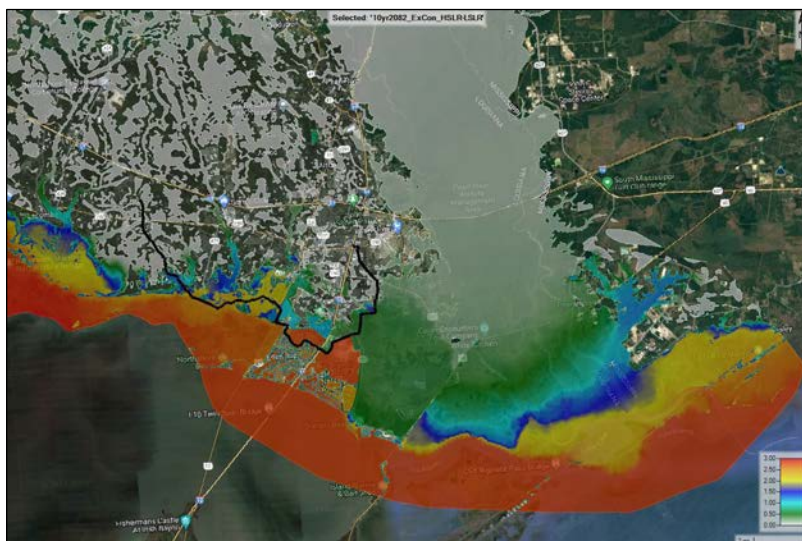


Figure 5-13. 10yr 2082 Event Existing Condition HSLR-LSLR with Coincident Frequency Inflows on Pearl River and Bogue Chitto River

The differences in performance of the 2032 (baseline) runs compared to the 2082 (future) runs is also assessed. It is found that for the 10-year event, baseline runs where the model domain is over solid land, the WSE difference between the HSLR and LSLR scenario ranges from 0 foot-0.4 foot (refer to Annex C for visual aid). For the corresponding 10-year future runs where the model domain is over solid land, the WSE difference between the HSLR and LSLR scenario ranges between 0 foot-3 foot. This is consistent between existing conditions and with-project runs, and that relationship will be discussed further below. For the 2082 runs, a larger portion of the Pearl River Basin floodplain exhibits impact from varying levels of SLR in comparison to the 2032 runs. Overall, it may be concluded that the 2032 runs are not as sensitive to varying rates of SLR as compared to the 2082 runs. This indicates that

the backwater effects of higher downstream boundaries for the future condition will cause greater impact to WSEs further inland.

An evaluation is also performed on the comparison of SLR impacts with respect to the with-project and existing conditions runs. Figure 5-14 depicts the 10-year 2082 event with-project simulation and can be compared to Figure 5-15 to evaluate the differences between with-project and existing conditions simulations. It is found that with the project in place, the impacts of SLR are exhibited the same extent inland as the existing conditions runs. WSE changes in similar magnitude are exhibited from the shoreline to the I-12 crossing, consistent with the existing conditions runs. This indicates that the sizing of the gate structures along the alignment at locations of waterway crossings and low-lying terrain maintains the existing conditions hydraulics in the area well. This also indicates that the presence of the levee will not aid in mitigating impacts caused by rising sea levels over time for more frequent precipitation events, such as the 10 year.

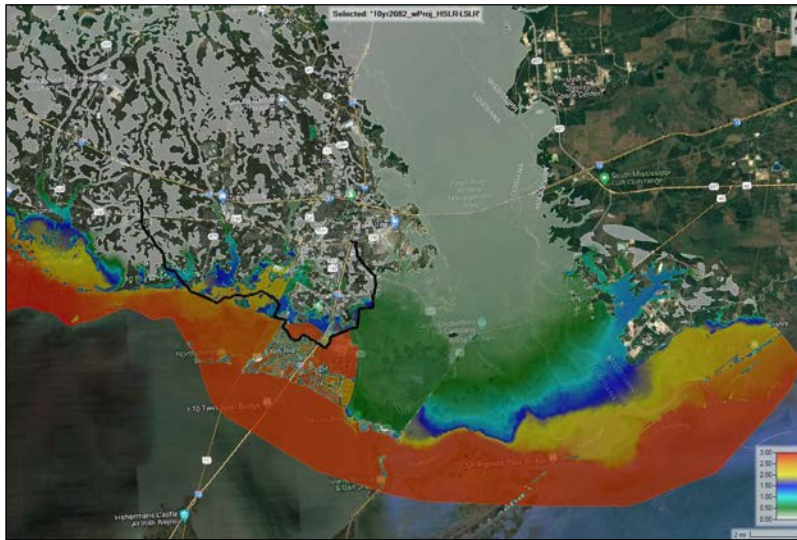


Figure 5-14. 10yr 2082 Event With-Project HSLR-LSLR with Coincident Frequency Inflows on Pearl River and Bogue Chitto River

Hydraulically, the study area performs differently to the various rates of SLR with a historic mean inflow from the Pearl River and Bogue Chitto River as compared to the coincident frequency inflows. Figure 5-15 and Figure 5-16 depict the difference in WSE between LSLR and HSLR for the 10-year 2082 event existing conditions and with-project simulations respectively. It is evident that the mean inflow runs exhibit impacts from varying rates of SLR further inland than the frequency inflow runs. For example, in the Pearl River basin, WSEs will be impacted as far as 15 miles inland. Additionally, in the Slidell area East of Norfolk Southern Railroad tracks, the WSE vary by higher magnitudes between the HSLR and LSLR simulations for the mean inflows. For the 10-year 2082 event mean inflow runs near the project area, WSE differences between the HSLR and LSLR simulations range between 0.5 foot-2.75 feet. This indicates that the Pearl River flood masks the impact of SLR to the area in the simulations. It also shows that this area is more susceptible to SLR with historically

mean inflows from the Pearl and Bogue Chitto. West of the Norfolk Southern Railroad tracks, WSEs vary from the coastline to the I-12 crossing for the 10-year 2082 event with mean Pearl River Basin inflows. This is the same distance inland as the frequency inflow runs.

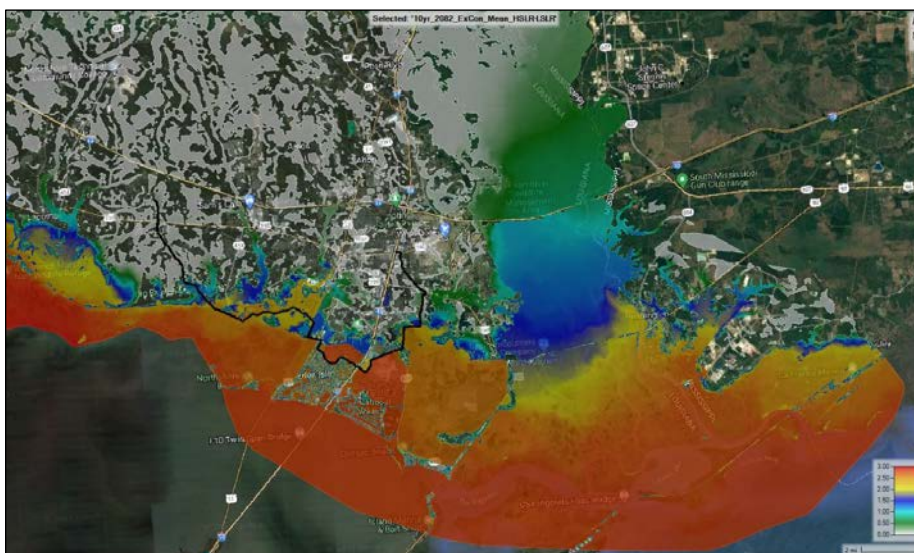


Figure 5-15. 10yr 2082 Event Existing Conditions HSLR-LSLR with Mean Inflows on the Pearl River and Bogue Chitto River

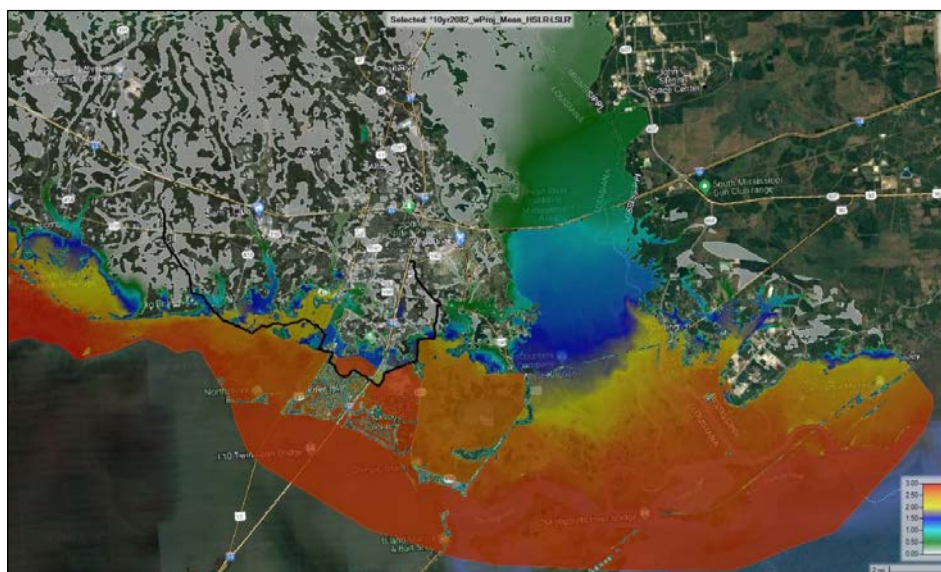


Figure 5-16. 10yr 2082 Event With-Project HSLR-LSLR with Mean Inflows on the Pearl River and Bogue Chitto River

Upon reviewing the 100-year future runs, the same conclusion may be drawn that the mean frequency inflow runs are more susceptible to SLR as compared to the frequency inflow

runs. Figure 5-17 and Figure 5-18 show the 100-year 2082 with-project runs with mean and frequency inflows respectively. It is evident that during the higher frequency events, the mean inflow runs have greater varying SLR impacts as compared to the coincident frequency inflows. The differences between the mean and coincident frequency inflows remain on the flood side of the levee alignment. Therefore, it can be concluded that unlike for the coincident frequency inflow runs, the levee does in fact aid in abating the impacts from SLR for the higher frequency events when there is a historic mean Pearl River Basin flood. This also indicates that the Pearl River flood masks the impact of SLR to the area in the simulation East of the Norfolk Southern Railroad tracks. West of the Norfolk Southern Railroad tracks, the SLR WSE differences are similar magnitude between the frequency inflow and historic mean inflow runs.

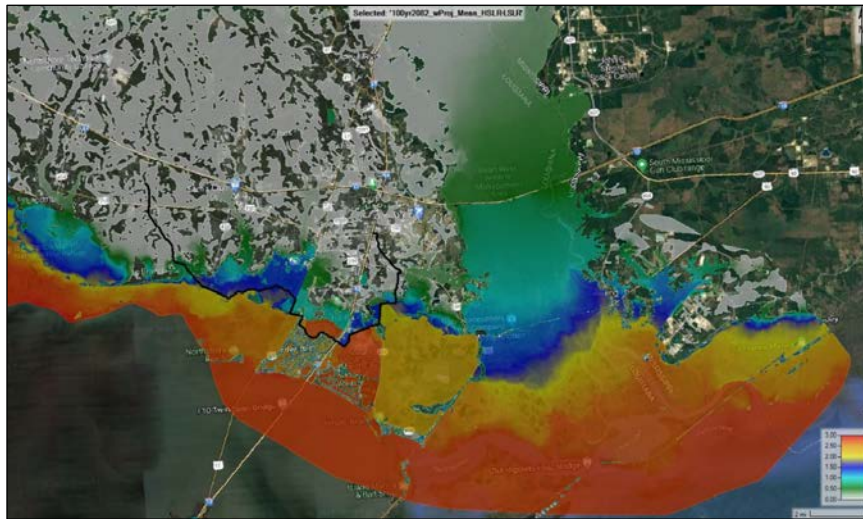


Figure 5-17. 100yr 2082 Event With-Project HSLR-LSLR with Mean Inflows on the Pearl River and Bogue Chitto River

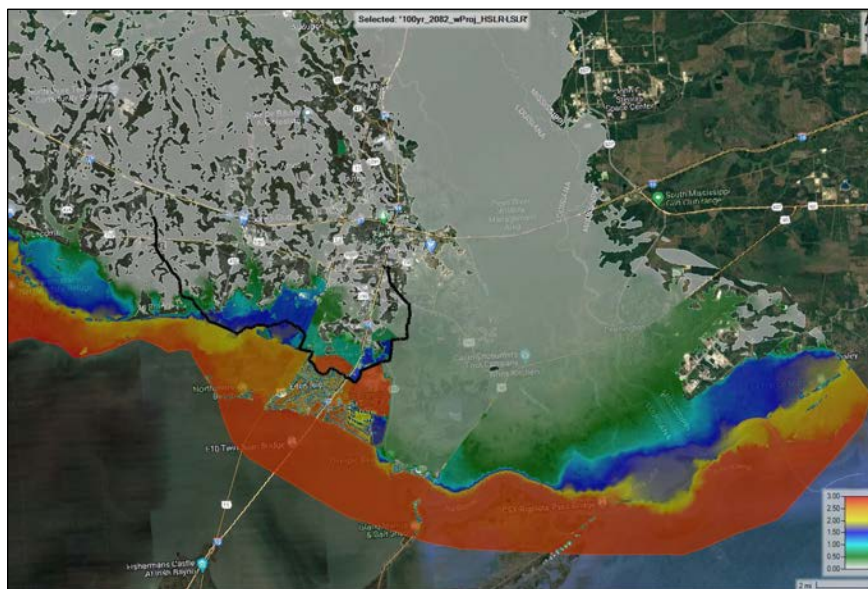


Figure 5-18. 100yr 2082 Event With-Project HSLR-LSLR with Frequency Inflows on the Pearl River and Bogue Chitto River

In conclusion, the Slidell area will be impacted in different ways when considering the various rates of SLR in conjunction with varying precipitation and Pearl River Basin flooding scenarios. This area experiences greater backwater effects and flooding for more frequent precipitation events, such as the 10-year. These backwater effects are exaggerated for the future (2082) runs as compared to the baseline (2032). This is the case for both the Pearl River Basin frequency inflows and the mean historic inflows. It is also concluded that with a mean historic Pearl River flood, the impacts to WSEs from varying rates of SLR are more exaggerated than when there are coincident frequency floods in the Pearl River Basin. Another finding for the region east of Lacombe, Louisiana, is that waterways hydraulically connected to Lake Pontchartrain act as a conduit for fluctuating WSEs in the lake, and propagate impacts from SLR further inland. Additionally, the WSE differences between the HSLR and LSLR scenarios for the with-project runs are not substantially different compared to the existing conditions runs. This indicates that the levee system will not be conducive for reducing risk associated with future rising sea levels. A full description and analysis is included in Appendix E: Hydrologic & Hydraulics.

West of Lacombe, LA: The Western region of the study area contains the Tchefuncte River and its large tributaries including but not limited to the Abita River and the Bogue Falaya. Difference grids denoting the change in maximum WSE between the HSLR and LSLR scenarios for the 10-year and 100-year, 2032, and 2082, existing condition and with-project runs for the Western region of the parish are also in Appendix E: Hydrologic & Hydraulics Annex C for review. As stated above, the difference maps for both Pearl River coincident frequency and mean runs are in Appendix E: Hydrologic & Hydraulics Annex C.

The impacts of SLR with coincident frequency inflows on the Western region of the parish are seen from the coastline of Lake Pontchartrain inland approximately 1-7 miles, and varies

along the extent of the coastline. As stated in the east of Lacombe section, the impact of SLR is viewed further inland along waterways hydraulically connected to Lake Pontchartrain. Between Lacombe and the western boundary of Mandeville, the SLR impact zone reaches a maximum of 1.8 miles inland along waterways Bayou Castine and Bayou Chinchuba. Further west, from the Tchefuncte River estuary north to the city of Covington, the impacts of SLR can be seen as far as 7 miles from the coast for the 100-year events and 8.3 miles for the 10-year events along the Tchefuncte River floodplain. This is approximately 2-3 miles north of I-12, which was the upper boundary for the impact zone of SLR on the eastern side of the parish. These findings indicate that the Tchefuncte River poses a threat in regard to rising sea levels for communities in the center of the parish, miles inland from the coast.

Similar to the eastern half of the parish, this region also exhibits impacts from SLR due to the backwater effects of Lake Pontchartrain. For example, Figure 5-19 and Figure 5-20 depict the existing condition future simulation difference between HSLR and LSLR, for the 10-year and 100-year precipitation events respectively. The impact of SLR for the 10-year event is exhibited inland to the extent of Abita Springs, Louisiana, and well into Covington, Louisiana. For the 100-year, the impacts from SLR do not make it into Covington, Louisiana. This shows that more frequent and smaller storms, such as the 10-year, are more susceptible to impacts from SLR due to backwater effects of higher stages in Lake Pontchartrain as compared to larger precipitation events.

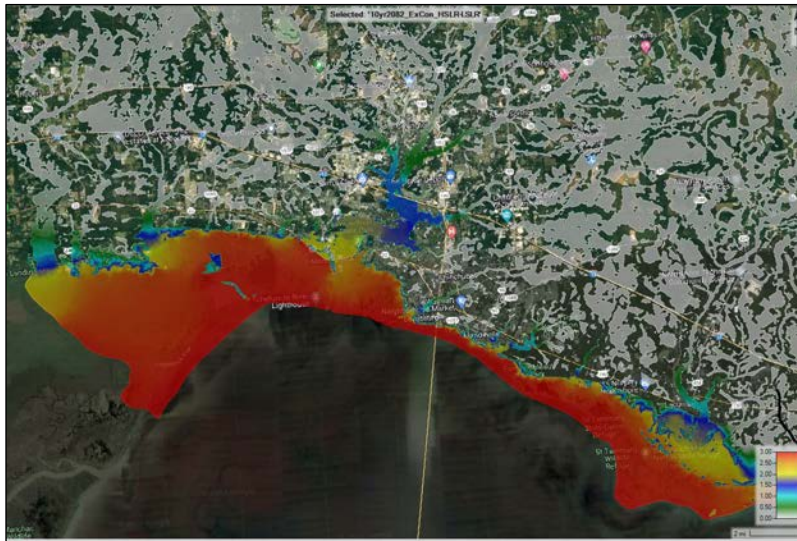


Figure 5-19. 10yr 2082 event Existing Condition HSLR-LSLR with Frequency Inflows on the Pearl River and Bogue Chitto River

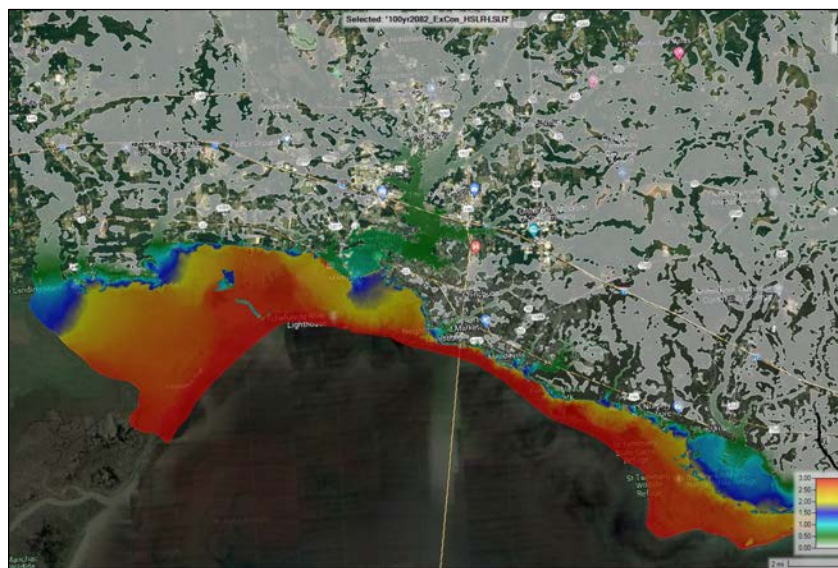


Figure 5-20. 100yr 2082 Event Existing Condition HSLR-LSLR with Frequency Inflows on the Pearl River and Bogue Chitto River

Figure 5-21 depicts the change in WSE with respect to High and Low SLR for the 10-year 2082 events for the existing conditions with-project runs, using mean inflows on the Pearl River and Bogue Chitto River. Similarly, Figure 5-22 shows the same simulations but with frequency inflows on the Pearl River and Bogue Chitto. Furthermore, upon reviewing difference maps in Annex C for the West of Lacombe, Louisiana region, the differences between the mean inflow runs and frequency inflow runs are not significant in the central portion of the parish. This indicates that the Pearl River Basin flooding impacts do not propagate west of Lacombe, Louisiana.

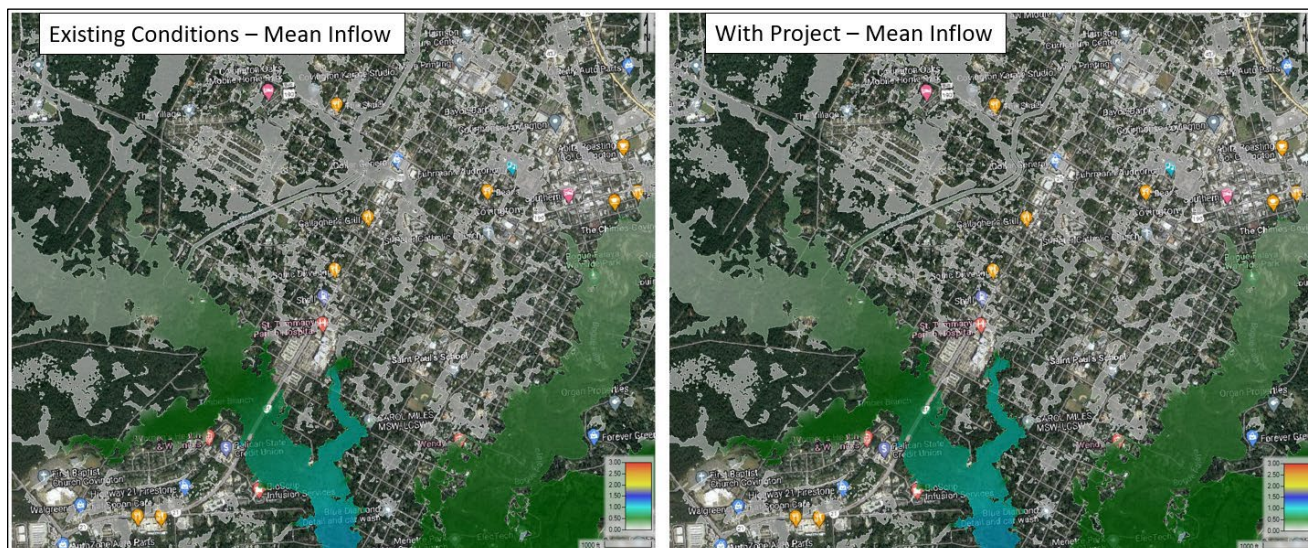


Figure 5-21. 10yr 2082 Event

Note: Existing Condition (left) and With-Project (right), depicting the change in WSE between the HSLR-LSLR simulations with mean

inflows on the Pearl River and Bogue Chitto River; zoomed into Mile Branch project area.

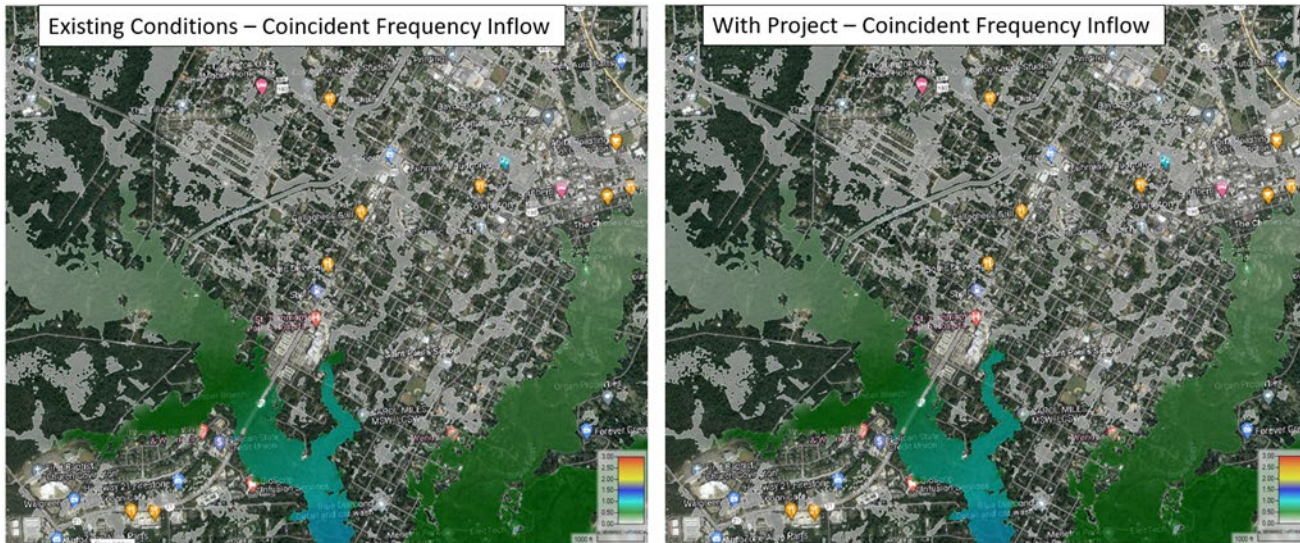


Figure 5-22. 10yr 2082 Event

Note: Existing Condition (left) and With Project (right), depicting the change in WSE between the HSLR-LSLR simulations with coincident frequency inflows on the Pearl River and Bogue Chitto River; zoomed into Mile Branch project area

5.1.1.10 Water Quality

Alternative 1: No Action Plan

Direct, Indirect, and Cumulative Impacts: No direct impacts to water quality would occur with implementation of the No Action Alternative. Indirect impacts as a result of not implementing the proposed action would be the continued degradation of water quality as the project area continues to erode as a result of flood events and human development in the project area.

Recommended Plan - Nonstructural Plan (Alternative 2) and West and South Slidell Levee and Floodwall System (Alternative 6c)

Nonstructural Plan (Alternative 2)

Direct, Indirect, and Cumulative Impacts: This alternative would not result in measurable impacts to water quality. Elevating homes that are adjacent to waterways may result in indirect impacts to water quality of the waterways by causing temporary turbidity. These impacts would be temporary and not adversely affect current water quality trends.

West and South Slidell Levee and Floodwall System (Alternative 6c)

The levee and floodwall system consists of a combination of the West Slidell levee alignment proposed in Alternative 5 and the South Slidell levee alignment proposed in Alternative 6. The two alignments would be connected by a new railroad gate across the existing Norfolk Southern Railroad tracks.

The RP alignment for the levee and floodwall system would consist of approximately 18.5 miles (97,700 feet) of levee and floodwall, which includes approximately 15 miles (79,500 feet) of levees constructed in separate (non-continuous) segments, and 3.5 miles (18,200 feet) of separate (non-continuous) segments of a floodwall. The RP consists of pump stations, floodgates, vehicular floodgates, and ramps.

The Marsh Mitigation Site (M2) is located within the BBMNWR near the confluence of Bayou Lacombe and Lake Pontchartrain. The estimated footprint of the mitigation site is 200 acres of marsh with a dike perimeter of 16,067 feet. Marsh Mitigation Site would obtain borrow material from Lake Pontchartrain to be accommodated.

Activities that would take place on the flood side of the existing and proposed levee and T-Wall alignments within Waters of the United States (e.g., navigable waterways, wetlands, etc.) would have the potential to increase turbidity, suspended sediments, Biological Oxygen Demand, and decrease Dissolved Oxygen. There would also be the potential for nutrient enrichment associated with suspended sediments during dredging and fill placement operations that could possibly lead to localized algae blooms. Localized short-term increases in turbidity could possibly lead to a temporary displacement of aquatic organisms. Where concrete pours occur adjacent to or within waterbodies for armoring to protect against erosion and scour, temporary minor impacts on water quality would occur. However, any such direct impacts would be expected to be minor and temporary.

Activities that would take place on the protected side of the existing and proposed levee would be expected to have little to no effect on water quality. Earth-moving activities during construction disturb soils and can create indirect water quality effects in the event of uncontrolled runoff or poor sediment control practices during construction. Adherence to permit requirements, best management practices (BMPs), and an approved sediment control plan by the construction contractor would minimize the risk of these indirect water quality effects.

Where wetland fill occurs, this would permanently eliminate the affected wetlands' ability to perform water quality functions, causing a major permanent impact on water quality. Fill material that would be used for levee construction would be tested in advance to eliminate placement of contaminants that could adversely affect water quality. Additionally, to help alleviate some water column impacts during construction, construction-related runoff into the wetlands and open water would be managed by construction contractors through implementation of BMPs and a SWPPP.

Water level fluctuations in the surrounding wetlands and waterbodies would continue to be regulated by water control structures, and no significant effects on normal water fluctuations would be expected to occur outside of a storm event. Furthermore, no significant alteration of salinity gradients would be expected to occur from the placement of fill material for levee construction.

There would be no anticipated permanent cumulative effects to water quality associated with these measures. As discussed previously, there would be construction-related water quality degradation that would have a temporary effect.

Mitigation Plan: Open water, broken marsh, SAVs, and mud substrate would be replaced with fresh/intermediate marsh, increasing spawning, nursery, forage and cover habitat for fisheries resources over the long term. For approximately 5 years after project construction the project area would be above daily tidal inundation and only partially vegetated, so maximum fisheries benefits would not be realized until after this 5-year period has elapsed. Turbidity during borrow excavation and fill placement would temporarily impair visual predators and would impact filter feeders, but these impacts are expected to cease after construction and benthic species would rebound once construction is complete. Temporary water quality impacts from turbidity are not anticipated to be substantial enough to cause impairment of the water body's designated uses as defined under the standards of Louisiana Administrative Code, Title 33, Part IX, Chapter 11. Water quality impacts in the fill area would temporarily add to the water quality impairment of this sub-segment, but these impacts would be minimized through best management practices and would diminish to background levels after construction.

Borrow Sources: There would be no impact to water quality resources resulting from excavation of borrow.

5.1.1.11 Air Quality

The U.S. Environmental Protection Agency (USEPA), under the requirements of the Clean Air Act (CAA), has established NAAQS for six contaminants, referred to as "criteria" pollutants (40 CFR 50). These are 1) carbon monoxide (CO), 2) nitrogen dioxide (NO₂), 3) ozone (O₃), 4a) particulate matter less than 10 microns in diameter (PM₁₀), 4b) particulate matter less than 2.5 microns in diameter (PM_{2.5}), 5) lead (Pb), and 6) sulfur dioxide (SO₂). The NAAQS standards include primary and secondary standards. The primary standards were established at levels sufficient to protect public health with an adequate margin of safety. The secondary standards were established to protect the public welfare from the adverse effects associated with pollutants in the ambient air. The primary and secondary standards are presented in Table 5-4.

The USEPA Green Book Nonattainment Areas for Criteria Pollutants (Green Book) maintains a list of all areas within the United States that are currently designated "nonattainment" areas with respect to one or more criteria air pollutants. Nonattainment areas are discussed by county or MSA. MSAs are geographic locations, characterized by a large population nucleus, that are comprised of adjacent communities with a high degree of social and economic integration. MSAs are generally composed of multiple counties. Review of the Green Book indicates that St. Tammany Parish is currently in attainment for all federal NAAQS pollutants, including the 8-hour ozone standard (USEPA 2019). This classification is the result of area-wide air quality modeling studies. Therefore, further analysis required by the CAA general conformity rule (Section 176(c)) is not required.

Table 5-4. Primary and Secondary NAAQS for the Six Contaminants Established by EPA

National Ambient Air Quality Standards [3][4]				
	Primary Standard		Secondary Standard	
Criteria Pollutant	Concentration Limit	Averaging Time	Concentration Limit	Averaging Time
Carbon monoxide	9 ppmv (10 mg/m³)	8-hour ⁽¹⁾	None	
	35 ppmv (40 mg/m³)	1-hour ⁽¹⁾		
Sulfur dioxide	0.03 ppmv (80 µg/m³)	Annual (arithmetic mean)	0.5 ppmv (1300 µg/m³)	3-hour ⁽¹⁾
	0.14 ppmv (365 µg/m³)	24-hour ⁽¹⁾		
Nitrogen dioxide	0.053 ppmv (100 µg/m³)	Annual (arithmetic mean)	Same as primary	
Ozone	0.075 ppmv (150 µg/m³)	8-hour ⁽²⁾	Same as primary	
	0.12 ppmv (235 µg/m³)	1-hour ⁽³⁾	Same as primary	
Lead	0.15 µg/m³	Rolling 3-month average	Same as primary	
	1.5 µg/m³	Quarterly average	Same as primary	
Particulate Matter (PM ₁₀)	150 µg/m³	24-hour ⁽⁴⁾	Same as primary	
Particulate Matter (PM _{2.5})	15 µg/m³	Annual ⁽⁵⁾ (arithmetic mean)	Same as primary	
	35 µg/m³	24-hour ⁽⁶⁾	Same as primary	

(1) Not to be exceeded more than once per year.

(2) The 3-year average of the fourth-highest daily maximum 8-hour average at each monitor within the area over each year must not exceed 0.075 ppmv.

(3a) The expected number of days per calendar year with maximum hourly averages above 0.12 ppm must be equal to or less than 1.

(3b) As of 15 June 2007, the U.S. EPA revoked the 1-hour ozone standard in all areas except for certain parts of 10 states.

(4) Not to be exceeded more than once per year on average over 3 years.

(5) The 3-year average of the weighted annual mean PM_{2.5} concentrations from single or multiple community-oriented monitors must not exceed 15 µg/m³.

(6) The 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within the area must not exceed 35.5 µg/m³.

Alternative 1: No-Action Plan:

With implementation of this alternative, no direct or indirect impacts to air quality would occur.

Recommended Plan - Nonstructural Plan (Alternative 2) and West and South Slidell Levee and Floodwall System (Alternative 6c)

Nonstructural Plan (Alternative 2)

With the implementation of this alternative there would be adverse, short-term, direct and indirect impacts to air quality from pollution associated with construction equipment. Additional effects may also arise from an increase in traffic required to deliver equipment, materials, and construction workers to the area. However, due to the short duration of the construction work, any adverse impacts to 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. Once all construction activities associated with the construction work cease, air quality within the vicinity would be expected to return to pre-construction conditions. Thus, the ambient air quality in St. Tammany Parish would not change from current conditions, and the status of attainment for the parishes would not be altered.

West and South Slidell Levee and Floodwall System (Alternative 6c)

With the implementation of this alternative there would be adverse, short-term direct and indirect impacts to air quality from noise and pollution. Additional effects may also arise from an increase in traffic required to deliver equipment, materials, and construction workers to the area. However, due to the short duration of the construction work, any adverse impacts to 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. Once all construction activities associated with the construction work cease, air quality within the vicinity would be expected to return to pre-construction conditions. Thus, the ambient air quality in St. Tammany Parish would not change from current conditions, and the status of attainment for the parishes would not be altered.

Similar impacts would be expected from construction of the mitigation sites M-2 and PSR-01. Regular controlled burns of the pine savanna mitigation site would occur over a period of several days that would result in temporary short-term adverse impacts to ambient air quality. Once the controlled burns are complete air quality within the vicinity would be expected to return to pre-burn conditions. Cumulative effects would be similar. Apart from the short-term effects, the ambient air quality in St. Tammany Parish would not change from current conditions, and the status of attainment for the parishes would not be altered.

Borrow Sources: There would be temporary minor impacts to air quality resources as result of borrow excavation, the action would add additional impact by obtaining material from existing operating pits or sites that have been previously cleared and are designated as borrow sites as described in 5.2 and previously for Alternatives 2, 6, and 8.

5.1.1.11.1 Greenhouse Gas

The Council of Environmental Quality (CEQ), CEQ-2022-0005, on 09 January 2023 introduced the interim guidance on Greenhouse Gas (GHG) and how agencies are able to compute GHG and the social cost for their projects. USACE, in coordination with USACEHQ, developed a methodology to analyze the components for GHG and incorporate them within National Environmental Policy Act (NEPA) documents. The components that are analyzed within GHG are Carbon dioxide (CO₂), Methane (CH₄), and Nitrous Oxide (N₂O) (Figure 5-23). Primary sources of CO₂ can be natural sources like decomposition of organic material and anthropogenic sources like burning of fossil fuel (Carbon Dioxide 101, 2023). For CH₄, emissions can come from a variety anthropogenic process including flora and fauna sources (Crutzen etc all, 1986). For N₂O, majority of the point source revolves around agricultural processes: fertilization (Nitrous Oxide Emissions, 2023). For GHG, CO₂ is the primary contributor to GHG and climate change, followed by CH₄ and N₂O. The pie graph below outlines the total U.S. emissions of 2021 showing that over 75 percent of GHG is CO₂ (Overview of Greenhouse, 2023).

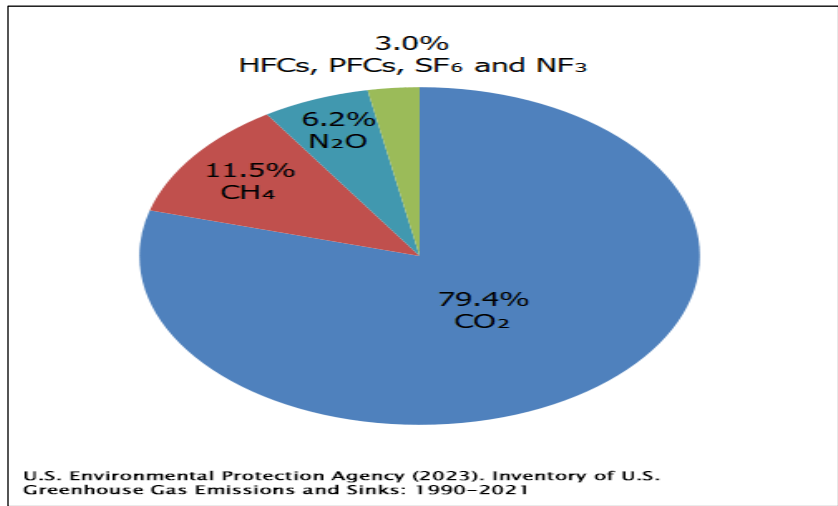


Figure 5-23. Inventory of U.S. Greenhouse Gas Emissions and Sinks.

Within this evaluation, two alternatives for the St. Tammany Parish Feasibility Study (STPFS) were considered for GHG emission evaluation: No Action and Proposed Plan (RP). The GHG emissions were calculated using the type, quantity, horsepower, total hours, and associated emission factors of the equipment (e.g., boats pushing the equipment and the excavators placing the stone). The social cost of greenhouse gas emissions (SC-GHG) were calculated for each project alternative by summing the individual emissions from the major greenhouse gas pollutants CO₂, CH₄, and N₂O, and then multiplying by the social cost of each pollutant for the year in which they were generated using the tables from the Interagency Working Group on Social Cost of Greenhouse Gases (IWGSC) report as established by Executive Order 13990 to provide interim updated social costs values, with a 3 percent discount rate (IWG 2021).

Alternative 1: No Action Plan

There would be no direct emissions from construction activities for STPFS, but there would be emissions if the project was not constructed. The emissions would be from the worst-case scenario for the project area: a 100-year flood event. If the proposed plan is not constructed in a 100-year flood event, it is estimated that roughly 12,000 residential structures and 2,000 non-residential structures would be impacted. For computing GHG emissions for the FWOP, evacuation of residents and business owners, emergency response to the flood event, and repair of impacted areas were evaluated. Table 5-5 outlines the potential GHG emissions if a 100-year flood event were to occur.

Table 5-5 Total GHG Emissions No Action (metric tons)

Total GHG Emissions (metric tons)				
Emissions	CO ₂	CH ₄	N ₂ O	CO _{2eq}
Total (metric tons)	68672.006	13.819	410.555	191823.864

Recommended Plan - Nonstructural Plan (Alternative 2) and West and South Slidell Levee and Floodwall System (Alternative 6c)

There would be direct emissions from construction activities for STPFS. The different components for the construction of the STPFS were evaluated: Construction of STPFS, Operation and Maintenance (O/M) of Levees, Construction of Mitigation, and Controlled burns. The data presented is merely an example of what GHG emissions could result from the RP.

A. Construction of STPFS structural measures (Includes Borrow excavation):

Table 5-6 outlines the potential GHG emissions for the construction of the STPFS levees and floodwalls and mitigation features. The data within the table includes the usage of a variety of different equipment that would be used to construct the features of the RP.

Table 5-6 Total GHG Emissions from Construction Activities (metric tons)

Total GHG Emissions from Construction Activities (metric tons)				
Emissions	CO ₂	CH ₄	N ₂ O	CO _{2eq}
Total (metric tons)	1825.888802	154.9621911	19.02173131	11368.41951

The loss of carbon sequestration (which reduces GHG in the atmosphere) due to loss of natural habitat was computed by using the Environmental Protection Agency Greenhouse Gases Equivalencies Calculator Carbon Sequestered in One Year by 1 Acre of Average U.S. Forest: -0.84 metric ton CO₂/acre/year (Greenhouse Gas Equivalencies Calculator,

2023). This number was multiplied by the total assumed impacted acres, 227 acres, resulting in -190.68 metric tons.

The total metric tons from the construction efforts were multiplied by 50 to determine the impacts the construction efforts would have for the 50 year period of analysis resulting in 9,534 metric tons of CO₂.

B. Flood Proofing (NS) Measures

Table 5-7 outlines the potential GHG emissions for the NS option. This evaluation includes approximately 6,410 structures that would be part of the RP. The data presented within the below table is merely an example of what GHG emissions could result from the flood proofing measures.

Table 5-7 Total GHG Emissions from Flood Proofing (Metric Tons)

Total GHG Emissions from Flood Proofing (Metric Tons)				
Emissions	CO ₂	CH ₄	N ₂ O	CO _{2eq}
Total Houses	593.5819685	0.344013744	111.2053513	11555.89057

C. A–RP Operation/Maintenance (O/M) of Levees:

Table 5-8 outlines the potential GHG emissions for the O/M of the proposed levees. O/M efforts involve the usage of tractors and string trimmers.

Table 5-8 Total GHG Emissions from O/M (metric tons)

Total GHG Emissions from O/M (metric tons)				
Emissions	CO ₂	CH ₄	N ₂ O	CO _{2eq}
Total (metric tons)	363.5811731	0.016486727	1.034576002	691.741101

RP Mitigation Sites (Beneficial and adverse effects to GHG)):

RP Marsh Creation (M-2)

It is proposed that approximately 200 acres of fresh and intermediate marsh habitat will be created to compensate for unavoidable wetland impacts from the construction. The creation of the marsh was computed by using the Environmental Protection Agency Greenhouse Gases Equivalencies Calculator Carbon Sequestered in One Year by 1 Acre of Average U.S. Forest: 0.84 metric ton CO₂/acre/year (Greenhouse Gas Equivalencies Calculator, 2023). The number was multiplied by the total assumed acres of marsh creation, 200 acres, resulting in 168 metric tons of carbon sequestered.

The total metric tons from the mitigation efforts were multiplied by 50 to signify the impacts the mitigation efforts would have on the project for 50 years resulting in -8,400 metric tons of CO₂.

–RP PSR-01 Pine Savanna Controlled Burns:

It is proposed that within the Refuge Pine Savanna Site that control burns will be used to eradicate invasive plants/ trees. This effort is estimated to occur every 3 to 5 years for 50 years. The site is roughly 50 acres. To compute this GHG emission, EPA's Emission Factors for the Southern region (Region 6) was used to compute the CH₄ (242 kg/Hectare) and N₂O (40 kg/Hectare) (Clearinghouse for Emission Inventories and Emissions Factors, 2023). (Note that 1 hectare = ~2.47 acres.) Both CH₄ and N₂O were converted to tons/acre and then multiplied by the total potential impacted area: 50 acres. This resulted in 5.395 metric tons for CH₄ and 0.89 metric tons for N₂O. To compute the CO₂, the EPA's Greenhouse Gas Equivalencies Calculator was used to estimate the potential CO₂ released for control burning: 150 metric tons (Greenhouse Gas Equivalencies Calculator, 2023). The onetime emissions were then multiplied by the number of occurrences of the controlled burns: 10. This resulted in 53.95 metric tons of CH₄, 8.9 metric tons of N₂O, and 1500 metric tons of CO₂.

Comparison of Alternative 1: No Action and RP:

The total of the two alternatives within this analysis were compared in Table 5-9. Social cost was computed for both of the alternatives.

Table 5-9. Total GHG Emissions by Project Alternative (metric tons) and Total Social Costs of Greenhouse Gases (2027 Dollars)

Total GHG Emissions by Project Alternative (metric tons)				
Emission	CO ₂	CH ₄	N ₂ O	CO ₂ e
No-Action Alternative	68672.0 ₁	13.82	410.56	191823.86
RP	2419.47	155.31	130.23	22924.31
RP with Mitigation	3553.47	154.96	19.02	13096.00
RP with Maintenance of Levee and Mitigation	3917.05	154.98	20.06	13768.30
RP with Maintenance of Levee, Mitigation and Controlled Burns	5417.05	208.93	28.96	19269.25
Total Social Costs of Greenhouse Gases (2027 Dollars)				
Emission	CO ₂	CH ₄	N ₂ O	Total
No-Action Alternative	\$4,051,648.33	\$24,873.69	\$8,621,665.22	\$12,698,187.23
RP	\$142,748.78	\$279,551.17	\$2,734,768.73	\$3,157,068.68
RP with Mitigation	\$209,654.78	\$279,551.17	\$2,734,768.73	\$3,223,974.68
RP with Maintenance of Levee and Mitigation	\$231,106.06	\$278,931.94	\$399,456.36	\$909,494.37
RP with Maintenance of Levee, Mitigation, and Controlled Burns	\$319,606.06	\$376,071.62	\$608,082.45	\$1,303,760.14

5.1.1.12 Hazardous, Toxic, and Radioactive Waste (HTRW)

USACE policy is to avoid the use of project funds for Hazardous, Toxic, and Radioactive Waste (HTRW) removal and remediation activities. See ER 1165-2-132 HTRW Guidance For Civil Works Projects (26 June 1992), and the American Society for Testing and Materials (ASTM) E 1527-13, Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process (ASTM, 1997). Pursuant to USACE policy, potential HTRW concerns are to be identified early and construction in HTRW-contaminated areas is to be avoided to the extent practicable. Residential structures that are 4 units or less are exempt from asbestos and lead abatement regulations unless they are being demolished, which will not occur under the NS Plan since the acquisition or buy-out of properties is not included in the Optimized TSP.

An American Society for Testing and Materials (ASTM) Phase I Environmental Site Assessment (ESA) and asbestos investigation site reconnaissance was conducted on 1-22 October 2021 to assess the potential for HTRW materials within the footprints for each of the alternatives in the Final Array of Alternatives.

A second updated ASTM Phase I ESA for the Optimized TSP was completed on 8 March 2023. See Appendix C: Environmental for the full report. The March 2023 ESA determined that there is a low probability of encountering HTRW during construction of the Optimized TSP including the borrow sites. The Phase I ESA included the following tasks: 1) the review of HTRW Phase I Environmental Database Review Corridor Reports and state and federal databases (e.g., Resource Conservation and Recovery Act Information, Toxic Release Inventory, Superfund Enterprise Management System, Assessment, Cleanup and Redevelopment Exchange System, and state databases on underground storage tanks and hazardous waste programs, etc.) to identify Recognized Environmental Conditions (RECs), and 2) site reconnaissance to accessible regions of the subject areas to determine if RECs are within the proposed project right of way (ROW). The public crossing of the creeks and bayous 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. Indicators were found during the site visits.

Prior to construction and after a right-of-entry for on-site HTRW investigations is provided by the property owner, an ASTM E 1527-13 Phase II ESA will be completed. If the Phase II ESA identifies contamination, the property owner will be notified in writing of the remediation that is required and that the work must be performed by a licensed HTRW remediation professional. If the presence of HTRW, asbestos, or asbestos-containing materials in a damaged or friable form is confirmed on the property, the property owner shall be obligated, at his sole cost and expense, to conduct all necessary response and remedial activities in full compliance with applicable local, state, and federal laws and regulations and provide proof thereof before USACE makes a final determination as to whether the structure meets the eligibility requirements. In addition, documentation from a third party licensed HTRW remediation professional must be provided by the property owner to the USACE with sufficient evidence to support that the contamination has been successfully and properly remediated. See Appendix C: Environmental.

Alternative 1: No-Action Plan

There would likely be no potential for direct or indirect effects to HTRW because implementation of the action would not occur.

Recommended Plan - Nonstructural Plan (Alternative 2) and West and South Slidell Levee and Floodwall System (Alternative 6c)

Nonstructural Plan (Alternative 2)

Any HTRW concerns would be handled by the NFS and reported to USACE HTRW Specialist for record.

West and South Slidell Levee and Floodwall System (Alternative 6c)

Personnel from CEMVN conducted a 2nd site reconnaissance on 23 January 2023 and 26 January 2023. The site reconnaissance was conducted via public access roads and public parks for this feasibility study. The mitigation sites (M2 and PSR001) were not accessible due to location and lack of ROE. The proposed borrow sites were viewed from public access roads due to lack of ROE. The areas 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 soils, water sheens, out-of-place dirt mounds or depressions in the landscape, evidence of fire, stressed soils with lack of vegetation, animal remains, unusual animal behavior, biota indicative of a disturbed environment, and odors indicative of poor water quality or chemical presence.

Desktop research that included the review of government environmental databases, historical aerial photographs, and historic topographic maps was conducted on the proposed project areas including borrow areas and mitigation areas. No evidence of RECs that would affect the proposed construction was found within the ROW. RECs were found within a one-mile radius of the ROW, but these RECs should pose a low risk due to the distance they are from the ROW.

5.1.1.13 Cultural, Historic, and Tribal Trust Resources

CEMVN has determined that the proposed action constitutes an Undertaking as defined in 36 CFR § 800.16(y). CEMVN proposes to adopt a programmatic approach in accordance with 36 CFR § 800.14(b) to determine the Area of Potential Effects (APE) for structural and NS measures in consultation with LA SHPO and participating Tribe(s) pursuant to 36 CFR § 800.16(d). The APEs would incorporate both direct effects (e.g., access, staging, and construction areas) and indirect effects (e.g., visual), including all areas of proposed ground disturbance. Furthermore, CEMVN may consider information provided by other parties, such as the NFS, local governments, and the public, when establishing APEs.

Accordingly, the USACE has developed a PA, in consultation with the NFS, LA SHPO, federally-recognized tribes, and other interested parties, to fulfill its Section 106 responsibilities, described in Section 8.15 (Environmental Laws and Regulations: NHPA of 1966). The PA, entitled *Programmatic Agreement Among the U.S. Army Corps of Engineers, New Orleans District; Louisiana State Historic Preservation Officer of the Department of Culture, Recreation & Tourism; The U.S. Fish and Wildlife Service; Louisiana Coastal Protection and Restoration Authority; and The Choctaw Nation of Oklahoma Regarding the St. Tammany Parish, Louisiana Flood Risk Reduction Project*, outlines the steps needed to identify and evaluate cultural resources and make determinations of effects. The PA will be executed prior to signing the Record of Decision. Once executed, the PA will be submitted to the ACHP. The final PA is contained in Appendix C of this FIFR-EIS.

As such, all field survey, evaluation, and reporting required to make NRHP eligibility determinations for Section 106 compliance would largely be deferred to the PED/Construction phase. If direct adverse effects to cultural resources are identified and

cannot be avoided or minimized, such impacts would be mitigated through the procedures outlined in the PA. The PA would govern the CEMVN's subsequent NHPA compliance efforts and any additional conditions or requirements would be documented in accordance with procedures outlined in the PA at that time.

Alternative 1: No Action Plan

Impacts to cultural and historic resources within the study area have resulted from both natural processes (e.g., erosion) and human activities (e.g., land development, dredging, agriculture, and vandalism). Riverine environments are dynamic, and impacts to cultural and historic resources in the area would remain largely the same as present due to natural processes including anthropogenic modifications of the landscape as well as human alterations. Cultural resources may remain vulnerable to damage or complete loss from coastal and fluvial flooding.

Recommended Plan - Nonstructural Plan (Alternative 2) and West and South Slidell Levee and Floodwall System (Alternative 6c)

Nonstructural Plan (Alternative 2)

Direct, Indirect, and Cumulative Impacts: This alternative includes the introduction of new visual elements and/or modifications to built environment resources (i.e., elevation, flood proofing, relocations and/or acquisition (demolition) that may directly affect known and undocumented historic built resources in a manner that may diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association, and ground disturbing activities (e.g., access, staging, foundation work, utility relocations and hardening, demolition) within the footprint that may directly affect known and undocumented archeological resources in a manner that may diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association.

This alternative includes elevation, flood proofing, relocations, and/or acquisition (demolition) measures that may indirectly result in the potential successive introduction of new visual elements and/or modifications to the viewshed and overall visual landscape of known and previously undocumented cultural resources that may be listed or eligible for listing in the NRHP. These cultural resources could potentially include historic built resources, NRHDs, National Historic Landmarks (NHL), other built-environment resources, and/or TCPs. The introduction of new visual elements and/or modifications 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 TCP.

The cumulative impacts to cultural resources would be the additive combination of impacts by this and other federal, state, local, and private flood risk reduction efforts including authorized USACE construction projects adjacent to the study area (see Section 1.6). In addition to those direct and indirect impacts described above, successive additions and/or modifications to the visual landscape may result in cumulative adverse effects to cultural resources by introducing elements that are inconsistent with their historic or cultural

character. In conjunction with similar repetitive impacts from other large-scale NS projects in the region, this could lead to the loss of connection to place and cause a net loss of cultural diversity within St. Tammany Parish.

West and South Slidell Levee and Floodwall System (Alternative 6c)

Direct, Indirect, and Cumulative Impacts

Site 16ST153 (Guzman) is located within the West Slidell portion of the system; however, the historic site was recommended not eligible for listing in the NRHP due to disturbance and lack of research potential. Archaeological sites 16ST40, 16ST42, and 16ST138 are located within the levee footprint and would require further investigation as to whether they may be adversely affected by construction. Previously recorded historic built resources are located within and adjacent to the alternative and would require further investigation.

Additionally, the RP RPTSP includes proposed alignment changes in the vicinity of Bayou Paquet Road to avoid impacts to the BBMNWR and reduce the number of engineering structures required along waterways. This optimized portion includes three archaeological sites (16ST19, 16ST139, and 16ST279) and one previously identified built resource (52-02368) that are located within or directly adjacent to the levee footprint and would require further investigation as to whether they may be adversely affected by construction.

This measure includes ground disturbing activities involving access, staging, construction of structural features, which include levee and floodwall, five pump stations, eight floodgates, seven culverts and sluiceways, eight vehicular gates, one railroad gate along the Norfolk Southern Railroad tracks, and eight road ramps, borrow fill, and/or other direct effects to above-ground historic properties (i.e., demolition). These activities may directly impact both known and undocumented cultural resources listed or eligible for listing in the NRHP not limited to: archaeological sites; historic built resources; cemeteries or other sites that may contain human remains, funerary objects, sacred objects, or objects of cultural patrimony; and TCPs; that exist both within the footprint and associated areas in a way that would diminish the integrity of these property's location, design, setting, materials, workmanship, feeling, or association. Cultural resources surveys would likely be required to identify existing cultural resources.

This measure includes the introduction of new visual elements (levee, access gate, floodgates, sluiceways, and pump stations) to the area's viewshed that have the potential to directly or 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 TCP. Implementing the proposed action may have beneficial indirect impacts to cultural and historical resources by providing an added level of rainfall and coastal storm risk reduction to known and unknown cultural resources in the project vicinity on the protected side of the levee, thereby reducing the damage caused by rainfall and coastal storm flood events.

Mile Branch Channel Improvements (not part of the Final Recommended Plan)

Background: In 1996, R. Christopher Goodwin & Associates, Inc. conducted cultural resource field investigations for Mile Branch (22-1996). Approximately 14 percent of the corridor was determined to have a high potential for the presence of prehistoric and historic archaeological resources. Survey was conducted on 5.4 acres. The remaining 23.7 acres were not surveyed because right-of-entry was denied by landowners. No cultural resources sites were recorded as a result of the survey and testing. Two historic built resources were recorded adjacent to Mile Branch. Both were recommended not eligible for listing in the NRHP. Site 16ST273 (Wilson Cemetery) is located within the right-of-way on North Columbia Street. The cemetery is still in use and should be avoided.

Direct, Indirect, and Cumulative Impacts: One archaeological site, Wilson Cemetery (16ST273), is adjacent to the alternative at the northern end. A staging area (that would become Backwater improvements) is proposed just east of this cemetery. There are previously recorded historic built resources adjacent to the location of this alternative; however, there are no previously recorded historic built resources within the footprints of this alternative. This measure includes ground disturbing activities involving access, staging, clearing and grubbing, mechanical dredging, replacement of culverts or bridges, and/or other direct effects to above-ground historic properties (i.e., demolition). These activities may directly impact both known and undocumented cultural resources listed or eligible for listing in the NRHP not limited to: archaeological sites; historic built resources; cemeteries or other sites that may contain human remains, funerary objects, sacred objects, or objects of cultural patrimony; and TCPs; that exist both within the footprint and associated areas in a way that would diminish the integrity of these property's location, design, setting, materials, workmanship, feeling, or association. Cultural resources surveys would likely be required to identify existing cultural resources.

This measure includes the introduction of new visual elements to the area's viewshed that have the potential to indirectly or directly 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 or directly 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 cultural resource.

The indirect impacts to cultural resources for this alternative would be similar to Measure: Bayou Bonfouca Detention Pond described previously.

The cumulative impacts to cultural resources would be the additive combination of impacts by this and other federal, state, local, and private flood risk reduction efforts including authorized USACE construction projects adjacent to the study area and other projects that will alter the hydrology of St. Tammany Parish (see Section 1.6).

Mitigation measures of the RP: There are no known archaeological sites or previously recorded historic built resources within the mitigation measures of the RP. This measure

includes ground disturbing activities that may directly impact undocumented cultural resources listed or eligible for listing in the NRHP in a way that would diminish the integrity of these property's location, design, setting, materials, workmanship, feeling, or association. Cultural Resources surveys would likely be required to identify existing cultural resources.

Levee Borrow Sources

Direct, Indirect, and Cumulative Impacts: All available information suggests that it is highly unlikely that cultural resources exist within the proposed borrow areas. With implementation of the proposed action, any undiscovered cultural resources may be damaged during borrow excavation and construction operations. Cultural resource surveys were completed for ST5, ST9, MS-1, and MS-2 (Table 5-10) and no cultural resources were identified within those borrow areas. As a result, it is unlikely that direct impacts to cultural resources would occur within those sites. Additionally, borrow site ST6 has not been surveyed for cultural resources; however, the city of Slidell constructed the West Diversion Detention Pond in 1998 (USACE 2012). As a result, it is unlikely that intact cultural deposits exist within the previously disturbed ST6 borrow area.

In the unlikely event that undocumented cultural resources exist within the proposed borrow areas, the CEMVN would use the developed PA that outlines the steps necessary to identify and evaluate cultural resources and complete the Section 106 of the NHPA process.

With implementation of the proposed action, no indirect or cumulative impacts to cultural resources would be anticipated.

Table 5-10. Summary of Cultural Resources and Surveys within the Proposed Borrow Sites

Borrow Site	Previously Recorded Cultural Resources	Previous Survey	Previous Survey Coverage	Other Notes:
ST5	None	22-3725	Full	Phase I cultural resources survey on behalf of St. Tammany Parish for a 156.41 acre (63.30 ha) tract on Cypress Bayou in St. Tammany Parish, Louisiana (22-3725; Kuttruff et al. 2011). No cultural resources were identified within the ST5 borrow site.
ST6	None	None	None	City of Slidell constructed the West Diversion Detention Pond in 1998 (USACE 2012).
ST9	None	22-3151	Full	Phase I cultural resources survey on behalf of USCAE for five proposed detention ponds along the north side of the existing W-14 drainage canal (22-3151; Moreno et al. 2012). The parcel surveyed included 30.28 acres (12.25 ha). No cultural resources were identified within the ST9 borrow site. A determination of No Historic Properties Affected was submitted to the LA SHPO on 9 Sept 2008 and 22 Sept 2011. SHPO concurred with CEMVN's determination on 7 Oct 2008 and 16 Nov 2011.
MS-1	None	07-395	Full	MS-1 was investigated for cultural resources for IER #19 and #23 for the HSDRRS projects. At that time, the Mississippi Division of Archives and History (MDAH) had no record of listed or eligible historic properties within MS-1. A Phase I survey of the proposed borrow area did not identify any cultural resources within the Pearlington site (07-395; Pumphrey 2007). The MS SHPO concurred with CEMVN's determination on 22 Nov 2006.
MS-2	None	09-0690	Full	MS-2 was investigated for cultural resources for IER #31 for the HSDRRS projects. A Phase I cultural resources assessment was performed for the Port Bienville contractor-furnished borrow area and no NRHP listed or eligible cultural resources were identified (09-0690; Thorne 2008). Concerns were raised by the Jena Band of Choctaws and the Mississippi Band of Choctaws about potential unrecorded burials within the proposed borrow area. At that time, a Memorandum of Agreement (MOA) was signed between the two tribes as well as by M. Matt Durand, L.L.C. of Port Bienville Clay Mine, L.L.C. outlining procedures to allow use of the borrow area and to care for unexpected discoveries should these occur. It is unknown if this MOA has expired pursuant to its duration provision. If the agreement expired before the undertaking or mitigation measures have been completed, CEMVN must reinitiate consultation to develop a new MOA to resolve the adverse effects from the proposed undertaking. The new agreement may acknowledge, incorporate, or continue already agreed upon measures.

5.1.1.14 Noise and Vibration

Alternatives 1 No Action Plan

Direct, indirect and cumulative impacts: These alternatives would not have an impact on noise and vibration.

Recommended Plan - Nonstructural Plan (Alternative 2) and West and South Slidell Levee and Floodwall (Alternative 6c)

Construction activities in each of the measures would consist of heavy equipment associated during levee and floodwall construction. Overall, to the extent that construction

activities occur within a 1000-ft of residences or communities, noise and vibration impacts are anticipated to remain low to moderate during construction and within the staging area and is expected to temporarily disturb wildlife and residences. Some noise and vibration impacts may be potentially reduced by the use of electricity for the construction equipment. More information on equipment used during construction can be found in Appendix D: Engineering.

There would be temporary noise and vibration impacts from the construction of the mitigation site M-2 resulting from dredging activities for borrow in Lake Pontchartrain and placement of materials in the mitigation site. Temporary minor noise impacts would result from construction equipment utilized to construct the mitigation site. There would also be minor temporary impacts resulting from controlled burns of the PSR-1 mitigation sites from ATVs, UTVs traversing the area managing the controlled fires. Should there be tree thinning, there would be temporary minor noise impacts from that activity. Once construction activities cease, noise levels typical of the area would return to background levels.

Levee Borrow Sources: There would be temporary minor impacts to noise and vibration resources as result of borrow excavation, the action would add additional minor impact to the existing conditions by obtaining material from existing operating pits or sites that have been previously cleared and are designated as borrow sites as described in 5.3 and previously for Alternatives 2, 4, 5, 7, 8, and 9.

5.1.1.15 *Aesthetics*

The forecasting of what the study area's visual landscape would look like in the future is determined by:

1. Physical and ecological changes (e.g., land use or vegetative succession).
2. Identifying trends in recreation and land use.
3. Reviewing government agencies' planning documents.

The extent of effort involved for forecasting the study areas' visual landscape's future is limited by time and the availability of relevant information. Additionally, physical and ecological changes combined with trends in recreation and land use may be found elsewhere in this document. Therefore, the focus of this section is on identifying relevant study area planning documents containing information related to desired visual resources' conditions; these include:

4. The Bogue Falaya Park Master Plan (<https://www.covingtonplan2030.com/related-plans>).
5. The Bogue Chitto National Wildlife Refuge's Comprehensive Conservation Plan (https://www.fws.gov/refuge/Bogue_Chitto/what_we_do/conservation.html).
6. The Big Branch National Wildlife Refuge's Comprehensive Conservation Plan (https://www.fws.gov/refuge/Big_Branch_Marsh/what_we_do/conservation.aspx).

The aforementioned planning documents contain information on planned improvements in Bogue Falaya Park and conservation measures for resources in the national wildlife refuges.

Alternative 1: No Action Plan

Under the No Action alternative, impacts to aesthetics would not occur as a result of the proposed action. Continuing trends of development would continue to affect aesthetic resources. Projects and plans implemented by private, corporate and government entities, such as the plans for improvements to the Bogue Falaya Park and Bogue Chitto Refuge would also affect aesthetic resources.

Recommended Plan - Nonstructural Plan (Alternative 2) and West and South Slidell Levee and Floodwall System (Alternative 6c)

Nonstructural Plan

The direct, indirect, and cumulative impacts to visual resources caused by the NS alternative are detailed in the cultural resources' section; these impacts would include the introduction of potentially visually distressful elements into the area's viewshed and/or modifications to the built-environment that includes elevating historic structures.

West and South Slidell Levee and Floodwall System. The direct, indirect, and cumulative impacts to visual resources caused by this alternative are detailed in the cultural and recreational resources' sections; these impacts would include the introduction of potentially visually distressful elements into the area's viewshed and any proposed project related alterations to the Louisiana Natural and Scenic Rivers System. Additional impacts may be caused by modifications to the built-environment that involves elevating historic structures.

Reestablishment of marsh sites for mitigation would add to the viewshed. The regular controlled burns of the mitigation PSR-01 would temporarily introduce visually distressful elements into the area's viewshed due to the smoke-filled air.

Levee Borrow Sources: The visual character of the study area's proposed borrow areas identified as locations 5, 6, and 9 are institutionally and technically insignificant; public significance is undetermined. The proposed borrow areas (5,6, and 9) are adjacent to residential areas. The adjacent residents may determine that the borrow areas are visually distressful. This visual distress may occur if the soil removal process exposes the nearby residents' line of sight to an area cleared of vegetation.

5.1.1.16 Recreation

Alternative 1: No Action Plan

Without intervention, conditions within the recreational environment would continue to evolve as they have in the past and would be dictated by the natural land use patterns and processes that have dominated the area in the past. Access to recreational resources along the shoreline and associated marsh may decrease with continued erosion impacts from wind and wave action. Land loss would likely continue and there could be an overall loss of habitat within the system that once provided cover, resting, nesting, and foraging habitat.

The loss of these habitats, and the effect such losses would have on wildlife and aquatic species, could cause recreational resources in the basin to transition.

Recommended Plan – Nonstructural Plan (Alternative 2) and West and South Slidell Levee and Floodwall System (Alternative 6c)

Nonstructural Plan

The NS features would have no impact to recreational resources depending on the methods used. Refer to the RP analysis below for a discussion of potential impacts from implementing this alternative.

West and South Slidell Levees and Floodwall System

Direct, indirect, and cumulative impacts

The NS features should have no impact to recreational resources, however depending on the type of recreational use, some types of recreational uses would be temporarily unavailable during flood proofing work, but the facilities may be available for public use sooner after a flood event. An indirect impact of elevating structures on building costs of future recreational camps could result in fewer camps being constructed.

With the proposed levee measures, recreational resources tied directly to BBMNWR would closely correspond to the environmental effects of hydrology alterations in the refuge. During construction and while in operation, the proposed gate complexes on Bayou Paquet, Bayou Liberty, and on Bayou Bonfouca would temporarily impact the flow and recreational boating and fishing on the bayous. When the proposed features are in operation, recreational boats would not be able to traverse the bayous at these locations (see also 5.1.1.18 Navigation). St. Tammany Trace would also see temporary, indirect impacts such as interrupted access related to construction of the levee. Coordination with the NFS and local stakeholders would be implemented to minimize potential recreational impacts at St. Tammany Trace.

Mitigation Sites: The mitigation features and backwater area would have no adverse impacts to public recreation resources including, but not limited to wildlife observation, boating, fishing and hunting. Benefits to public recreation resources would be minimal and closely correspond with terrestrial and aquatic wildlife resources within this document.

Levee Borrow Sources: For the five borrow sources identified, the proposed measures would not directly or indirectly impact existing recreation resources in the region. In some cases, depending on how the end site is left, the habitat may be suitable to support some recreational activities (i.e., wildlife viewing and fishing), but these benefits are expected to be minimal, and sites would not be open to public access.

5.1.1.17 Socioeconomics

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.

Alternative 1 - No Action Plan

There would be no direct impact on the human environment under this alternative. The trends would continue as presented in the future without project condition.

There would be no indirect impacts under the No Action Alternative.

Recommended Plan - Nonstructural Plan (Alternative 2) and West and South Slidell Levee and Floodwall System (Alternative 6c)

Population and Housing

Direct impacts include the potential for damage to structures, landscaping, and driveways while the structure is being elevated. There could be potential inconvenience to residents having to move and store their personal possessions and relocate to a temporary residence while their residences are being elevated. Additionally, access to the residence would be impeded during the time the residence is being elevated. Temporary relocation of individuals and families could entail different travel routes through unfamiliar areas, longer commute times to work, school, and other destinations for typical life activities (e.g., shopping, doctor visits, etc.). The change in commute times could be a positive or negative impact since the relocation could temporarily move individuals and families either closer or farther away from their destinations. During construction of the levee and channel improvements, commute times could be increased for residents in some communities due to certain access points being blocked temporarily. Indirect impacts for the levee, channel improvements, and the elevation of structures would include reduced risk of damages from flooding events for population and housing. This risk reduction would lead to greater stability and sustainability of population and housing resources. However, if a residence is elevated, access to the elevated residences could be more difficult, especially for the elderly and physically handicapped, even if retrofitted with an elevator and other special access improvements. Additional indirect impacts would be the different visual appearance of neighborhoods and communities with a few elevated structures located within a community of nearby structures that are not elevated.

Direct impacts for the non-structural measures include the potential for damage to structures, landscaping, and driveways while the structure is being elevated. There could be potential inconvenience to residents having to move and store their personal possessions and relocate to a temporary residence while their residences are being elevated. Additionally, access to the residence would be impeded during the time the residence is being elevated. Temporary relocation of individuals and families could entail different travel routes through unfamiliar areas, longer commute times to work, school, and other destinations for typical life activities (e.g., shopping, doctor visits, etc.). The change in commute times could be a positive or negative impact since the relocation could temporarily move individuals and families either closer or farther away from their destinations. Indirect impacts would include reduced risk of damages from flooding events for population and

housing. This risk reduction would lead to greater stability and sustainability of population and housing resources. However, if a residence is elevated, access to the elevated residences could be more difficult, especially for the elderly and physically handicapped, even if retrofitted with an elevator and other special access improvements. Additional indirect impacts would be the different visual appearance of neighborhoods and communities with a few elevated structures located within a community of nearby structures that are not elevated.

Employment, Business, and Industrial Activity (Including Agriculture)

There would be direct impacts associated with the flood proofing of businesses in the NS plan. If commercial structures are flood proofed, businesses could potentially either shut down or relocate temporarily while the measure is being applied, which could lead to a loss of revenue, change in business clients to other more available businesses, as well as a loss of wages to employees. There is a potential that existing landscaping around businesses could be damaged and require restoration. Certain access points could be impeded during the construction of the levee and channel improvements, but access to public facilities would not likely be completely restricted. Indirect impacts of the levee, channel improvements, and NS measures would include reduced risk of damage for employment, business, and industrial activity that would translate into greater stability of productivity in the region.

There would be direct impacts associated with the flood proofing of businesses in the NS plan. If commercial structures are flood proofed, businesses could potentially either shut down or relocate temporarily while the measure is being applied, which could lead to a loss of revenue, change in business clients to other more available businesses, as well as a loss of wages to employees. There is a potential that existing landscaping around businesses could be damaged and require restoration. Indirect impacts would include reduced risk of damage for employment, business, and industrial activity that would translate into greater stability of productivity in the region.

Public Facilities and Services

Direct impacts associated with the levee and channel improvements would likely be negligible. Certain access points could be impeded during the construction of the levee and channel improvements, but access to public facilities would not likely be completely restricted. Direct impacts associated with flood proofing to public facilities in the area would be the interruption and temporary unavailability of public services if these facilities are forced to close or are relocated temporarily during implementation of the NS risk reduction measures. Indirect impacts include reduced risk of flooding damages for public facilities and services in the area, thereby reducing the number of days a structure is unavailable for use and minimizing the inconvenience to the public.

Direct impacts associated with flood proofing to public facilities in the area would be the interruption and temporary unavailability of public services if these facilities are forced to close or are relocated temporarily during implementation of the NS risk reduction measures. Indirect impacts include reduced risk of flooding damages for public facilities and services in the area, thereby reducing the number of days a structure is unavailable for use and minimizing the inconvenience to the public.

Transportation

Direct impacts associated with the construction of the levee, channel improvements, and the NS measures for transportation would include temporary and intermittent delays, disruption of traffic movement, congestion of roads, and re-routing of vehicles and pedestrians during the construction of the various risk reduction measures. Local parking access to businesses could also be affected by construction vehicles and crews. Indirect impacts would include the additional wear and tear on roads, especially local roads. There would also be greater noise and dust generated by construction vehicles. However, best construction management practices would be utilized to limit dust emissions and to ensure the safety of construction workers, residents, and employees during construction of the levee, channel improvements, and NS measures.

Direct impacts associated with the NS plan for transportation would include temporary and intermittent delays, disruption of traffic movement, congestion of roads, and re-routing of vehicles and pedestrians during the construction of the various risk reduction measures. Local parking access to businesses could also be affected by construction vehicles and crews. Indirect impacts would include the additional wear and tear on roads, especially local roads. There would also be greater noise and dust generated by construction vehicles. However, best construction management practices would be utilized to limit dust emissions and to ensure the safety of construction workers, residents, and employees during construction of the NS measures.

Community and Regional Growth

Direct impacts would include a temporary monetary stimulus to the region due to spending associated with the construction activities in the area. This stimulus would be an increase to the region's income for as long as the spending continued. Temporary relocations would likely take place within the overall study area during implementation of the NS measures, resulting in little if any change. Indirect impacts would include reduced risk of flooding damages for low-lying structures, thus reducing overall social vulnerability and preserving growth opportunities for communities in the region and enhancing the potential for long-term growth and sustainability.

Tax Revenues and Property Values

Parish sales tax revenue would likely increase during the implementation of NS measures due to an expected influx of workers and construction expenditures from outside of the area. Construction activities would provide jobs and could increase the level of spending, labor, and capital expenditures in the area.

Community Cohesion

Direct impacts that would disrupt community cohesion, temporarily, include the noise from construction activities, the temporary displacement and relocation of residents during construction, and disruption of businesses during construction. Furthermore, non-residential structures that serve as meeting places for the community could become temporarily unavailable during the implementation of NS measures. Indirect impacts for the NS plan would include reduced risk of flooding damages for structures within communities; thus, preserving community cohesion in the region.

Levee Borrow Sources There would be temporary minor impacts to socioeconomic resources as result of borrow excavation, the action would add additional impact by obtaining material from existing operating pits or sites that have been previously cleared and are designated as borrow sites, as described in 5.3 and above for Alternatives 2, 4, 5, 7, 8, and 9.

5.1.1.18 Navigation

Alternatives 1: No Action Plan

There would be no impacts to navigation resulting from not implementing the proposed action. Current trends would be expected to continue into the future.

Recommended Plan - Nonstructural Plan (Alternative 2) and West and South Slidell Levee and Floodwall System (Alternative 6c)

Nonstructural Plan

There would be no impacts to navigation resulting from implementing the Non-structural plan. Current trends would be expected to continue into the future.

West and South Slidell Levee and Floodwall System

Lake Pontchartrain and the tributaries that drain into it primarily serve recreational boating interests, and recreational fishing in the areas. Recreational boats would be able to continue to traverse Liberty Bayou and Bayou Bonfouca. There may be some temporary impacts to boating on Bayou Bonfouca during construction of the bypass channel and during transition times pre- and post-construction. There would also be temporary impacts to recreational boating during named storm events when proposed FG would be closed due to an impending storm. The gates are estimated to be closed for a few days until it is considered safe to reopen the gates. These impacts would be expected to be short term. Additional H&H modeling and project design would occur during PED to determine operating plans for the floodgate structures, open and closing triggers as well as durations. There are no major shipping corridors that would be impacted, affecting commerce in the study area. Impacts to navigation that affect recreational boating are described further in 5.3.11 Recreation.

Mitigation Sites: There would be no impact to navigation resources as a result of the proposed mitigation sites.

Levee Borrow Sources: There would be no impact to navigation resources as result of borrow excavation as described in 5.3.

5.1.1.19 Environmental Justice

An EJ assessment identifies areas of EJ concern and assesses impacts to these areas and mitigation strategies that avoid, reduce and minimize both direct, indirect, and cumulative impacts. First areas of EJ concern are identified using minority and low-income criteria, which are discussed below. Figures are an excellent way to visually display the areas and

for this EJ analysis, census block groups are the preferred geographic display. A Census Block Group (CBG) is a geographical unit used by the United States Census Bureau which is, in size, between the Census Tract and the Census Block. It is the smallest geographical unit for which the bureau publishes sample data, i.e., data which is only collected from a fraction of all households. This data is available for the years between the decennial census (taken every 10 years). Typically, Block Groups have a population of 600 to 3,000 people. EJ areas of concern are identified in Section 3.2.2.1.6 and are the focus of the impacts assessment. Figure 5-24 illustrates the areas of EJ concern at the Block Group Level for the study area.

The second step is to identify the impacts to areas of EJ concern from the federal action, in this case, the impacts of constructing a flood risk reduction system. The third step is to determine if the impacts to areas of EJ concern are high, adverse disproportionate impacts. Both of these steps are discussed in this section. Regardless, if adverse impacts are disproportionate or not, this EJ assessment provides mitigation measures for the adverse impacts. Additionally, a whole-of-government approach to solving barriers to implementation of project measures should be utilized to advance project benefits to areas of EJ concern, particularly in reference to NS plan participation. Further discussion of a whole-of-government approach is discussed for the NS plan measure in this section.

A key element of the EJ assessment is EJ Outreach and engagement throughout the planning process. Both the EOs mentioned earlier express the need to meet with residents who live in Areas of EJ Concern throughout the planning process. The goal of the outreach is to inform and engage with the hope of receiving comments about the project. EJ outreach is discussed at the end of this section. A summary of the EJ outreach is provided in Section 9.3.2, EJ Outreach and Meetings.

Two different tools are used to identify areas of EJ concern. The National Historic Geographic Information System (NHGIS) tool enables the user to download 2020 U.S. Census Bureau demographic data for several different geographic levels. The NHGIS tool provides data (from the U.S. Census Bureau) and maps that identify areas of EJ concern. Areas of EJ concern is the focus of the EOs which state the importance of achieving Environmental Justice. A second source for this EJ analysis is EPA's EJSCREEN which lists demographic data and 12 environmental indicators and an area's percentile rank compared to the region and the USA. The environmental indicator report helps determine if any of the areas of EJ concern are overburdened with different types of environmental pollution or environmental vulnerability further reinforcing its identification as an area of EJ concern.

Identification of areas of EJ concern is based upon two thresholds recommended in the EPA's "Promising Practices for EJ Methodologies in NEPA Reviews" ("Promising Practices") document prepared by the Federal Interagency Working Group on EJ. A CBG is considered an EJ area of concern if it is comprised of 50 percent or more of residents identifying as a minority, or if the minority percentage is meaningfully greater than (15 percent) the reference area minority population (in this case the State of Louisiana) or if 18.6 percent or more of households live below poverty level. The poverty threshold uses the state of Louisiana poverty rate (18.6 percent).

The EJSCREEN tool also displays environmental indicators for St. Tammany Parish that identifies environmental risks to communities. The indicators are another way of identifying an EJ community. Environmental Indicators are presented for St. Tammany Parish, Louisiana, in Table 2 of the Appendix C: Environmental Justice. An EJ Index that is above the 80th percentile in the State, the EPA Region or in the USA is, according to EPA, the percentile where one could expect environmental justice concerns. In the project area, none of the environmental indicators are at the 80th percentile or higher for the State of Louisiana or the USA. Much of the construction activities associated with the RP or with any of the Final Array of Alternatives would not exacerbate environmental concerns as identified by EPA's EJSCREEN tool. Nonetheless, best management practices would be utilized to avoid, reduce, and contain temporary impacts to human health and safety.

See Section 3.2.2.1.6 for discussion of Environmental Justice existing conditions.

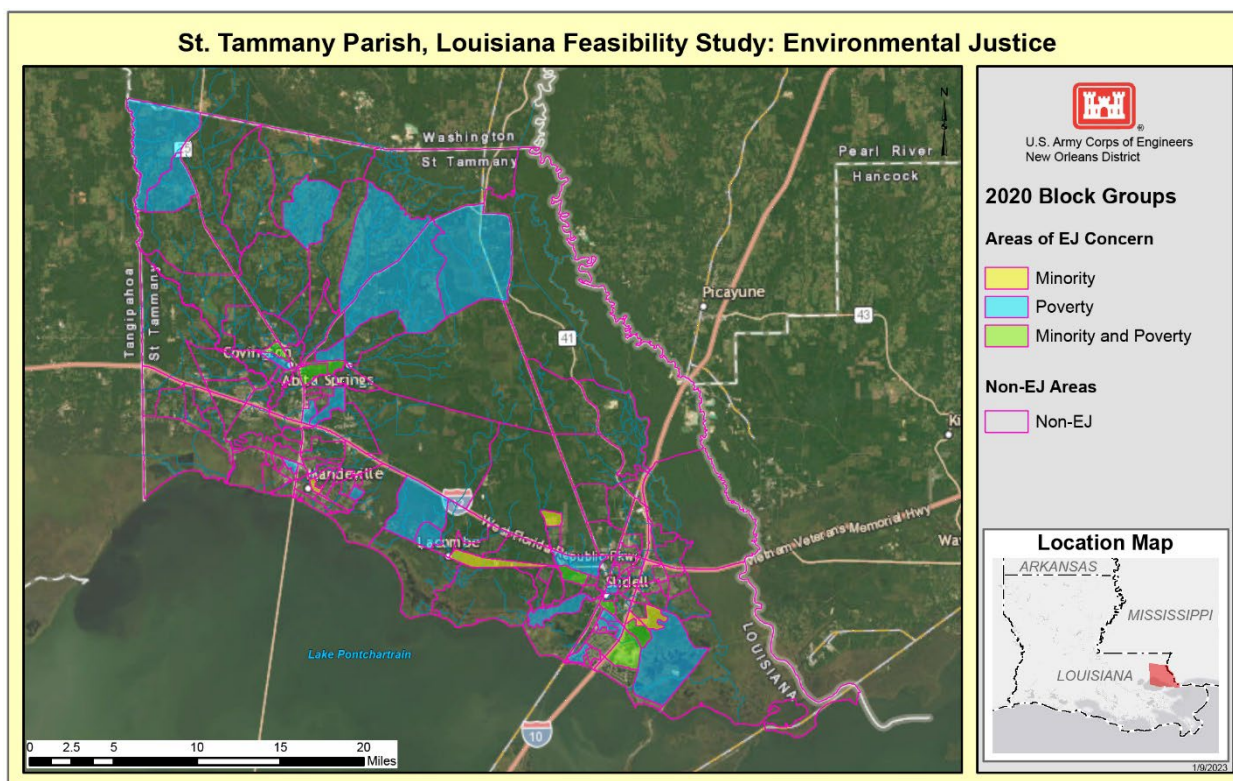


Figure 5-24. Areas of EJ concern at the Block Group Level, Study Area

Source: Steven Manson, Jonathan Schroeder, David Van Riper, Tracy Kugler, and Steven Ruggles. IPUMS National Historical Geographic

Alternative 1: No Action Plan

Without implementation of the proposed action, a federal flood risk reduction project would not be constructed. The area would continue to experience damages from rainfall and storm surge and housing and roads would continue to experience flooding during high water events. There would be no direct impact on minority and/or low-income population groups under this alternative. However, because this alternative fails to provide flood risk reduction, the actual and perceived risks to minority and/or low-income population groups under this

alternative would be higher than under the alternatives. Low-income and minority populations would continue to be affected by and potentially adapt to changes in environmental conditions under the No Action Alternative in the short-term. Continued risk of flooding to EJ areas of concern in the study area could result in these communities suffering economic losses, loss of agricultural lands, impacts to urban structures and property, loss of crops, or damage to property, and reduction in land values.

Indirect impacts under the No Action Alternative would include a higher potential for permanent displacement of minority and/or low-income population groups as compared to the with-project alternatives as residents relocate to areas with higher levels of flood protection.

Cumulative impacts under the No Action Alternative would 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 flood risks as well as continued financial and emotional strain placed on these groups as they prepare for and recover from flood events.

Recommended Plan - Nonstructural Plan (Alternative 2) and West and South Slidell Levee and Floodwall System (Alternative 6c)

Nonstructural Plan

NS Plan: The NS component of the RP, which is a voluntary plan, involves elevating homes and for non-residential properties, offers the option to have businesses dry or wet floodproofed. The NS plan includes 6,410 structures that would reduce flood risk and coastal storm damage to structures that are not included in the areas benefitted from the structural measures of the RP. Approximately 5,583 eligible residential structures would be elevated to the future 4 percent, 2 percent, or 1 percent flood stage (up to 13 feet). Additionally, 827 eligible nonresidential structures would be floodproofed up to 3 feet. For more information on the NS plan, refer to Appendix H: NS Implementation Plan.

Elevating or floodproofing structures offers the chance for property owners to reduce their flood risk from both storm surge and rainfall events. Overall, the NS plan would offer the opportunity to elevate or floodproof about 6,410 structures, the vast majority being residential (approximately 5,583). Of these residential structures, only 10 percent are in areas of EJ concern. Of course, one reason this figure is so low is that the parish is majority white and not low-income so there are fewer places spread throughout the parish that meet or exceed the minority and poverty thresholds for an area of EJ concern and the NS plan is tailored to those structures in hydrologic areas that have a 1 percent Annual Exceedance Probability or flooding from a 100-year event. Figure 5-25 shows the general location of the structures in the NS plan relative to EJ areas of concern.

STP NS INV Updated

Overall = 6,410

- Residential = 5,166
- Manufactured, modular and mobile homes = 417

- Non-Residential = 827

In EJ Areas = 745

- Residential = 505
- Manufactured, modular and mobile homes = 85
- Non-Residential = 155

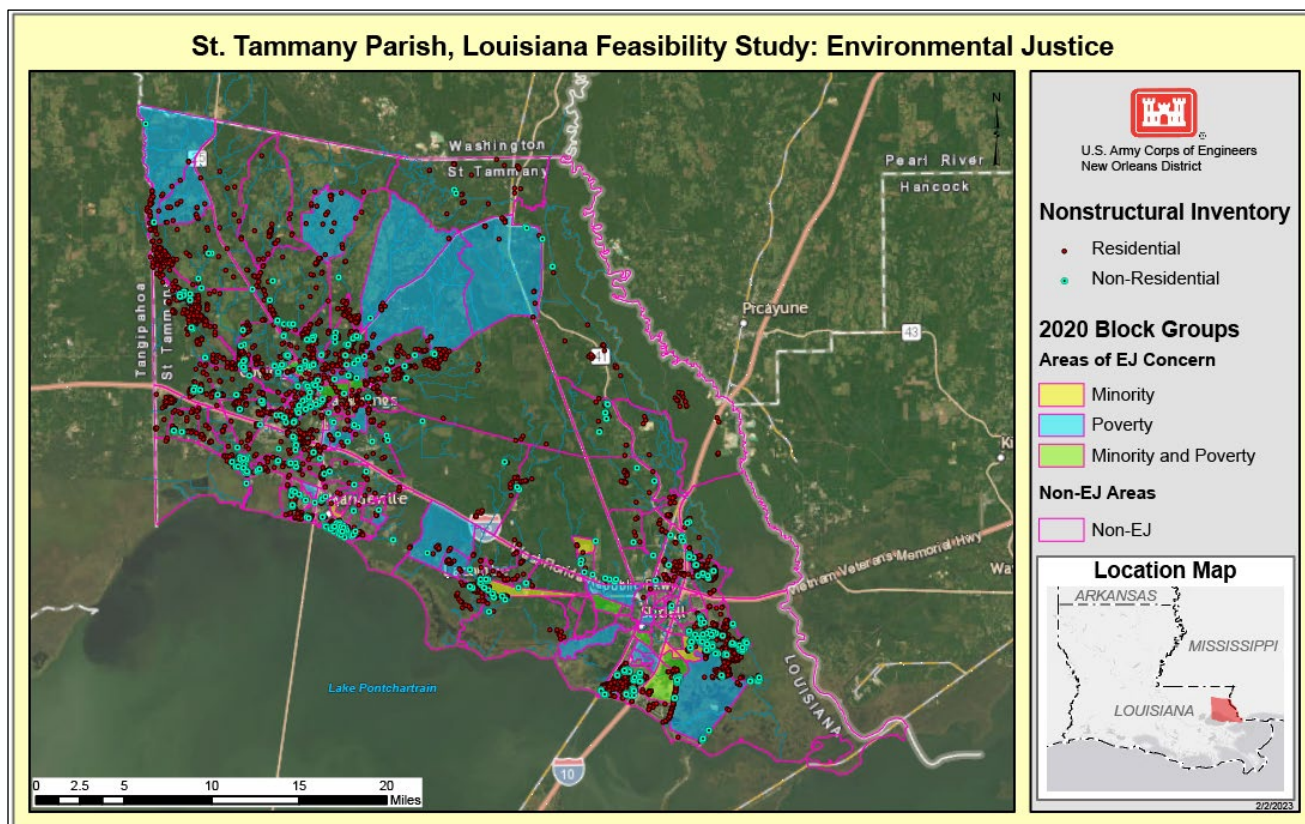


Figure 5-25. Nonstructural Plan Inventory and Areas of EJ Concern

Note: Polygon shapefiles shown on the maps in the EJ sections of the main report and attribute data used in the EJ analysis are from Steven Manson, Jonathan Schroeder, David Van Riper, Tracy Kugler, and Steven Ruggles. IPUMS National Historical Geographic Information System: Version 16.0 [dataset]. Minneapolis, MN: IPUMS. 2021. <http://doi.org/10.18128/D050.V16.0>

Adverse Direct Impacts to Areas of EJ Concern: Direct, adverse impacts from construction of the RP include the acquisition of structures that are within the ROW needed for the proposed footprint of the West and South Slidell Levee. There are no flooding inducements to structures in areas of EJ concern that are caused by either the South and West Slidell levee).

Twenty-three structures that are within the West and South Slidell Levee alignment may need to be acquired to construct the levee/floodwall; 18 of them are residential structures and 5 are non-residential structures. The number of structures that may need to be acquired are a worst-case scenario and would be reassessed and possibly refined to minimize acquisitions during pre-engineering and design phase of the project.

There are no known, direct adverse disproportionate impacts resulting from the NS plan, which is the elevation of residential homes and floodproofing of commercial structures. However, project implementation, at the time of PED, may result in low-income homeowners not being able to afford the costs associated with their home being elevated. At the time the NS plan is being implemented, homeowners, for various reasons, may be required to spend their own money on required documentation, home improvements, relocation costs, etc in order to participate in the plan. If the homeowner does have these funds on hand, they may not be able to participate. A whole of government approach can be used to resolve these issues and is discussed in this section and titled Mitigation of Impacts.

West and South Slidell Levee and Floodwall System

Positive and Adverse Impacts to EJ Areas of Concern: The RP includes two measures, 1) the slightly modified South and West Slidell combined levee (Alternative 6c) referred to as West Slidell Levee, and 2) the modified NS Alternative 2. The NS alternative includes only those structures in the future 4 percent, 2 percent, or 1 percent flood stage. However, the impacts are the same as described for Alternative 2 but less since fewer structures are included in the economically justified reaches. As stated for Alternative 2, further evaluation of the NS plan impact on communities with EJ concerns would be completed during (PED). This section discusses the RP impacts, both positive and adverse to areas of EJ concern.

Benefits to Areas of EJ Concern

A comprehensive benefits analysis and its positive impact on disadvantaged communities is presented in Section 6.5. Additionally, Justice 40 Initiative directs federal agencies to identify the percentage of project benefits accruing to disadvantaged communities. Disadvantaged communities are similar to areas of EJ concern and are shown at the census tract level using CEQ's Climate and Economic Justice Screening Tool (CEJST) and are detailed in the Economics Appendix (the main difference between the CEJST disadvantaged communities and areas of EJ concern is that the former identifies economically and environmentally burdened areas while areas of EJ concern identify economically burdened or minority majority areas). Forty-six percent of the NED benefits provided by the levee and floodwall system accrue to these disadvantaged communities. Four percent of the NED benefits provided by the NS plan accrue to disadvantaged communities. The low percentage of benefits under the non-structural plan is primarily due to community locations. Most of these communities are located either in northern areas of the parish that are not subject to frequent flooding, or they are located in the parts of the parish that would benefit from the levee system in Slidell. The disadvantaged communities where NS measures would be applied are in largely rural areas that are more sparsely developed and have lower flood risk. Overall, approximately 20 percent of the NED benefits provided by the Recommended Plan accrue to disadvantaged communities. For more information on the Justice40 Initiative and the percentage of overall benefits of the project going to disadvantaged communities in St. Tammany Parish, see Appendix F, Economics, Section 9.

However, the CEJST criteria used to identify the disadvantaged communities does not include minority data which is a criterion for identifying areas of EJ concern based upon EO

12898. Therefore, the EJ assessment provides a discussion of the impacts to areas of EJ concern that are defined as those areas being low-income or majority minority.

Positive impacts include a decrease in flood risk to minority or low-income populations. The alternatives would reduce the adverse impacts to areas of EJ concern experienced under the no-action condition - flood damages, loss of life, reduced economic activity, and potential out-migration. These positive impacts would be long term and would be likely to sustain the socioeconomic vitality of the area, positively impacting EJ communities. Positive economic dollar benefits accrue to those in areas of EJ concern, which are described in the Section 6.5, comprehensive benefits analysis.

West and South Slidell Levee: Construction of the West Slidell and South Levee could benefit nearly 16,000 structures. A vast majority of these structures are residential (approximately 13,000). Of the 13,000 residential structures benefiting, about 40 percent are in EJ areas of concern. Figure 5-26 shows the location of the structures benefiting in relation to areas of EJ concern.

Slidell Levee INV

Overall = 15,835

- Residential = 13,111
- Manufactured, modular and mobile homes = 818
- Non-Residential = 1,906

In EJ Areas = 6,342

- Residential = 5,220
- Manufactured, modular and mobile homes = 352
- Non-Residential = 770

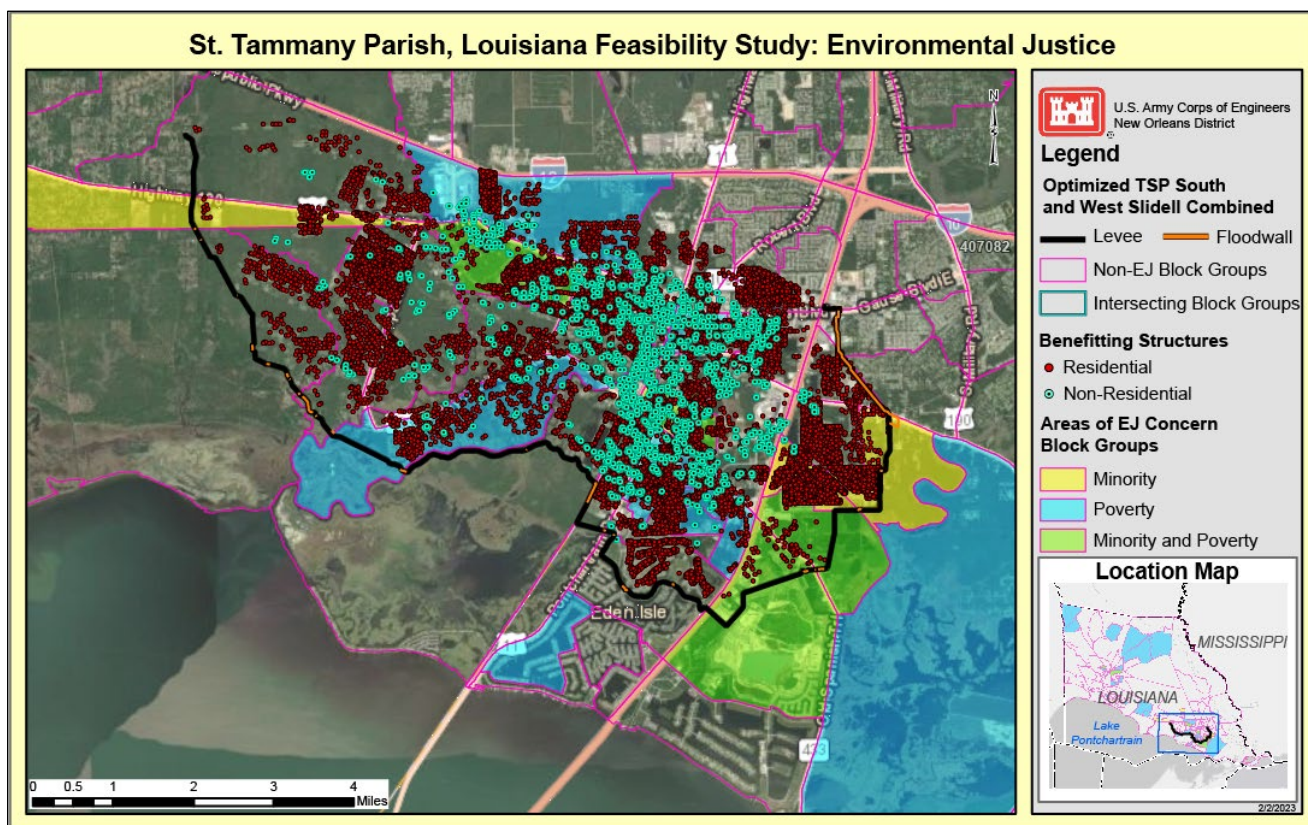


Figure 5-26. South and West Slidell Levee Alignment, Areas of EJ Concern and Structures Benefiting

Note: Polygon shapefiles shown on the maps in the EJ sections of the main report and attribute data used in the EJ analysis are from Steven Manson, Jonathan Schroeder, David Van Riper, Tracy Kugler, and Steven Ruggles. IPUMS National Historical Geographic Information System: Version 16.0 [dataset]. Minneapolis, MN: IPUMS. 2021. <http://doi.org/10.18128/D050.V16.0>

Direct Adverse Impacts: West and South Slidell Levee and Floodwall System: Of the 18 potentially affected (acquired) residential properties along the West Slidell levee/floodwall alignment, 4 are located in areas of EJ concern while 14 residential structures that may be acquired for construction of the levee/floodwall are NOT in areas of EJ concern. Additionally, when compared to who is receiving benefits from the levee, construction of the proposed West Slidell Levee could benefit nearly 16,000 structures. The high, adverse impact of residential acquisition for the West Slidell Levee does not cause a disproportion burden to areas of EJ concern. Mitigation measures would be offered to those households displaced because of the levee/floodwall construction. The mitigation measures include the use of the URA which is discussed in detail in the Appendix G: Real Estate Plan. Of the five commercial properties that could be acquired along the levee/floodwall alignment, three are in areas of EJ concern while two are NOT in areas of EJ concern. The high, adverse impact of commercial structure acquisition is not a disproportionate impact to areas of EJ concern as the impact is proportionally distributed across both EJ and non-EJ areas of concern. EJ outreach would inform and engage the communities with and about the impacts and the proposed project.

Figure 5-27. shows the locations of the structures that may be acquired along the West and South Slidell Levee/floodwall alignment and the structures that are in areas of EJ concern.

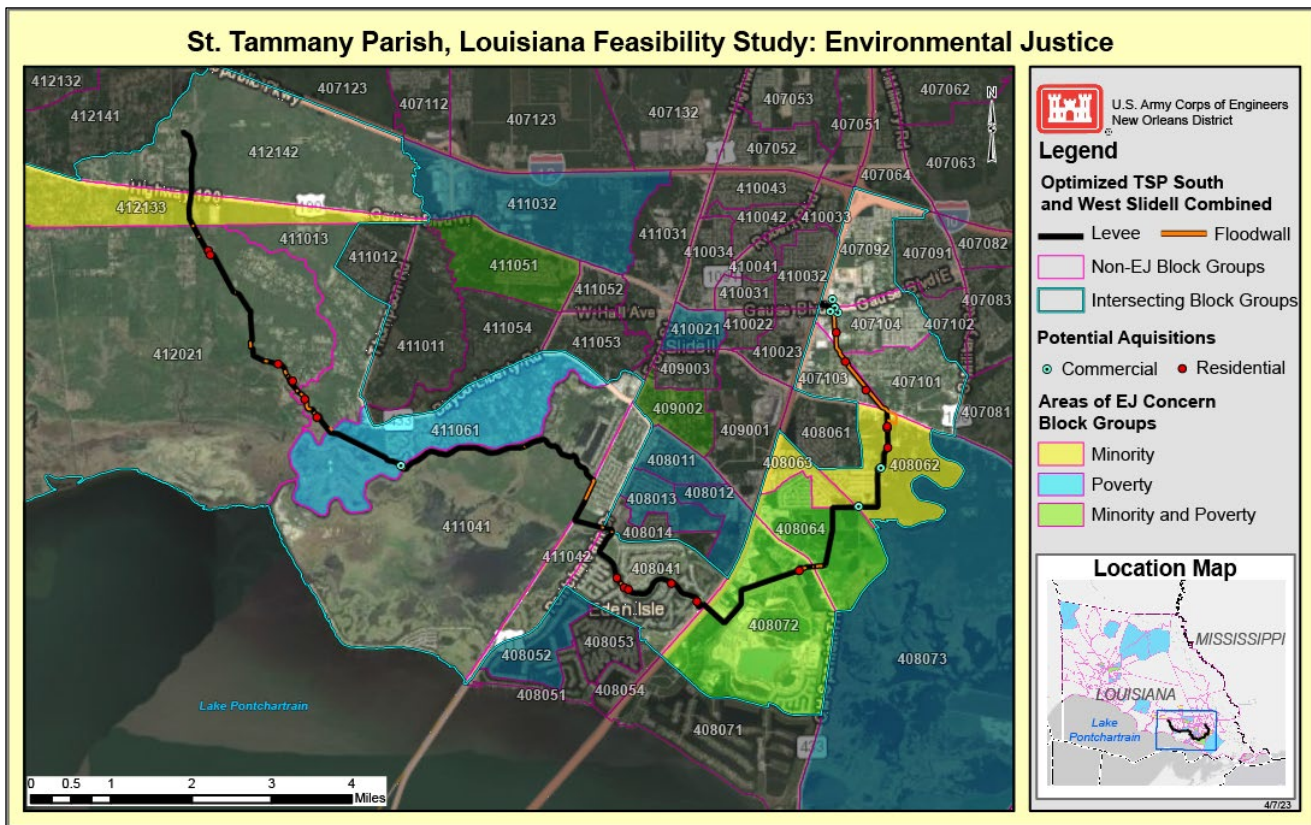


Figure 5-27. West and South Slidell Levee Potential Structure Acquisitions

Note: Polygon shapefiles shown on the maps in the EJ sections of the main report and attribute data used in the EJ analysis are from Steven Manson, Jonathan Schroeder, David Van Riper, Tracy Kugler, and Steven Ruggles. IPUMS National Historical Geographic Information System: Version 16.0 [dataset]. Minneapolis, MN: IPUMS. 2021. <http://doi.org/10.18128/D050.V16.0>

Adverse Indirect Impacts to Areas of EJ Concern: The indirect impacts from the construction of the West and South Slidell Levee construction are not expected to be high adverse impacts, would be temporary, and related to construction activities. Indirect adverse impacts due to the NS plan and elevating of structures also are related to construction activities associated with the elevation of the structure.

Adverse, indirect impacts of construction of the structural measures may include the following: transportation and traffic delays, noise, and dust and air quality impacts. Approximately 130,000 cubic yards of material would be dredged from the Mile Branch Channel (not part of the RP), resulting in about 9,000 truck trips over the course of the project. For the South and West Slidell Levee, approximately 7,239,000 cubic yards of borrow material would be required (including future levee lifts) to construct the levee system, resulting in approximately 499, 200 truck trips over a five-year period, or about 277 trucks trips per day traveling throughout the study area to the various segments of levee being constructed.

Adverse indirect impacts of structure elevations include the temporary relocation of the household members while the structure is being elevated. However, these indirect impacts would not be considered high, adverse, or disproportionate, are temporary in nature and would be felt by those in EJ and non-EJ communities.

In general, the construction, operation, maintenance of the RP, particularly the West and South Slidell Levee, may cause adverse temporary impacts on the road network adjacent to the West and South Slidell Levee alignment due to increased congestion, accelerated roadway wear-and-tear, and traffic delays resulting from re-routing major and local access roads. Temporary impacts on transportation due to increased congestion may occur and is dependent on road closures required to construct the improvements and the levee. Road closures may not occur every day, and if closures are required, they would be for the short-term. On those segments of roads that must close and traffic re-routed, minor to moderate delays, particularly during peak hours, may occur especially in more congested areas.

Noise along all segments of the channel improvement and along and adjacent to the levee construction would increase due to the temporary operation of equipment and vehicles used during construction. 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 are anticipated, and all noise emissions are expected to be short-term, lasting only as long as construction activities.

Dust and air quality impacts to EJ areas of concern are expected to be minor and short term. Temporary increases in air pollution could occur from the use of construction equipment (combustible emissions). Combustible emission calculations were made for standard construction equipment, such as bulldozers, excavators, dredgers, pumps, front end loaders, backhoes, cranes, and dump trucks.

Mitigation of Impacts to Areas of EJ Concern

Mitigation of Direct Impacts in Areas of EJ Concern

Uniform Relocation Act (URA) Benefits for those impacted under the Nonstructural Plan:

Allowable relocation assistance funds for displaced tenants are allocated in accordance with the Uniform Relocation Assistance (URA) and Real Property Acquisition Policies for federal and Federally Assisted Programs of 1970, Public Law 91-646, 84 Stat. 1984 (42 U.S.C. 4601), as amended by the Surface Transportation and Uniform Relocation Assistance Act of 1987, Title IV of Public Law 100-17, 101 Stat. 246-256. Relocation assistance for tenants may include, among other things, advisory services, eligible reasonable out-of-pocket expenses incurred during temporary displacement (e.g., moving and storage of household goods required to be removed during construction, temporary quarters, meals, etc.). Landowners whose properties are voluntarily elevated would not be eligible for benefits in accordance with URA; however, tenants of these structures may be eligible for these benefits.

A whole of government approach to improve participation in the NS plan by offering eligible low-income, disadvantaged community homeowners financial assistance to be able to participate in the program may be necessary. Discussions and collaboration with other federal and nonfederal governments on programs they may offer that could improve participation in the NS plan elevation program will be conducted at the time of project implementation, during the Pre-engineering and design phase of the project. Additionally, the implementation plan can recommend that the federal government be responsible for costs typically borne by the homeowner (but reimbursable) to prepare their home for elevation. Even though these costs may be reimbursable costs, the inability of the homeowner to pay the upfront costs may be a deterrent to participation, especially to those part of disadvantaged communities.

Uniform Relocation Act (URA) Benefits for those impacted by Acquisition: Homeowners who are impacted by acquisition would also qualify for URA benefits, which are described in more detail in Appendix G: Real Estate Plan.

Mitigation of Indirect Construction-Related Impacts to Areas of EJ Concern: Best Management Practices include several impact avoidance features which are included as integral components of the proposed action to minimize impacts to vehicular transportation. Specific routes would be designated for construction-related traffic to minimize residential disturbance and traffic congestion. USACE contracts would designate specific routes for construction-related traffic to avoid residential areas, to the maximum extent practicable, and staging areas for construction equipment and personnel would be located away from heavily populated areas. Streets that would serve construction-related traffic would be resurfaced, if needed and as appropriate, prior to initiation of construction activities, and maintenance of those streets would be provided during the construction period. Appropriate detour signage would be placed in order to preserve access to local streets during construction activities. Off-street parking would be provided for construction workers, and shuttle vans would be used to transport construction workers to the work sites, if necessary. Streets that are damaged by any and all construction activities would be repaired.

Noise along all segments of levee construction would increase due to the temporary operation of equipment and vehicles used in the construction of the levee. Short-term noise impacts would be avoided, minimized or mitigated by use of the following best management practices:

The contractor, as a best management practice and as practicable, would restrict work to regular business hours (approximately 0700-1900) on weekdays to reduce potential effects from noise and increased truck traffic to the identified existing EJ community and general public.

Placement of temporary noise barriers adjacent to construction activities.
If machinery causing vibrations is used, the following noise and vibration monitoring language would be included in the contract specifications for specific work items:
Monitoring of noise levels to verify adherence to contract specifications.
Limit pile driving activities associated with pile founded T-walls to daylight hours.

Use vibration monitoring equipment that measures surface velocity waves caused by equipment and monitor vibration up to a threshold value established and approved in writing by USACE. Such measurements would only be taken near residences and occupied buildings that could be adversely affected by excessive ground vibrations.

Construction equipment noise would be minimized during construction by muffling and shielding intakes and exhaust on construction equipment (per the manufacturer's specifications), and by shrouding or shielding impact tools.

All equipment, haul trucks, and worker vehicles would be turned off when not in use for more than 30 minutes.

Equipment warm-up areas, water tanks, equipment storage areas, and staging areas would be located as far from existing residences as is feasible.

According to EPA's EJSCREEN environmental indicators for St. Tammany Parish (EJ Appendix, Table 2), the Air Toxics Respiratory Hazard Index is low (any index above the 80 percentile is a high burden that would warrant further investigation and discussion) and any temporary effect of dust related to construction activities or use of construction equipment is not expected to alter this index.

Borrow Sources: Material obtained from borrow sources would be from four sites that would have no direct impact on EJ communities and one site that would impact an EJ community. Two sites in Mississippi (MS-1 and MS-2) are commercially- operated borrow pits. These two sites were previously evaluated in Individual Environmental Reports (IER) #19, 23, and 31 for the Hurricane and Storm Damage Risk Reduction System (HSDRRS) projects. That discussion is incorporated by reference. The remaining three sites are STP-5, STP-6, and STP-9. More information regarding the selection of borrow sources can be found in Appendix C: Environmental.

Borrow site STP-6 is in the Slidell area and is adjacent to a minority and low-income community, as identified using CBG data. Population groups residing near the borrow sites may experience minor, temporary, adverse indirect impacts. Potential impacts to these communities include an increase in truck traffic accessing and leaving the borrow sites, noise, and dust. Truck traffic and noise along roads, highways and streets during borrow site excavation would cease following completion of work activities. There may also be a degradation of the transportation infrastructure, primarily local roads and highways, as a result of the wear and tear from transporting earthen material. Best management practices would be utilized to avoid, reduce, and contain temporary impacts to human health and safety. During PED, the particulars of these impacts would be identified, including the approximate duration of activities involved in extracting material and the number of truck trips needed to deliver the material. Locations STP-5 and STP- 9 are located near communities that are predominately white and not low-income.

The two borrow sites in Mississippi, MS-01 and MS-02, are located on lands surrounded by undeveloped parcels and therefore impacts to minority and low-income residents would be

either nonexistent or very minimal. Additionally, the areas around the borrow sites are vastly white and not low-income.

5.2 CUMULATIVE EFFECTS ANALYSIS

The Council on Environmental Quality (CEQ) Regulations define cumulative impacts as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.” (40 CFR §Parts 1500-1508).

USACE recognizes that on 16 July 2020, CEQ published a Final Rule revising its NEPA-implementing regulations at 40 CFR Parts 1500 - 1508 (85 FR 43304). The revised regulations apply to NEPA processes begun after their effective date, 14 September 2020, although agencies may apply the revised regulations to ongoing NEPA evaluations begun before that date. 40 CFR 1506.13. USACE has chosen to proceed under the regulations in effect at the time the St. Tammany Parish EIS process began in early 2020 (The Notice of Intent was published on 19 June 2020 [85 FR 37075]).

Cumulative effects 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 effects analysis to important issues of national, regional, and local significance (CEQ, 1997).

The CEQ issued a manual entitled Cumulative Effects under NEPA (CEQ, 1997). This manual presents an 11-step procedure for addressing cumulative impact analysis. The cumulative effects analysis concentrates 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.

In Louisiana, the causes of coastal wetland degradation and loss have been researched extensively. Losses are expected to continue due to many different, and often interacting factors, including agriculture, nutrient enrichment, drainage, climate change, human development, pollution, invasive species, world-wide eustatic sea level rise, subsidence, navigation channels, oil and gas activities, saltwater intrusion, and tropical storms.

The gradual decline of marsh vegetation due to storm surge events, inundation, and saltwater intrusion eventually lead to complete loss of marsh vegetation. As this marsh vegetation is lost, underlying soils become more susceptible to erosion, leading to an increase in open water areas and preventing marsh regeneration. Without the accretion or deposition of sediments where erosion is occurring, it is not possible for marsh habitat to reestablish.

Rising sea levels in climate forecasting for the state of Louisiana are anticipated to expose additional shoreline areas to erosive forces. Levees, floodwalls, and other water resource management structures provide risk reduction to the human environment during flooding events from storm surge; aid in the reduction of flood risk and damages to residential, commercial, historic, cultural, and critical assets and infrastructure; limit economic damages and improve economic resiliency of the local economy and communities; convert flood zones to help minimize insurance expenses; and help reduce recovery time from high water events that make evacuation routes and other critical roadways impassable.

Regional Projects and Programs

Since the 2005 hurricane season, significant resources and efforts focused on rebuilding southeast Louisiana. To quantify these regional efforts, a wide array of resources were canvassed to try to bring the impacts of as much of this rebuilding effort as practicable under one overarching evaluation of cumulative impacts due to regional actions. For the cumulative impact analysis, regional projects conducted by others in southeastern LA were broadly addressed through the following subheadings:

- Storm Damage Reconstruction Projects - 29;
- Orleans Parish building permits 343,220 (2005-2011)
- Redevelopment Project – 500
- Coastal and Wetlands Restoration Projects – 240
- Flood Risk Reduction Projects – 125
- Transportation Projects – 339

Past, present, and reasonably foreseeable future regional projects including regulatory permits are listed in Appendix C, Annex N under the subheadings as indicated above. Coastal and restoration projects considered in the analysis include the State Master Plan measures in southeastern Louisiana. The analysis includes projects under the Final Comprehensive Environmental Document, Louisiana Coastal Impact Assistance Program (CIAP) and the Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA). As of October 2020, there are a total of 226 CWPPRA projects. Of those, 149 are active, 6 are inactive, 17 are complete, 96 are in long-term O&M, 8 have been transferred, and 46 have been deauthorized. In addition, other regional projects include Section 408 permissions under Section 14 of the River and Harbors Act of 1899, codified at 33 USC Section 408. A total of 114 Section 408 permissions were issued between July 2016 and August 2020 by the CEMVN Operations Division. Of the issued permissions, 55 projects were in a five-parish area including St. Tammany Parish, a majority of which were evaluated as Categorical Permissions or Categorical Exclusions.

Levee Systems:

The proposed project would construct approximately 18 miles of earthen levees. The impacts from construction of this project would be an additive impact to other similar projects constructed in the past, present and into the future. The proposed project would result in conversion of marsh and pine savanna habitat to earthen levees. The floodgates proposed

for the waterways would be closed during named storm events and over time would be closed more frequently due to sea level rise.

Construction of levees, floodwalls and floodgates are, in a way, a way of life in coastal Louisiana and the coastal states along the Gulf Coast. These structures are necessary to provide flood risk reduction to the cities and communities in which they are constructed to protect. Billions of dollars have been spent in coastal Louisiana to construct flood risk reduction projects. Projects such as the Lake Pontchartrain & Vicinity and Westbank & Vicinity Hurricane Storm Damage Risk Reduction System have constructed approximately 213 miles of levees, floodwalls, closure structures, and pump station structures. The direct and indirect effects of implementing the HSDRRS projects, the significant environmental resources, ecosystems, and human communities that are affected, and the effects important from a cumulative impact's perspective have been documented in the Comprehensive Environmental Document dated October 2021. The CED is a cumulative impact assessment of the HSDRRS projects evaluated in 66 Individual Environmental Reports (IERs) supplemental IERs and EAs.

As a result of environmental conditions in coastal Louisiana such as subsidence and sea level rise, future levee lifts are necessary to maintain the 100-year level of risk reduction. Initial rough order of magnitude estimates suggests that future levee lift of the HSDRRS would require 9 million cubic yards of additional borrow. The non-federal sponsor can construct future lifts to sustain the design heights until 2025 with USACE 33 USC Section 408 permissions. Absent future construction of additional levee lifts by either the USACE or CPRAB and the local levee districts, risk associated with flooding from a tropical event in the metro New Orleans area would increase over time.

Borrow

In 2007, the USACE began an unprecedented search for suitable earthen material to rebuild and reinforce the HSDRRS in the Greater New Orleans metropolitan area. Approximately 72 borrow sites were evaluated in IERs. These borrow sites are located in 12 parishes in Louisiana and 1 county in Mississippi; these include, Jefferson, Orleans, St. Charles, Plaquemines, St. James, St. John the Baptist, Iberville, St. Tammany Parishes in Louisiana, and Hancock County, Mississippi.

Of those borrow sites investigated, only 21 borrow sites were excavated. All sites with wetlands were avoided. Two sites that were cleared by IERs are proposed borrow sites for this proposed project.

Farmland or pasture sites were primarily used as borrow areas for the HSDRRS construction. Two sites that were cleared by IERs and utilized as a borrow source for HSDRRS are proposed borrow sites for this proposed project. The other five borrow sites proposed are grasslands. Generally, agricultural fields and open grassland areas are ideal sources of borrow for construction of flood risk reduction projects. Over time, this results in significant loss of open grasslands and agricultural lands and leaves the landscape marked by open pits converted to essentially bodies of water such as ponds.

The currently known significant long term adverse cumulative effects expected from implementation of the proposed action would be associated with the conversion of existing marsh, and pine savanna habitats to levee and the impacts to hydrology resulting from operation of floodgates during named storm events. The significant impacts are offset by the restoration of marsh and pine savanna habitats for compensatory mitigation. Conversion of marsh, and forested habitats to grass-covered levee habitat would provide benefits for human development at the cost of lost habitat, including productive wetlands. Some loss of wetland habitat would occur even in the absence of the proposed project; current loss of wetlands throughout the area is the result of development, subsidence, erosion as well as sea level rise.

Longer term cumulative impacts of the project would include a reduction in existing habitat used by various terrestrial and aquatic organisms for shelter, nesting, feeding, roosting, cover, nursery, EFH and other life requirements.

Construction impacts associated with potential levee construction (i.e. Southeast Louisiana Urban Flood Damage Reduction Projects (SELA)), ecosystem restoration (LPV Zydeco Ridge II), hydrologic restoration (Fritchie Marsh Restoration), development (Madison Bulkhead) could result in short term localized impacts such as increased turbidity, chemical leaching, reduced dissolved oxygen, and elevated carbon dioxide levels as well as providing some long-term benefits including flood risk reduction for communities, habitat restoration providing shelter, food and foraging opportunities for wildlife. Areas exposed to Lake Pontchartrain along the outside of the levee alignment are expected to receive an increased rate of erosion due to the reflection of storm surge against the levee. Indirect, longer term impacts include alterations to canals and their associated spoil banks, as hydrology changes within these wetland systems, often interfering with normal tidal flooding from Lake Pontchartrain, as well as overland water flow.

SECTION 6

Recommended Plan

6.1 SUMMARY OF PLAN FORMULATION PROCESS

The plan formulation process for this study identified potential solutions to rainfall, riverine and coastal storm related flooding across the study area. The study area has discrete hydrologic sub-basins, which allowed for measures and alternatives to be developed for each of these areas independently. At the onset of the study, a total of 208 site-specific management measures were identified. Throughout the study, measures and alternatives were independently evaluated and screened so that the recommended measures to address flooding could be identified. Decisions on the selection of the measures in the RP, were informed by, among other things, hydraulic (H&H) modeling (Advanced CIRCulation (ADCIRC) and Hydrologic Engineering Center – River Analysis System (HEC-RAS)), economic modeling (Hydrologic Engineering Center Flood Damage Analysis (HEC-FDA)), USACE cost estimates, engineering, design, environmental impacts and compensatory mitigation, risk assessments and potential life safety concerns.

A DIFR-EIS containing a Draft TSP was released in June 2021 for a concurrent public, ATR, IEPR, and legal and policy review. After the release of the DIFR-EIS, the additional engineering, economic, and environmental investigations on the separate measures of the Draft TSP were conducted. The information gathered through these additional investigations, together with the comments received on the DIFR-EIS were used to refine and optimize the Draft TSP. In July 2023, a RDIFR-EIS that contained the Optimized TSP, was released for another concurrent public, ATR, IEPR, and legal and policy review. After review of the comments received on the RDIFR-EIS, the analysis on the measures in the Optimized TSP was updated, and the refinement ultimately informed the measures to be included in the final RP.

The RP is a comprehensive plan to address flooding parish-wide, and includes structural and NS measures that address both FRM and CSRM flood risks. The structural component of the RP consists of the construction of a levee and floodwall system along an alignment in South and West Slidell, Louisiana (West Slidell and South Slidell Levee and Floodwall System). In concert with structural measures, NS measures would be a key component to reducing long term FRM and CSRM to the study area. The NS component of the RP spans the entire St. Tammany Parish and consists of the elevation of 5,583 structures and floodproofing of 827 structures. Figure 6-1 illustrates the RP and Table 6-1 details the RP attributes. Table 6-2 gives a cost and benefits breakdown for each measure in the Recommended Plan.

A summary of the final feasibility level RP is included in this Section. The full engineering project description and assumptions for the Structural Plan are included in Appendix D: Engineering. The NS Plan is further described in Appendix F: Economics and Appendix H: NS Implementation Plan. Detailed plans and specifications for implementing would be

developed as part of the PED. The PED phase occurs after Congress authorizes a proposed plan into law and appropriates funds for its construction.

The RP supports the USACE Environmental Operating Principles through consideration of environmental consequences of federal actions, fostering sustainability as a way of life and mutually supporting economic/environmentally sustainable solutions. By developing a plan that is responsible, legally compliant and leverages scientific, economic, and social considerations. The planning process and development of a plan to meet the problems and needs of the area was transparent with consideration of the views and comments from stakeholders, NGO's and the public.

The RP will not reduce all flood risk within St Tammany Parish, but rather is intended to provide benefits in concert with other ongoing efforts, programs and projects by other federal agencies, state and local government and community efforts. The residual risk, along with the potential consequences, has been communicated to the NFS and will become a requirement of any communication and evacuation plan. The RP would reduce flood risk to approximately 26,350 structures and approximately 70,000 residents. The RP will produce an estimated \$145,331,000 in net benefits, has a benefit to cost ratio of 1.6, and is consistent with USACE policies, laws, and regulations. The RP will decrease annual damages from \$537,780,000 (without-out project condition) to \$165,289,000 under the "with project" condition. Approximately 20 percent of the benefits provided by the RP would accrue to disadvantaged communities (Justice 40 Initiative). For the NS component, construction would occur from 2025-2037. The construction of the West and South Slidell Levee and Floodwall System and related components) would occur from 2025-2076. Additional levee lifts would occur three times post initial construction at 5-7 years, 15-20 years, and 30 years.

It is anticipated the cost share for the design and construction of the project would be 65 percent federal and 35 percent non-federal as shown in Table 6-7. Final, specific cost share requirements would be identified in the Project Partnership Agreement. Among other responsibilities, the NFS must provide all project LERRDs required for the project. The non-federal sponsor will be 100 percent responsible for the OMRR&R. For the NS component of the plan, these responsibilities include inspection of the elevations and floodproofing measures on properties to ensure compliance with the restrictions provided within the non-standard(s) estate to be acquired by the non-federal sponsor for continued effectiveness of the measures. The total average OMRR&R annual cost is currently estimated at \$7,753,000.

The estimated total Project First Cost for the RP is \$5,894,229,000.00 at a FY 24 price level. The Project First Cost (Current Price Level) is the cost estimate that will serve as the basis for providing the cost of the project for which authorization is sought. The fully funded total Project First Cost includes a contingency developed utilizing the Cost and Schedule Risk Analysis, and computed contingency for the overall project as 46 percent, with a 51 percent computed contingency for the West and South Slidell Levee and Floodwall System and 43 percent computed contingency for the NS component of the RP. The cost contingencies reflect an 80 percent confidence level in estimated fully funded total project cost and are

intended to cover potential cost and schedule increases associated with identified project risks and their probability of occurrence.

The estimated total Project First Cost for the Structural measure (West and South Slidell Levee and Floodwall System) is \$2,882,000.00. The construction of the levee and floodwall system will impact an estimated 290 private landowners and the NS measures will impact 6,410 private landowners. The total estimated real estate cost for the West and South Slidell Levee and Floodwall System, including contingencies, borrow sites and environmental mitigation costs, is estimated as \$81,476,000.

The total estimated Project First Cost for the NS measures is \$3,012,000 which includes \$1,832,345,000 for implementation of residential structure elevation measures (for 5583 eligible residential structures at \$95 per square foot and \$2,295,896,000 for implementation of the dry floodproofing measures for 827 eligible nonresidential structures at approximately \$29-\$80 per square foot (dependent on the square footage of the nonresidential structure). The total estimated real estate cost for NS measures, including contingencies is \$170,764,000.

The real estate cost estimates may require revisions during Preconstruction, Engineering and Design (PED) if the project is approved.

The RP includes a compensatory habitat Mitigation Plan to mitigate for habitat losses that will result with the implementation of the RP. The Mitigation Plan consists of a combination of mitigation bank credit purchases and marsh restoration and pine savanna (refuge) mitigation projects to be constructed by USACE either before or concurrent with the construction of the RP. The total cost of compensatory habitat mitigation for fish and wildlife losses under the RP is \$ 39,973,512 which is included in the total estimated Project First Cost. See Appendix I: Mitigation Plan.

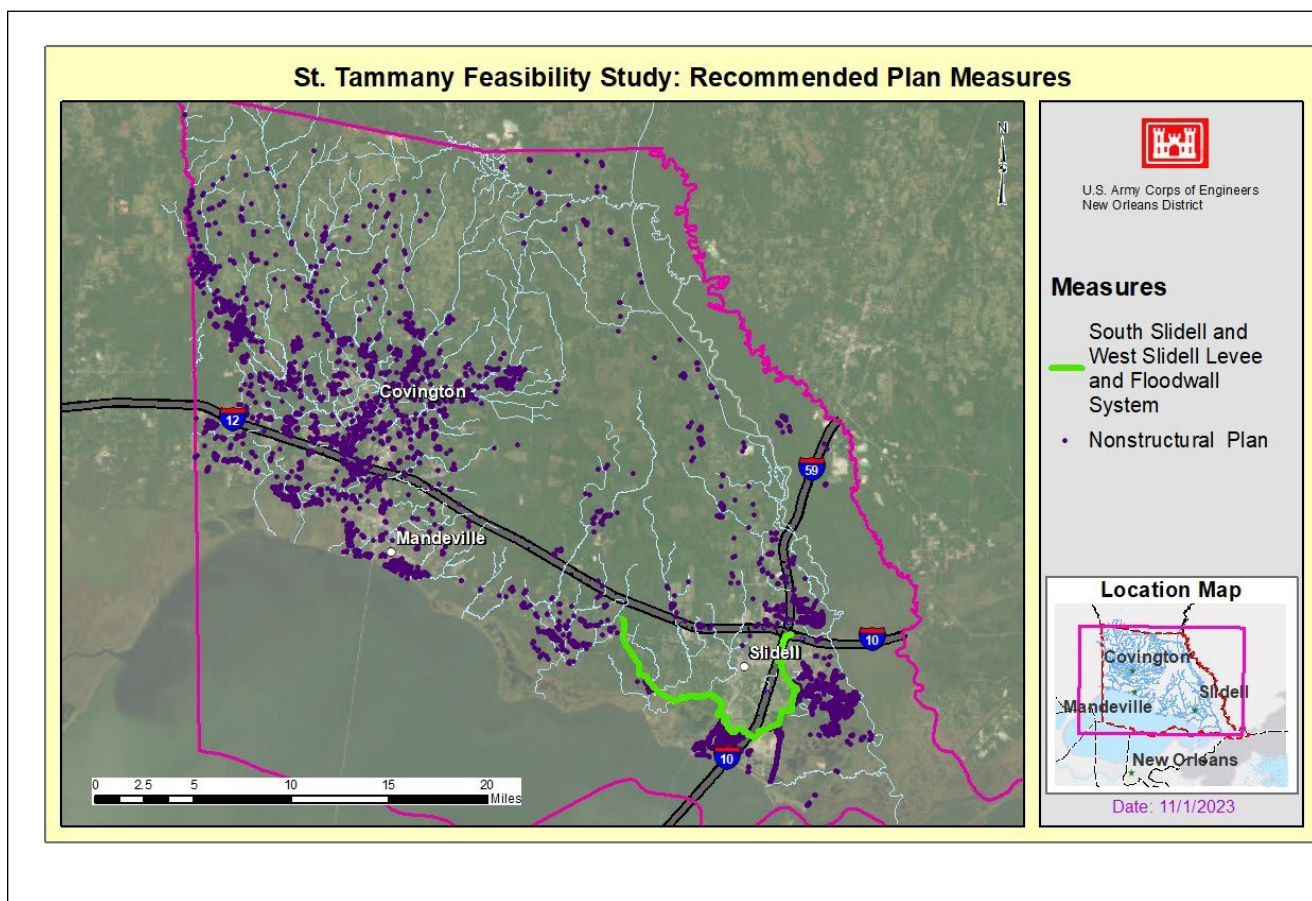


Figure 6-1. RP/NED Plan

Table 6-1. RP/NED Plan Attributes (in 1,000s)

Attribute	West and South Slidell Levee and Floodwall System	Nonstructural	Total
Total Length of alignment/improvements	18.5 miles (97,700 feet)	-	18.5 miles (97,700 feet)
Length of Floodwall	3.5 miles (18,200 feet)	-	3.5 miles (18,200 feet)
Length of earthen Levee	15 miles (79,500 feet)	-	15 miles (79,500 feet)
Hydraulic Design Elevation Range (Dependent on location)	13.5 to 16 (year 2032) 17.5 to 20 (year 2082) (depending on location)	-	13.5 to 16 (year 2032) 17.5 to 20 (year 2082) (depending on location)
Pump Stations	8	-	8
Culverts/ Sluice Gates/ Life Gates	13	-	13
Number of Vehicular Floodgates	18	-	18
Number of Pedestrian Floodgates	1	-	1
Number of Railroad Gates	1	-	1
Number of Road Ramps	6 (includes the I-10 near Oak Harbor)	-	6 (includes the I-10 near Oak Harbor)
Number of staging areas for clearing and grubbing and mechanical dredging and for bridge replacement	-	-	-
Number of Bridge Replacements	-	-	-
Fill (Borrow Material) Required	7,079,000 cubic yards (initial construction plus future lifts) 3,000,000 cubic yards for initial construction only	-	7,079,000 cubic yards (initial construction plus future lifts) 3,000,000 cubic yards for initial construction only
Material to be Mechanically Dredged	-	-	-
Temporary Acres of Construction Impacts	238 acres (3.34 net acres)	-	238 acres (3.34 net acres)
Permanent Construction Impacts	352 acres (224 net acres)	-	352 acres (224 net acres)
Number of structures benefitted	20,000	6,410	26,350
Mitigation Costs	\$39,973,512.	-	\$39,973,512.
Construction Costs	\$2,150,654	\$2,315,234	\$4,465,888
Net Benefits	\$43,840	\$101,491	\$145,331
B/C Ratio	1.4	1.9	1.6

Table 6-2. Cost and Benefits Breakdown for Measures in the RP (in 1,000s)

Measure	West and South Slidell Levee and Floodwall	Nonstructural	Recommended Plan Combined Structural & NS Plan 4%, 2% and 1% AEP for areas not receiving flood damage protection from structural measures
Project First Cost	\$2,881,740	\$3,012,488	\$5,894,229
Benefits	\$159,036	\$213,455	\$372,491
Average Annual Costs	\$115,196	\$111,964	\$227,160
Net Benefits	\$43,840	\$101,491	\$145,331
B/C Ratio	1.4	1.9	1.6
Approx. number of structures with flood risk reduction	20,000	6,410	26,350

*The NS plan varies by location and the AEP for each area.

6.2 NONSTRUCTURAL PLAN

The NS measures reduce flood damages without significantly altering the nature or extent of flooding. Damage reduction from NS measures is accomplished by changing the use of the floodplains, or by accommodating existing uses to the flood hazard. NS measures differ from structural measures in that they focus on reducing the consequence of flooding for a specific structure rather than reducing the probability of flooding in that area.

The NS component of the RP includes all of St. Tammany Parish and consists of the elevation of approximately 5,583 eligible residential structures to the future 100-year flood stage (not to exceed 13 feet above the existing grade), and the floodproofing of 827 eligible nonresidential structures up to 3 feet. See Figure 6-2. The cost estimate for the NS component of the RP assumes 100 percent participation by the owners of eligible residential structures, so the overall total project cost has inherent conservatism.

The NS elevations and floodproofing are 100 percent voluntary; property owners who have preliminarily eligible structures that wish to participate in the flood proofing measures would be required submit an application and provide a right-of- entry for their structure to undergo site assessment, appraisal, and other inspections and evaluations to determine the final eligibility of the structure.

Eligible structures must have a first-floor elevation (FFE) at or below the 25, 50 or 100 -year storm surge floodplain (depending on location within the study area), based on hydrologic conditions predicted to occur in 2032 (the beginning of the 50-year period of analysis). This included consideration of underserved communities as identified by the Justice 40 criteria. The NS measures are anticipated to reduce annual damages by approximately 40 percent relative to the without project condition. The NS plan was efficient and incrementally justified because as it provided the most net benefits to reduce flood damages. The NS plan also

had positive NED, RED and OSE benefits and the least EQ impacts of any alternative in the Final Array of Alternatives.

Further detail can be found in Appendix F: Economics and Appendix H: NS Implementation Plan.

6.2.1 Residential Structure Elevation

The NS component of the RP includes all of St. Tammany Parish and consists of the elevation of approximately 5,583 eligible residential structures to the future 100-year flood stage (not to exceed 13 feet above the existing grade). In order to be preliminarily eligible for elevation, a residential structure must meet the following initial criteria:

- The structure must have a FFE at or below the applicable floodplain (which may be either a 25-, 50- or 100-year floodplain depending on the location of the structure), based on hydrologic conditions predicted to occur in 2032 (the beginning of the 50-year period of analysis) at a specific location.
- The structure must be outside of the area receiving flood risk reduction protection from a structural measure of the RP.
- The structure must have a permanent foundation and be permanently immobilized and affixed or anchored to the ground as required by applicable law and must be legally classified as immovable real property under state law. Notwithstanding the provisions of La. R.S. 9:1149.6, a manufactured, modular or mobile homeowner and any subsequent owner of an immobilized manufactured, modular or mobile home, may not deimmobilize the manufactured, modular or mobile home in the future, by detachment, removal, act of deimmobilization, or any other method. Manufactured, modular and mobile homes that do not meet these requirements are not eligible for elevation.

6.2.2 Non-residential Dry Floodproofing

As part of the RP, 827 eligible nonresidential structures in would be floodproofed up to 3 feet. Dry floodproofing consists of sealing all areas of a structure up to a maximum of approximately 3 feet above grade level to reduce damage caused by coastal storm surge inundation by making walls, doors, windows and other openings resistant to penetration by water. The proposed plank system is composed of gasketed aluminum planks and steel posts which are quickly mountable and watertight. It is erected when flooding is imminent and then easily disassembled and stored, leaving an unobstructed view of the area with no protrusions. Back-flow from water and sewer lines is prevented by installing mechanisms such as drain plugs, standpipes, grinder pumps, and back-up valves. Openings, such as doors, windows, sewer lines, and vents, may also be closed temporarily with sandbags or removable closures, or permanently sealed. In order to be preliminarily eligible for elevation, a nonresidential structure must meet the following initial criteria:

- Eligible structures must have a first-floor elevation (FFE) at or below the 25, 50 or 100-year storm surge floodplain (depending on location within the study area), based on

hydrologic conditions predicted to occur in 2032 (the beginning of the 50-year period of analysis).

- Additionally, the structure must not be receiving flood risk reduction protection from the levee and floodwall system measure of the RP.

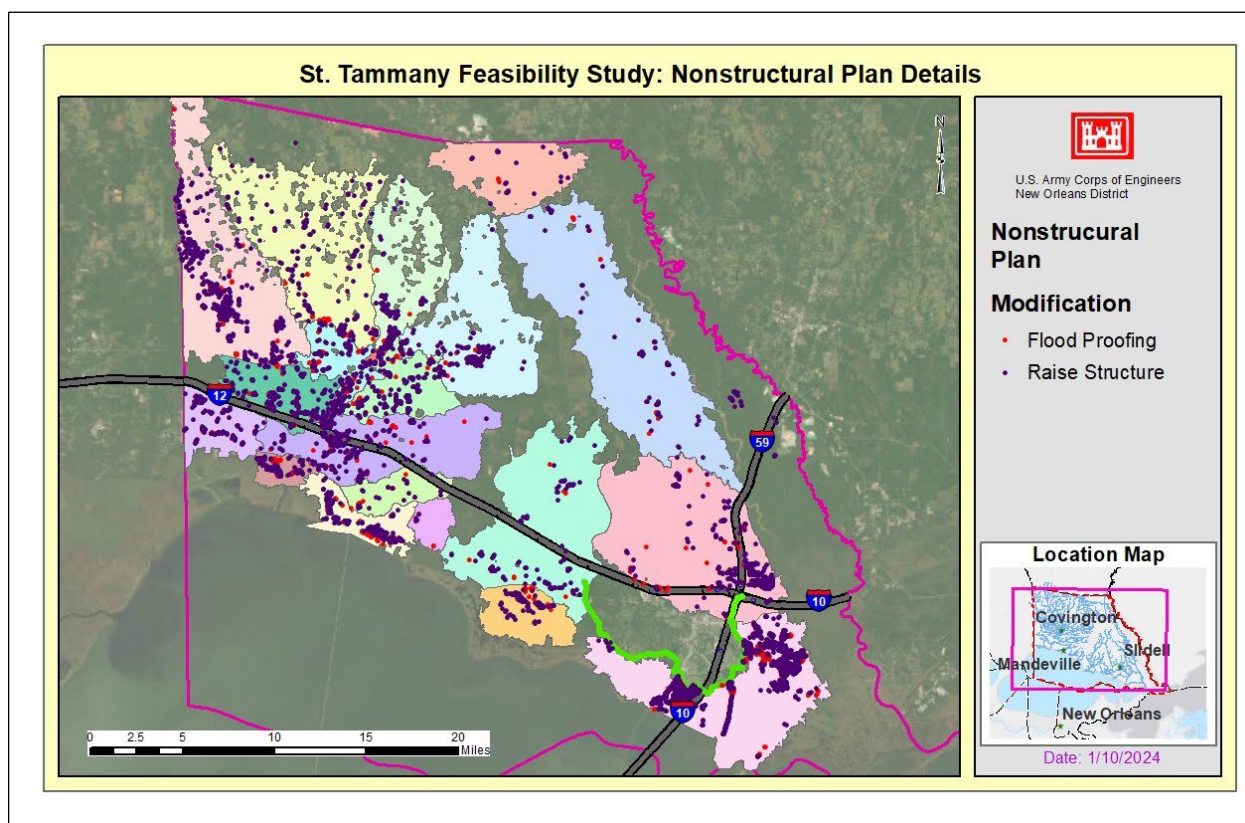


Figure 6-2. Nonstructural Plan **Refer to Figure 4-18 for Name of Subaggregates Identified

6.3 STRUCTURAL PLAN- WEST AND SOUTH SLIDELL LEVEE AND FLOODWALL SYSTEM

The levee and floodwall system and associated structures would reduce risk of flooding for over 20,000 structures and 4 miles of evacuation routes and I-10 would be located in the system. The levee and floodwall system (18.5 miles) consists of earthen levees (15 miles), floodwalls (3.5 miles of floodwalls), pump stations (8), sluice gates/lift gates (13), vehicular floodgates (18), pedestrian floodgate (1), railroad gate (1), and road ramps (6). Appendix D: Engineering provides levee, floodwall and structure dimension and typical segments diagrams required to perform the impact analysis and develop cost estimates.

For the 50-year period of analysis, the construction of the levee alignment would impact approximately 102 acres of staging area and 483 acres of permanent ROW. The levee alignment would require approximately 7,239,000 cubic yards of fill for construction (includes 30 percent contingency). The I-10 road surface would be raised to a construction elevation

of 22.0 feet in order to ramp over the new levee and remain above the hydraulic design elevation for year 2082.

The construction of the floodwall and levee system, would be based on a 1 percent probability storm level of risk reduction and a 2032 intermediate RSLR condition. In order to maintain the levee crown at or above the future year (2082) design elevations, and accounting for levee settlement and RSLR, the levees would be constructed in multiple lifts over the 50-year period of analysis. Both the design elevations and constructed "top of levee" elevations vary by location due to surge and wave differences due to storm path, wind speeds and direction, etc. Initial construction is estimated to take place in 2032. Four future levee lifts are projected to be needed subsequent to that initial construction. The assumed cross-section for these lifts would have a 10 feet wide levee crown and side slopes of 1V:3H. Existing berm sections from initial construction would be in place on both sides of the levee.

Conversely, all floodwall segments, structures and the 1-10 crossing were designed and would be constructed to the future year condition (2082 condition) during the initial construction in 2032. These features would not need additional lifts or construction after they constructed and beyond the planned OMRR&R.

Approximately 110 acres of the Big Branch Marsh National Wildlife Refuge (BBMNWR), generally along the south side of Bayou Bonfouca westward of the Norfolk Southern Railroad tracks, is required from the USFWS for the West and South Slidell Levee and Floodwall System feature of the RP. The USFWS is authorized to exchange property with the NFS. Accordingly, property determined to be suitable and desirable by USFWS in a location where it is authorized to acquire property for the BBMNWR would be identified by USFWS, then the identified property may be acquired by the NFS and exchanged with USFWS for the LERRDs required within the Refuge for the construction of the levee and floodwall system. The exchange of BBMNWR is authorized under the National Wildlife Refuge System Administration Act administered by the National Wildlife Refuge System. In the case of an exchange, an Exchange Agreement is to be executed between the NFS and USFWS.

The only features of the RP that require borrow material are the West and South Slidell Levee and Floodwall System. Borrow material for construction will come from sites estimated to be within no more than 17 miles of the levee and floodwall system. A total of 3,000,000 cubic yards of soil is needed for initial construction and a grand total of 7,239,000 cubic yards is needed over the entire authorized 50-year period to sustain the 1 percent AEP design elevations out to year 2082.

The levee and floodwall system consists of a combination of portions of the West Slidell levee measure and the South Slidell floodwall measure from the Final Array of Alternatives. The two alignments would be connected by a new railroad gate across the existing Norfolk Southern Railroad tracks. Figure 6-3. All levee and floodwall features (the West and South Slidell Levee and Floodwall System) are based on the post-Hurricane Katrina design

standards developed by USACE for the Hurricane and Storm Damage Risk Reduction System (HSDRRS) for the greater New Orleans area which includes St. Tammany Parish.

6.3.1 West Slidell Segment

Starting from the western segment of the levee and floodwall system, construction would commence on the south side of U.S. Highway 190 and South Tranquility Road, and on the eastern side of Pineridge Road. The alignment would run southward and would run on the west side of Tranquility Road (CC Road) and then turn in the southeast direction crossing Bayou Paquet Road on the east side of Bayou Paquet Channel to avoid impacts to the BBMNWR. The alignment would cross Bayou Paquet and Bayou Liberty and continue eastward on the northside of the BBMNWR. The alignment would cross Bayou Bonfouca and continue on the south bank of the Bayou (northern side of the refuge) until reaching the Norfolk Southern Railroad tracks west of U.S. Route 11 in the vicinity of Dellwood Pump Station in Slidell.

To plan for the conditions expected throughout the 50-year period of analysis, the intermediate scenario of RSLR between years 2032 and 2082, was used to develop the 2082 hydraulic design elevations. Based on this information, an alignment extension with additional length of levee and additional structures was developed that would adapt the project while maintaining a 1 percent risk reduction. The alignment extension would commence north of U.S. Highway 190 near the intersection of North Tranquility Road and Shannon Drive between two private properties. The alignment extension would be a berm with hydraulic design elevation of 17.5 feet for year 2082. The alignment extension would change from a berm to a levee (hydraulic design elevation of 17.5 feet (Year 2082)) and continue south and cross U.S. Highway 190, the Tammany Trace Bike Trail and South Tranquility Road on the eastern side of Pineridge Road. The alignment extension would run south southeast an additional 890 feet past the intersection with South Tranquility Road and tie into the existing year 2032 alignment for the West Slidell segment of the System. The West Slidell levee would have a 10 feet wide levee crown and side slopes of 1V:3H. Berm sections would be constructed on both sides of the levee. The floodside berm would have a slope of 1V:42H. The land side berm would have a slope of 1V:33H. The hydraulic design elevations of the West Slidell levee segment would be 13.5 feet (year 2032) and the 17.5 feet (year 2082). Right of way for the levee was assumed to be 300 feet wide.

Within the West Slidell portion of the system there are three floodwalls as shown in Figure 6-3. The floodwall segments are located at the end of West Doucette (350 feet long with a design elevation of 17.5 feet), the north side of Bayou Paquet Drive (250 feet long with a design elevation of 16.5 feet) and at the east bank of Bayou Paquet/Mayer Drive (1400 feet long with a design elevation of 16 feet).

There are a total of eight sluice gates and lift gates that fall within the western portion of the alignment as listed below:

- Sluice gate # 7 near Tranquility Road/CC Road (control structure). The gate width is 25 feet and structural opening height is 8.9 feet.

- Sluice gate # 6 (control structure) at Bayou Paquet North Tributary. The gate width is 75 feet and structural opening height is 15.2 feet. Bayou Paquet North Tributary pump station with a pumping capacity of 300 cfs.
- 60 feet wide Bayou Paquet vehicular gate
- Lift gate at Bayou Paquet (navigable gate). The gate width is 90 feet and structural opening height is 16.5 feet. Bayou Paquet Pump station with a pumping capacity is 500 cfs.
- 20-ft wide Mayer Drive vehicular gate
- Lift gate at Bayou Liberty (navigable gate). The gate width is 80 feet and structural opening height is 22.8 feet. Bayou Liberty pump station with a pumping capacity of 1,800 cfs.
- Lift gate at Bayou Bonfouca (navigable gate). The gate width is 110 feet and structural opening height is 25 feet. Bayou Bonfouca pump station with a pumping capacity of 2,000 cfs.
- Sluice gate # 2 at Bayou Bonfouca (control structure). The gate width is 50 feet and opening height is 17.1feet.

The Western Segment includes two (2) **pump stations** with large pumping capacity at Bayou Liberty (1,800 cfs) and Bayou Bonfouca (2,000 cfs) and (2) pumpstations with small pumping capacity at sluice gate # 6 on the Bayou Paquet North Tributary (300 cfs) and Bayou Paquet lift gate (500 cfs).

The **vehicular, pedestrian and railroad gates and road ramps** for the western segment are included below and shown on Figure 6-3.

- 10 –foot Pedestrian Swing Gate at Tammany Trace with Lift Gate for Culvert on south side
- 20 –foot Vehicular Roller Gate at Tranquility Road
- 60 foot Vehicular Roller Floodgate at Bayou Paquet Road
- 20 foot Vehicular Gate at Mayer Road Roller
- 60 foot Floodgate for Railroad Swing
- 75 foot Roller Gate at Hwy 11 (Pontchartrain Drive Vehicle
- 500 Linear feet of floodwall for narrow section of Oak Harbor levee at Mariners Cove Blvd Roller Vehicle
- Floodwall and 20-foot Vehicular Gate for Oak Harbor Roller
- Floodwall and 20-foot Vehicular Gate for access to Oak Harbor Country Club Roller Vehicle
- 30 foot roller gate at Hwy 433 east crossing (Old Spanish Trail) Roller Vehicle
- 20 foot roller gate for access from Hardin Road to power substation Roller Vehicle
- 50 foot roller gate at Hwy 190-B east crossing (Fremaux Road) Roller Vehicle
- 20 foot roller gate at South Holiday Drive Roller Vehicle
- 20 foot roller gate at Jaguar Avenue Roller Vehicle
- 20 foot roller gate at Natchez Avenue Roller Vehicle
- 20 foot roller gate at Kisatchie Avenue Roller Vehicle

- 20 foot roller gate at Manzella Drive (Added to extend floodwall to 18.5 feet ground elevation south of Hwy 190) Roller Vehicle

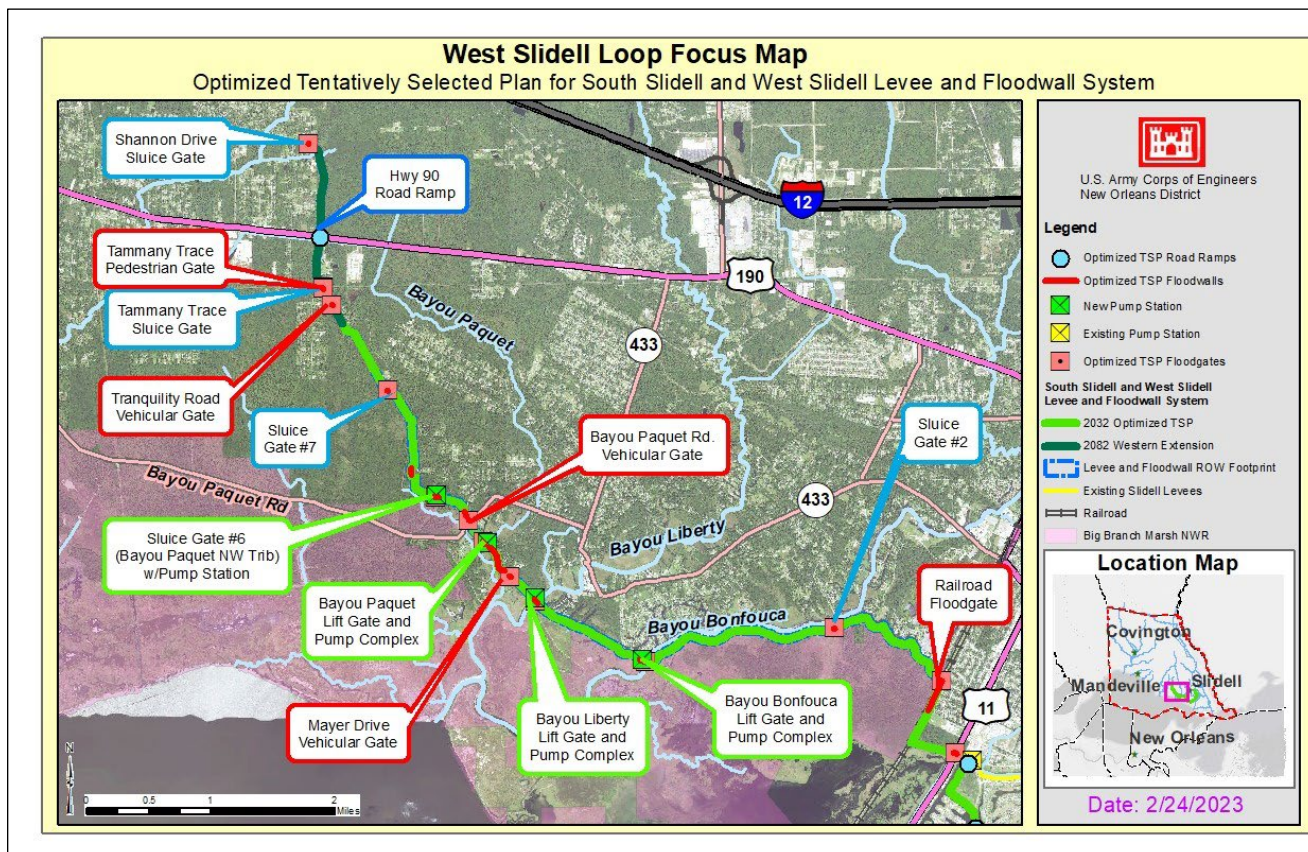


Figure 6-3. West Slidell Loop of the Levee and Floodwall System

6.3.2 South Slidell Segment

The levee and floodwall system alignment from West Slidell would continue to South Slidell. From the railroad gate connecting West Slidell with South Slidell, the alignment would transition to a floodwall parallel to the east side of the Norfolk Southern Railroad tracks. The floodwall by the railroad tracks would have a hydraulic design elevation of 16.5 feet for year 2082. The alignment would transition to levee when it turned east toward U.S. Route 11. The alignment would cross U.S. Route 11 and would turn south in the vicinity of the existing Schneider Canal Pump Station and then turn east to tie into a portion of the existing Oak Harbor ring levee. The alignment would run on the south side of Oak Harbor Boulevard and would cross to the north side immediately past Mariners Cove Boulevard. The new levee along the south side of the Oak Harbor would have a hydraulic design elevation of 14 feet for year 2032. If the existing Oak Harbor ring levee is below a hydraulic elevation of 14 feet, it will have to be raised to a hydraulic elevation of 14 feet for year 2032.

The new levee and floodwall system alignment would coincide with a portion of the existing Oak Harbor ring levee. The levee alignment would turn north and then east in the vicinity of the I-10. The I-10 would be raised to ramp over the new levee section (hydraulic design elevation of 18.5 feet for year 2082). The length of the I-10 section being elevated is approx. 2,100 feet. The total length of the work on the I-10 ROW including the detour tie-in sections on each side of the highway is approx. 6,100 feet. The location is between Exit 261, Lakeshore Oak Harbor and Exit 263, LA433, Old Spanish Trail, Slidell. The levee alignment would continue southeast and tie into an existing portion of the Lakeshore Estates ring levee. The new levee alignment would turn north, then east, and cross Old Spanish Trail/LA Highway 433. The levee alignment would continue north and tie into a portion of the existing King's Point west levee. The new levee section would have a hydraulic design elevation of 16 feet for year 2032.

The levee alignment would cross the W-14 Canal and tie to a portion of the existing King's Point east ring levee and turn north. The new levee section would have a hydraulic design elevation of 16 feet for year 2032. The levee would turn east and then north. Immediately south of U.S. Highway 190 (Business) the alignment would turn from levee to floodwall at the existing Hardin Road power substation. The floodwall would have a hydraulic design elevation of 18.5 feet for year 2082.

The floodwall alignment would cross U.S. Highway 190 (Business) and continue northwest on the west side of the existing CLECO Corporate Holdings, LLC utility corridor. The alignment would cross South Holiday Drive and continue north. The floodwall would turn east on Manzella Drive and turn north in the middle of the block between Yaupon Drive and Malbrough Drive. The floodwall would have a hydraulic design elevation of 18.5 feet for year 2082.

The floodwall alignment would cross Gause Boulevard and turn west. A vehicular roller gate would be constructed across Gause Boulevard, and a vehicular roller gate would be constructed for the I-10 Service Road. The floodwall would transition to a berm that would tie into the I-10 embankment. The berm would have a hydraulic design elevation of 16 feet for year 2082 and 19.5 feet for year 2082 and side slopes of 1V:3H .

An I-10 on-ramp would be constructed at Gause Boulevard. The drainage on the grass area where the ramp merges to the I-10 would be reworked during PED. The existing highway embankment would serve as the means of risk reduction in order to form a continuous System up to the elevation required in 2082. Floodgates would be constructed at Reine Canal and French Branch.

The new levee segments would have a 10 feet wide levee crown and side slopes of 1V:3H. The hydraulic design elevation of the new South Slidell levee would vary between 14 feet and 16 feet during initial construction in year 2032 depending on the location; and the floodwalls and other structures would be built to the 2082 future condition. The floodwall segments would have a hydraulic design elevation of 16.5 feet for the 2082 future condition. Starting from the west, these are floodwall reaches:

- 1375 feet of floodwall along the Norfolk Southern Railroad tracks between Dellwood Pump Station and Baptist Church (Front Street).
- 100 feet floodwall would cross downstream of existing Schneider Canal pump station. Minimal number of changes would be required.
- 500 feet of floodwall for narrow section of Oak Harbor levee at Mariners Cove Boulevard.
- 160 feet floodwall for the 20 feet vehicular gate for access to Oak Harbor Country Club.

The following floodwall reaches would have a hydraulic design elevation of 18.5 feet (year 2082 elevation). Refer to Figure 6-4 which shows the floodwall segments in red for South Slidell.

- 300 feet of floodwall near Old Spanish Trail.
- 450 feet of floodwall behind Esprit du Lac Street.
- 1,950 feet of floodwall to enclose power substation south of U.S. Highway 190 Business on east side of alignment.
- 430 feet of floodwall at U.S. Highway 190 Business (East Side).
- 3,530 feet of floodwall on western edge of the utility corridor.
- 3,700 feet of floodwall for northeast extension of alignment along the utility corridor and along east side of Yaupon Street.
- 650 feet of floodwall from Manzella Drive to Gause Boulevard
- 635 feet of floodwall north of Gause Boulevard to I-10, on the East Terminus

The South Slidell portion of the alignment includes the following structures and ramps the structures would have a hydraulic design elevation of 16.5 feet (Year 2082).

- 75 feet wide vehicular (roller) gate at U.S. Route 11 (Pontchartrain Drive)
- Oak Harbor Boulevard ramp
- Islander Drive ramp
- 50 feet wide Mariners Cove Boulevard vehicular gate
- 20 feet wide Oak Harbor vehicular gate
- 20 feet wide Oak Harbor Country Club vehicular gate
- Grand Champions Lane ramp

After crossing the I-10, the structures for the alignment would have a hydraulic design elevation of 18.5 feet (year 2082 elevation).

- 30 feet wide Old Spanish Trail vehicular gate (LA Highway 433)
- Sector gate at W-14 Canal (navigational gate). The gate width is 90 feet and opening height is 18.4 feet W-14 pump station with pumping capacity of 1,000 cfs.
- Sluice gate # 8 (control structure) at Kings Point East. The gate width is 90 feet and opening height is 14.1 feet Kings Point East pump station with a pumping capacity is 200 cfs.
- 20 feet wide Hardin Road Substation vehicular gate
- 50 feet wide Hwy 190 Business vehicular gate

- 20 feet wide South Holiday Drive vehicular gate
- 20 feet wide North Holiday Drive vehicular gate
- 20 feet wide Jaguar Drive vehicular gate
- Sluice gate # 10 near eastern terminus (control structure). The gate width is 20 feet, and the structural opening height is 8 feet
- 20 feet wide Natchez Drive vehicular gate
- 20 feet wide Kisatchie Drive vehicular gate
- 20 feet wide Manzella Drive vehicular gate
- 80 feet wide Gause Boulevard vehicular gate near eastern terminus
- 65 feet wide vehicular gate for businesses on north side of Gause Boulevard
- 85 feet wide vehicular gate on the I-10 Service Road near Gause Boulevard
- Ramp for I-10 on-ramp at Gause Boulevard

On the eastern terminus, the Interstate 10 is consistently at high ground (hydraulic design elevation of 18.5 feet for year 2082). To use the I-10 embankment for risk reduction, any hydraulic openings past the tie-in point would need to be closed so that water does not have a path to flood the protected side of the alignment. There are hydraulic openings where Reine Canal and French Branch cross the I-10. The following structures (hydraulic design elevation of 18.5 feet for year 2082) would be needed north of the eastern terminus:

- Sluice gate at Reine Canal (control structure). The gate width is 30 feet, and the structural opening height is 11 feet Reine Canal pump station (pumping capacity is 200 cfs).
- Sluice gate at French Branch at I-10. The navigable gate width is 25 feet, and the structural opening height is 10.2 feet French Branch pump station (pumping capacity is 450 cfs).

6.3.3 Interstate 10 Elevation

The I-10 road surface would be raised to construction elevation 22.0 feet to ramp over the new levee section to stay above the hydraulic design elevation for year 2082, to ensure the entire pavement section remains above the hydraulic design elevation across the interstate. The hydraulic design elevation at this location for year 2082 is 18.5 feet. The pavement section was assumed to have a thickness of 2.5 feet, and 1 foot settlement was assumed.

The existing elevation of the I-10 at the proposed location is approximately 12.8 feet as per the terrain raster dataset. This location is the highest elevation of the I-10 in the vicinity of the alignment. The I-10 elevation is lower (approximately 10 feet) in the adjacent areas.

This feature would be fully designed during PED. The traffic control would be a complex item to be developed during PED to allow for uninterrupted interstate traffic while working on a total of 6 lanes of traffic.

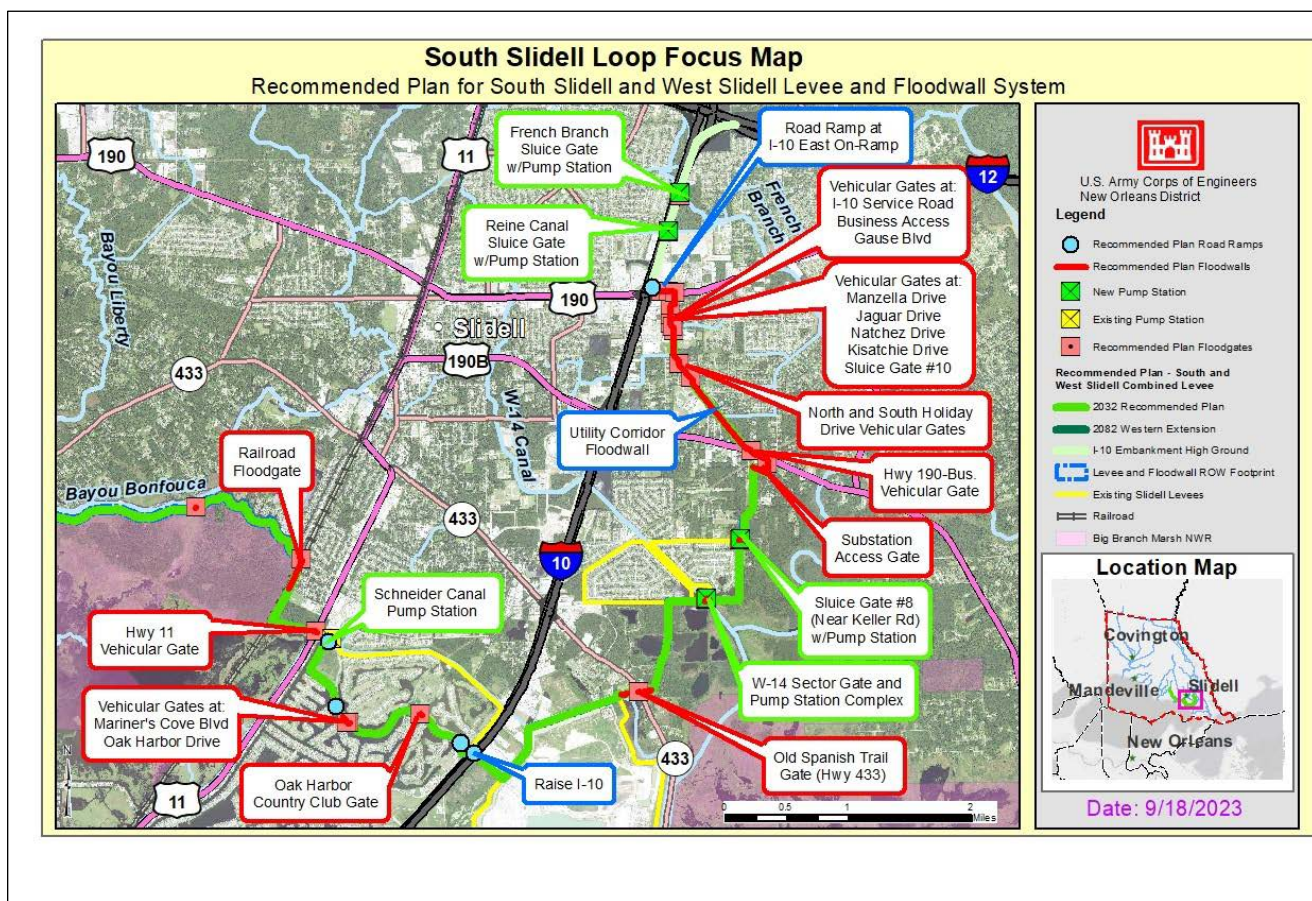


Figure 6-4. South Slidell Loop of the Levee and Floodwall System

Pump Stations: The RP would include a total of eight pump stations. These pump stations are divided into large pumping capacity and small pumping capacity. The Southern Segment of the RP includes (4) pump stations with small pumping capacity at W-14 Canal (1,000 cfs), sluice gate # 8 at Kings Point (200 cfs), Reine Canal (200 cfs) and at French Branch at the I-10 (450 cfs). Additional detail on the optimized levee and floodwall system can be found in Section 10 Appendix D: Engineering.

6.4 VIEW OF THE NON-FEDERAL SPONSOR

The NFS supports the implementation of the RP and is in basic agreement with the applicable model PPA that will be signed if the RP is approved and funded. The CPRAB supports and recognizes the importance for flood risk reduction and coastal storm risk reduction in St. Tammany Parish. Similar projects to reduce risk to the study area are included in the 2023 Master Plan, such as the Slidell Ring Levee project (Project No. 032), and a programmatic approach to NS risk reduction in St. Tammany Parish.

6.5 COMPREHENSIVE BENEFITS-NATIONAL SIGNIFICANCE OF THE PROJECT

USACE involvement in flood control construction is predicated on the project being in the national interest, which is determined by factors such as the likelihood of widespread and general benefits, the national savings achieved, precedent and law. The RP reduces risk to life and safety, reduces the extent of property damage and property loss and reduces the risk of damage to critical infrastructure and transportation in the study area. The RP is also the plan that maximizes NED benefits.

National Economic Development (NED) Benefits for RP- The NED Account represents increases in the net value of the national output of goods and services, expressed in monetary units, and are the direct net benefits that accrue in the planning area, and the rest of the Nation. The benefits, average annual cost and total cost were based on the monetary costs or damages prevented and were ranked accordingly. The RP is estimated to produce nearly \$145,331,000 in net benefits with a BCR of 1.6. The RP decreases expected annual damages from \$537,780,000 under the without-out project condition to \$165,289,000 under the “with project” condition.

Regional Economic Development (RED) Benefits for RP-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. This 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 RP. The 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 using 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. Tables 6-3 and 6-4 summarize the RED results for the of the RP. Additional information is contained in Appendix F: Economics.

Table 6-3. RED Summary for the West and South Slidell Levee and Floodwall System

Area	Output	Jobs*	Labor Income	Value Added
Local				
Direct Impact	\$2,219,412,264	505	\$1,606,683,533	\$1,462,181,013
Secondary Impact	\$1,893,120,238	235	\$626,059,375	\$1,061,856,953
Total Impact	\$4,112,532,502	740	\$2,232,742,907	\$2,524,037,966
State				
Direct Impact	\$2,331,560,812	576	\$1,826,483,378	\$1,602,061,631
Secondary Impact	\$2,367,881,842	278	\$754,458,665	\$1,320,902,540
Total Impact	\$4,699,442,654	853	\$2,580,942,043	\$2,922,964,171
US				
Direct Impact	\$2,415,105,510	599	\$1,901,147,647	\$1,701,368,649
Secondary Impact	\$4,391,611,291	422	\$1,409,043,954	\$2,402,920,452
Total Impact	\$6,806,716,800	1020	\$3,310,191,601	\$4,104,289,101

Table 6-4. RED Summary for the Nonstructural Plan

Area	Output	Jobs*	Labor Income	Value Added
Local				
Direct Impact	\$1,531,085,009	276	\$996,857,892	\$957,565,145
Secondary Impact	\$1,228,406,804	154	\$390,645,169	\$675,553,628
Total Impact	\$2,759,491,813	430	\$1,387,503,061	\$1,633,118,773
State				
Direct Impact	\$1,651,881,781	312	\$1,191,054,939	\$1,107,210,463
Secondary Impact	\$1,559,809,227	183	\$482,082,740	\$861,277,124
Total Impact	\$3,211,691,008	495	\$1,673,137,679	\$1,968,487,587
US				
Direct Impact	\$1,861,922,843	350	\$1,353,887,980	\$1,266,033,975
Secondary Impact	\$3,338,857,796	313	\$1,070,990,779	\$1,831,033,991
Total Impact	\$5,200,780,639	664	\$2,424,878,759	\$3,097,067,965

Environmental Quality (EQ) - The Environmental Quality (EQ) account is an assessment of favorable or unfavorable ecological, aesthetic and cultural or natural resources changes. Environmental Impacts of the RP are described in detail in Section 5. The analysis was conducted with the participation of agencies, local governments, and stakeholders through an on-going and engaging series of scoping meetings, public input meetings, agency and

stakeholder meetings, and on-site meetings, and will continue through the Preconstruction Engineering and Design (PED) study phase and coordination of the project through State and Agency reviews.

The West and South Slidell Levee is expected to result in EQ impacts on BBMNWR and Bayou Liberty Louisiana Scenic Waterway, but they would be offset by the anticipated land swap and nature based designs for the floodgate at Bayou Liberty. Compensatory mitigation is incorporated into the RP for the impacts to marsh and pine savanna habitat.

Approximately 110 acres of the BBMNWR, generally along the south side of Bayou Bonfouca westward of the Norfolk Southern Railroad tracks, is required from the USFWS for the West and South Slidell Levee and Floodwall System feature of the RP. The USFWS is authorized to exchange property with the NFS. Accordingly, property determined to be suitable and desirable by USFWS in a location where it is authorized to acquire property for the BBMNWR would be identified by USFWS, then the identified property may be acquired by the NFS and exchanged with USFWS for the LERRDs required within the Refuge. The exchange of BBMNWR is authorized under the National Wildlife Refuge System Administration Act administered by the National Wildlife Refuge System. In the case of an exchange, an Exchange Agreement is to be executed between the NFS and USFWS.

The NS portion of the RP is expected to have minimal and temporary EQ impacts.

Other Social Effects (OSE) - The West and South Slidell Levee and Floodwall System provides direct social effects benefits by reducing flooding on LA Hwy 433 and U.S. Highway 190, which are critical evacuation and transportation routes and provide access to 1-10 and 1-12. The NS Plan is expected to indirectly reduce roadway flooding and impacts to smaller roadways, and benefit overall evacuation.

In the Justice 40 Initiative, the federal government made it a goal that 40 percent of the overall benefits of certain federal investments flow to disadvantaged communities that are marginalized, underserved, and overburdened by pollution. There are nine census tracts in St. Tammany Parish that have been identified as disadvantaged communities according to the Justice 40 criteria. Each of these communities qualify due to their low-income designation and the economic loss to building value resulting from natural hazards each year. Additionally, categories shared by some, but not all, of these communities include barriers to transportation, unemployment, percent of adults with less than a high school diploma, high rates of heart disease, and projected flood risk.

Forty-six percent of the NED benefits provided by the West and South Slidell Levee and Floodwall System and accrue to these disadvantage communities. Four percent of the NED benefits provided by the NS plan accrue to disadvantaged communities. The lower percentage of benefits under the non-structural plan is primarily due to community locations. Most of these communities are located either in northern areas of the parish that are not subject to frequent flooding, or they are located in the parts of the parish that would benefit from the West and South Slidell Levee and Floodwall System. The disadvantaged communities where NS measures would be applied are in largely rural areas that are more sparsely developed and have lower flood risk. Overall, approximately 20 percent of the NED

benefits provided by the RP accrue to disadvantaged communities. Table 6-5 shows the Justice 40 benefit analysis for the RP.

Table 6-5. Justice 40 Benefit Analysis for the RP (in \$1,000s)

Measures	OSE	
	Justice40 Benefits	Justice40 Benefit %
West and South Slidell Levee and Floodwall System	\$75,826	46%
Nonstructural	\$10,526	4%

Life Safety

The life safety risk indicators (LSRI) for the West and South Slidell Levee and Floodwall System in the RP were modeled using the LSRI software.

<https://www.usace.army.mil/missions/civil-works/budget/https://team.usace.army.mil/sites/HQ-CW/PDT/budget/Manual/Forms/AllItems.aspx?View={A42833E2-B04E-42BE-A0A2-A01F662A2C1E}>

The results of which show an LSRI value of 6.682 meaning if the RP was not implemented, the areas receiving structural flood risk reduction from the System would experience an average annual life loss of 6.682 people per year. Additionally, the cost per statistical life saved (CSSL) for St. Tammany Parish as a whole, is \$10,623,109 annually. Further detail on the final Life Safety Analysis is contained in Appendix F: Economics.

A Potential Failure Mode Analysis (PFMA) was also performed to qualitatively describe potential failure mechanisms and life safety incremental risk for the proposed levee and floodwall system. Further detail on this analysis is contained in Appendix D: Engineering Annex 11.

6.6 IMPLEMENTING THE RP

Detailed design for the RP would be cost-shared between the NFS and the USACE contingent upon the execution of a Design Agreement and approval of Work in Kind in accordance with the provisions of ER 1165-2208. All design efforts would be conducted in accordance with USACE regulations and standards. Subject to project authorization and funding, and full environmental compliance, the construction of the structural features of the RP is scheduled to begin in 2025. A continuous funding stream is needed to complete this project within the anticipated timeline, which requires continuing appropriations from Congress and the State of Louisiana to fund the detailed design phase, PED, and fully fund construction contracts. Once construction funds are appropriated, the NFS, and the Department of the Army would enter into a PPA. After the signing of a PPA, the NFS would acquire the necessary land, easements and ROW to construct the project. Because project

features cannot be advertised for construction until the appropriate real estate interests have been acquired, obtaining the necessary real estate in a timely fashion is critical to meeting the project schedule.

A revised construction schedule was developed for the RP. For the NS component, construction would occur from 2025-2037. The NS plan will be implemented over a period of 12 years. See Appendix H: NS Implementation Plan. For the West and South Slidell Levee and Floodwall System, construction would occur from 2025-2076. Additional levee lifts would occur three times post initial construction at 5-7 years, 15-20 years, and 30 years. See Appendix D: Engineering. At the completion of construction of the project, or functional elements thereof, the NFS would commence and be fully responsible for OMRR&R.

6.6.1 Real Estate Required for Construction

A real estate plan (REP) was prepared to conform with the requirements of ER 405-1-12, dated 1 May 1998 and contains the estimated ROW requirements based on available information. See Appendix G: The West and South Slidell Levee and Floodwall System will impact an estimated 290 private landowners and the NS measures will impact 6,410 private landowners at the 100 percent participation rate. The total estimated real estate cost for structural features including contingencies, borrow sites and mitigation sites, is estimated at \$81,476,000. The total estimated real estate cost for NS measures including contingencies is \$170,764,000. The real estate cost estimates may require revisions during PED.

Approximately 110 acres of the BBMNWR, generally along the south side of Bayou Bonfouca westward of the Norfolk Southern Railroad tracks, is required from the USFWS for the West and South Slidell Levee and Floodwall System feature of the RP. The USFWS is authorized to exchange property with the NFS. Accordingly, property determined to be suitable and desirable by USFWS in a location where it is authorized to acquire property for the BBMNWR would be identified by USFWS, then the identified property may be acquired by the NFS and exchanged with USFWS for the LERRDs required within the Refuge. The exchange of BBMNWR is authorized under the National Wildlife Refuge System Administration Act administered by the National Wildlife Refuge System. In the case of an exchange, an Exchange Agreement is to be executed between the NFS and USFWS.

Generally, the non-federal sponsor's policy is to not appropriate or expropriate property rights for the implementation of USACE flood/coastal storm risk management and ecosystem restoration projects. Appropriation or expropriation is only used by the non-federal sponsor for USACE projects that mandate that the non-federal sponsor use appropriation and/or expropriation to acquire the lands, easements, rights-of-way, relocations, and/or material disposal/placement areas ("property") required for the project. For USACE projects that include the construction of levees and related structures, appropriation and/or expropriation may be used by the non-federal sponsor if necessary, and as a last resort, and only in the following limited situations: (a) the property has numerous undeterminable and/or absent owners; (b) the non-federal sponsor is unable to negotiate reasonable conditions or payment for conventional acquisition of the property; (c) under "friendly" quick take circumstances (e.g., the non-federal sponsor is unable to

negotiate a reasonable price for the property, but the landowner(s) willing to give up property voluntarily); and/or (d) there is limited time available for the non-federal sponsor to acquire the required property (i.e. emergency situations or other time constraints imposed by outside factors). Therefore, if necessary, appropriation and/or expropriation may be used by the non-federal sponsor for the implementation of the structural components of the RP. On the other hand, appropriation and expropriation will not be used by the non-federal sponsor in the implementation of the non-structural component of the RP since property buy-outs are not included in the plan and participation is 100 percent voluntary. Descriptions of the real estate requirements and the estates required for implementation of the RP are included in Appendix G: Real Estate Plan.

The dry floodproofing of eligible non-residential structures would require the NFS to acquire a Right of Entry for Survey and Exploratory Work, Right of Entry for Construction, and a permanent easement with restrictive covenants (for OMRR&R). A standard Temporary Work Area Easement will be acquired for the duration of construction on any improvements. For non-residential flood proofing of structures, a separate non-standard easement would be required, which provides the necessary rights and restrictions to protect the federal investment. The draft easement language would be submitted through CEMVD to USACE CEMP-CR as a request for approval of a Non-Standard Estate.

The elevation of eligible residential structures will require the NFS to acquire a standard Right of Entry for Survey and Exploratory Work and a standard Right of Entry for Construction. A standard Temporary Work Area Easement will be acquired for the duration of construction on any improvements. Also, the NFS will be required to obtain subordinations and releases for all compensable facility and utility relocations and rights required for project implementation, including the temporary ROW easements.

In addition, a non-standard estate in the form of a Permanent Easement for restrictions and access (permanent easement), will likely be proposed and submitted by CEMVN in accordance with USACE regulations. It is anticipated that such an easement will be imposed in, on, over, and across the land on which the residential structure(s) has been or will be elevated. The contemplated easement will perpetually prohibit the grantors, heirs, successors, assigns, and all others from: (1) using any portion of the ground level of the elevated structure for human habitation; (2) constructing or placing any enclosure or permanent obstruction that would impair the flow of water on the ground level of the elevated structure; and (3) engaging in other uses of the elevated structure or the land that would impair, contravene, or interfere with the integrity of the elevated structure. There would be a reservation of rights and privileges in favor of the grantors, heirs, successors, and assigns to use the land in such a manner so as not to interfere with, or abridge, the rights, easement, prohibitions, and restrictions contained in the easement. The easement would also include a right of ingress and egress over and across the land by the Coastal Protection and Restoration Authority Board of Louisiana, its representatives, agents, contractors, and assigns, for the purpose of inspecting and monitoring the elevated residential structures and land in order to enforce the rights and prohibitions contained in the easement. A similar nonstandard estate (permanent easement) to that described above, may also be required for manufactured, modular and mobile homes that are to be elevated as part of the NS Plan.

The draft easement language would be submitted through CEMVD to USACE CEMP-CR as a request for approval of a Non-Standard Estate. Also, the NFS will be required to obtain subordinations and releases for all compensable facility and utility relocations and rights required for project implementation, including the temporary ROW easements. obtained in the permanent easement or that would interfere with the project.

6.6.2 Borrow Required for Construction of the West and South Slidell Levee and Floodwall System

The construction of the West and South Slidell Levee and Floodwall System would require approximately 7 million cubic yards of fill or borrow material. Borrow material will come from sites estimated not more than 17 miles of the System alignment. A total of 3,000,000 cubic yards of soil is needed for initial construction and a grand total of 7,239,000 cubic yards is needed over the entire authorized 50-year period to sustain the 1 percent AEP design elevations out to year 2082.

Existing Government borrow sites were not available within the 17 miles distance limitation. Feasibility level borrow site investigations were conducted to confirm that there were available borrow quantities within the vicinity to support the RP decision and evaluate the anticipated impacts associated with the potential borrow sites.

The evaluation of borrow sites led to the identification of three sites in St. Tammany Parish and two sites in Hancock County, Mississippi as potential borrow sources (See Figure B:4-2 to B:4-6). These sites include land cleared of vegetation and previously investigated HSDRRS borrow sources. Environmental resource assessments were performed on five sites (ST-5, ST-6, ST-9, MS-1, and MS-2) to determine if significant impacts to potentially affected resources in the potential borrow areas. The borrow sites have been previously investigated and partially or fully cleared for Cultural Resources. See IER 19, 23 and 31 for sites MS-1 and MS-2 and SHPO report #'s 22-3725, 22-5346 and 22-3151 for the St. Tammany sites. For additional information regarding environmental resource borrow evaluation see Section 5 of the RDIFR-DEIS.

These five potential borrow site options contain approximately 27.3 million cubic yards of borrow where only approximately 7 million cubic yards is estimated to be needed for construction of the RP and follows environmental operating principles to reduce impacts. The potentially affected resources included wetlands, uplands, prime and unique farmland, fisheries, wildlife, T&E species, cultural resources, recreational resources, noise, and aesthetics. The five borrow sites avoid impacts to wetlands and are not expected to require compensatory mitigation. A Phase I ESA will be conducted by the CEMVN on the proposed borrow sites. Any additional potential borrow sites will require supplemental environmental evaluations in accordance with the NEPA.

The final borrow sources will be selected prior to acquisition and may include borrow material from all sites, from just one of the identified sites or a combination of sites depending on the suitability of the sites. The necessary right of entry and onsite surveys to get the additional information needed for site selection including geologic profiles, borings, and Cone Penetration Test would be obtained.

Transportation routes and mechanisms for the delivery of borrow material have been examined and can be achieved using highways including Interstate-10, Highway 190, Highway 433 and Highway 11. Sensitive areas such as schools and hospital would be avoided. These actions are expected to avoid and minimize transportation, noise and socioeconomic impacts. Staging areas and haul roads would be contained within the borrow site and construction footprints.

The final borrow site(s) design would include slopes, depths, drainage, environmental design considerations. Best management practices would be developed and would address the installation of signage, construction fencing and gates, and erosion control. A stormwater pollution prevention plan (SWPPP) would be prepared in accordance with EPA and state regulations. The SWPPP will outline temporary erosion control measures, such as silt fences, retention ponds, and dikes. The construction contract will include permanent erosion control measures, such as turfing and placement of riprap or filter material.

6.6.3 Relocations

Based on the research and investigations, multiple facilities and utilities are located within the footprint of the West and South Slidell Levee and Floodwall System alignment. The System alignment crosses the Norfolk Southern Railroad tracks. A floodgate in this area would affect the Railroad and a transmission corridor running parallel to the eastern side of the Railroad tracks. USACE would have to meet criteria around these transmission lines to provide necessary clearance for pile driving activities associated with construction of the floodgate and adjacent floodwall. Possible underground utilities servicing the Norfolk Southern Railroad (i.e., communication lines) would be impacted as well.

Entergy Louisiana, LLC has right-of-way use requirements pertaining to USACE work around their existing transmission lines, electrical distribution lines and power poles, that would have to be met to provide clearance for construction activities (i.e., pile driving).

The total estimated cost of facility/utility relocations for the System (and also the RP) is \$32,000 inclusive of a 51 percent contingency. These costs are reflected as relocations (02-Relocations) within the Baseline Costs Estimate herein. Although the relocations costs are a 100 percent NFS financial responsibility, the payment of compensable relocation costs by the NFS may be eligible for credit toward the NFS cost share under the terms of a future PPA. Refer to Section 15 entitled "Facility/Utility Relocations" in the Engineering Appendix D for more information regarding the costs associated with these relocations. The Facility/Utility Relocations identifications and associated cost estimates are preliminary and will be refined in PED if the RP is authorized for construction and funded. The estimated costs for relocations represent a preliminary level of design and will be further refined during the PED.

6.6.4 Operations, Maintenance, Repair, Rehabilitation, and Replacement- Obligations of the NFS

The NFS's obligation to OMRR&R for the project at no cost to the Government shall be set forth in an OMRR&R manual prepared and issued by USACE in accordance with ER 1110-

2-401 “*Operation, Maintenance, Repair, Replacement and Rehabilitation Manual for Projects and Separable Elements Managed by Project Sponsors*” dated 30 September 1994, the executed PPA, and applicable USACE regulations. The NFS shall conduct its OMRR&R responsibilities in a manner compatible with the authorized purpose of the project and in accordance with applicable federal laws and specific directions prescribed by the Government in the OMRR&R manual. The assumed OMRR&R included items such as routine maintenance, monitoring, routine clearing and snagging, periodic inspection, machinery and gate replacements, and minor and major repairs. The estimated costs were annualized and included in the economic analysis to determine the BCR. The estimated project specific annual OMRR&R activities and associated costs for the West and South Slidell Levee and Floodwall System is \$7,753,000 and will be further refined in PED. See Appendix F: Economics for details on the estimated OMRR&R annual costs.

6.6.5 Cost Sharing Requirements Under the PPA

It is anticipated the cost share for the design and construction of the project would be 65 percent federal and 35 percent non-federal as shown in Table 6-6. Final, specific cost share requirements would be identified in the Project Partnership Agreement. Among other responsibilities, the NFS must provide all project LERRDs required for the project. The OMRR&R cost is a 100 percent NFS responsibility.

*Table 6-6. RP *Project First Costs, (October 2023 FY24 Price Level, 2.5% Discount Rate) (in 1,000s)*

Recommended Plan (Levee and Floodwall System and Nonstructural)	Federal	Non- Federal	Total
Lands, easements, rights-of-way, relocations, and disposal areas (LERRD) 65/35%			
Lands and **Damages	\$60,945	\$180,588	\$241,533
Facility/Utility Relocations (inclusive of % contingency)		\$32,162	\$32,162
<i>LERRDs Subtotal</i>	<i>\$60,945</i>	<i>\$212,750</i>	<i>\$273,695</i>
Construction First Cost (65 Fed/ 35 Non-Fed)			
Fish and Wildlife Relocations**	\$56,358	\$30,346	\$86,704
Levees and Floodwalls	\$642,207	\$345,803	\$988,011
Pumping Plant	\$592,842	\$319,222	\$912,064
Floodway Control and Diversion Structure (sluice gate)	\$85,613	\$46,100	\$131,713
Buildings, Grounds, and Utilities	\$1,609,289	\$686,607	\$2,295,896
Cultural Resource Preservation	\$ 12,570	\$ 6,768	\$ 19, 338
<i>Construction First Cost Subtotal</i>	<i>\$2,998,879</i>	<i>\$1,434,847</i>	<i>\$4,433,726</i>
Administrative Cost (65 Fed/ 35 Non-Fed)			
Planning Engineering and Design	\$497,261	\$267,756	\$765,017
Construction Management	\$274,164	\$147,627	\$421,791
<i>Administrative Subtotal</i>	<i>\$771,425</i>	<i>\$415,383</i>	<i>\$1,186,808</i>
RP Total Project First Cost			
	\$3,831,799	\$2,062,980	\$5,894,229

*The Project First Cost (Current Price Level) is the cost estimate that will serve as the basis for providing the cost of the project for which authorization is sought.

** Includes cultural cost for mitigation of levee and flood system and sluice gates.

***The term "damages" as used in Table 6-6 means the diminution in the fair market values of remainder properties resulting from the Government's acquisition of the affected ownerships for which just compensation must be paid.

6.6.6 Federal Responsibilities Under the PPA

The federal government would be responsible for PED and construction of the project in accordance with the applicable provisions of Public Law 99-662 (WRDA of 1986), as

amended. The Government, subject to Congressional authorization, the availability of funds, and the execution of a binding agreement with the NFS in accordance with Section 221 of the Flood Control Act of 1970, as amended, and using those funds provided by the NFS, shall expeditiously construct the project, applying those procedures usually applied to federal projects, pursuant to federal laws, regulations, and policies.

6.6.7 Non-Federal Responsibilities Under the PPA

As a shared responsibility, the RP is inclusive of the NFS's additional floodplain management responsibilities and emergency response actions in conjunction with state and Federal Emergency Management Agency (FEMA) related programs to mitigate the RP's residual risk, including potential life loss and damages to critical infrastructure.

The federal implementation of the coastal storm risk management structural component includes, but is not limited to, the following items of local cooperation to be undertaken by the non-federal sponsor in accordance with applicable federal laws, regulations, and policies:

a. Provide 35 percent of construction costs, as further specified below:

1. Provide, during design, 35 percent of design costs in accordance with the terms of a design agreement entered into prior to commencement of design work for the project;

2. Provide all lands, easements, rights-of-way, and placement areas and perform all relocations determined by the federal government to be required for the project;

3. Provide, during construction, any additional contribution necessary to make its total contribution equal to at least 35 percent of construction costs;

b. Prevent obstructions or encroachments on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) that might reduce the level of coastal storm risk reduction the project affords, hinder operation and maintenance of the project, or interfere with the project's proper function;

c. Inform affected interests, at least yearly, of the extent of risk reduction afforded by the project; participate in and comply with applicable federal floodplain management and flood insurance programs; prepare a floodplain management plan for the project to be implemented not later than one year after completion of construction of the project; and 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 the project;

d. Operate, maintain, repair, rehabilitate, and replace the project or functional portion thereof at no cost to the federal government, in a manner compatible with the project's

authorized purposes and in accordance with applicable federal laws and regulations and any specific directions prescribed by the federal government;

e. 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 to inspect the project, and, if necessary, to undertake work necessary to the proper functioning of the project for its authorized purpose;

f. Hold and save the federal government free from all damages arising from design, construction, operation, maintenance, repair, rehabilitation, and replacement of the project, except for damages due to the fault or negligence of the federal government or its contractors;

g. Perform, or ensure performance of, any investigations for hazardous, toxic, and radioactive wastes (HTRW) that are determined necessary to identify the existence and extent of any HTRW regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. 9601-9675, and any other applicable law, that may exist in, on, or under real property interests that the federal government determines to be necessary for construction, operation and maintenance of the project;

h. Agree, as between the federal government and the non-federal sponsor, to be solely responsible for the performance and costs of cleanup and response of any HTRW regulated under applicable law that are located in, on, or under real property interests required for construction, operation, and maintenance of the project, including the costs of any studies and investigations necessary to determine an appropriate response to the contamination, without reimbursement or credit by the federal government;

i. Agree, as between the federal government and the non-federal sponsor, that the non-federal sponsor shall be considered the owner and operator of the project for the purpose of CERCLA liability or other applicable law, and to the maximum extent practicable shall carry out its responsibilities in a manner that will not cause HTRW liability to arise under applicable law; and

j. Comply with the 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. 4630 and 4655) and the Uniform Regulations contained in 49 C.F.R Part 24, in acquiring real property interests necessary for construction, operation, and maintenance of the project including those necessary for relocations, and placement area improvements; and inform all affected persons of applicable benefits, policies, and procedures in connection with said act.

The federal implementation of the project for nonstructural flood risk management includes, but is not limited to, the following required items of local cooperation to be undertaken by the non-federal sponsor in accordance with applicable federal laws, regulations, and policies:

a. Provide 35 percent of construction costs, as further specified below:

1. Provide, during design, 35 percent of design costs in accordance with the terms of a design agreement entered into prior to commencement of design work for the project;

2. Provide all lands, easements, rights-of-way, and placement areas and perform all relocations determined by the federal government to be required for the project;

3. Provide, during construction, any additional contribution necessary to make its total contribution equal to at least 35 percent of construction costs;

b. Prevent obstructions or encroachments on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) that might reduce the level of flood risk reduction the project affords, hinder operation and maintenance of the project, or interfere with the project's proper function;

c. Inform affected interests, at least yearly, of the extent of risk reduction afforded by the flood risk management features; participate in and comply with applicable federal floodplain management and flood insurance programs; prepare a floodplain management plan for the project to be implemented not later than one year after completion of construction of the project; and 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 the project;

d. Operate, maintain, repair, rehabilitate, and replace the project or functional portion thereof at no cost to the federal government, in a manner compatible with the project's authorized purposes and in accordance with applicable federal laws and regulations and any specific directions prescribed by the federal government;

e. 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 to inspect the project, and, if necessary, to undertake work necessary to the proper functioning of the project for its authorized purpose;

f. Hold and save the federal government free from all damages arising from design, construction, operation, maintenance, repair, rehabilitation, and replacement of the project, except for damages due to the fault or negligence of the federal government or its contractors;

g. Perform, or ensure performance of, any investigations for hazardous, toxic, and radioactive wastes (HTRW) that are determined necessary to identify the existence and extent of any HTRW regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. 9601-9675, and any other applicable law, that may exist in, on, or under real property interests that the federal government determines to be necessary for construction, operation, and maintenance of the project;

h. Agree, as between the federal government and the non-federal sponsor, to be solely responsible for the performance and costs of cleanup and response of any HTRW regulated under applicable law that are located in, on, or under real property interests required for construction, operation, and maintenance of the project, including the costs of any studies and investigations necessary to determine an appropriate response to the contamination, without reimbursement or credit by the federal government;

i. Agree, as between the federal government and the non-federal sponsor, that the non-federal sponsor shall be considered the owner and operator of the project for the purpose of CERCLA liability or other applicable law, and to the maximum extent practicable shall carry out its responsibilities in a manner that will not cause HTRW liability to arise under applicable law; and

j. Comply with the 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. 4630 and 4655) and the Uniform Regulations contained in 49 C.F.R Part 24, in acquiring real property interests necessary for construction, operation, and maintenance of the project including those necessary for relocations, and placement area improvements; and inform all affected persons of applicable benefits, policies, and procedures in connection with said act.

6.7 RISK AND UNCERTAINTY

Risk and uncertainty are intrinsic in water resources planning and design. Risk is a measure of the probability and consequence of uncertain future events. It is the chance of an undesirable outcome. Uncertainty refers to the likelihood an outcome results from a lack of knowledge about critical elements or processes contributing to risk or natural variability in the same elements or processes. Throughout the planning process, the PDT identified risk and uncertainty using collaboration with the NFS and stakeholders and in accordance with USACE policies related to risk such as USACE ER 1105-2-100. Risk informed decisions were made regarding the reliability of estimated benefits and the costs of alternative plans.

Measures were developed to manage risk by expanding on and referencing successful similar completed projects along the Louisiana coast, as well as nationwide. Experience from previous projects helped in the identification of possible risks and decrease uncertainty in plan formulation. No measure or alternative in the RP is burdened by significant risk or uncertainty regarding its eventual success. Significant risks were avoided by using proper design, appropriate selection, and correct seasonal timing of applications. Risks were also managed through extensive coordination with other agencies and experts. The dynamic and complex nature of coastal environmental processes is a principal source of uncertainty. This section described various categories of risk and uncertainties pertinent to the study. See Section 4 for information regarding how the PDT incorporated risk-informed decision making into the planning process.

As the study moves into the next phases, USACE will focus on the primary cost and other significant risk drivers within USACE's control. However, there still exists the potential for

other unanticipated and uncontrollable changes in environmental or economic conditions that could further increase the total project first cost beyond the current estimate and/or necessitate changes in the project's design.

Because natural systems are complex and consist of an intricate web of variables that influence the existence and condition of other variables within the system, all projects (e.g., flood risk management, restoration, etc.) contain inherent uncertainties. The effects of tropical storms, increased sea level rise, and climate change on each project's performance are uncertain and are addressed through future projections based on existing information.

The PDT identified the following environmental factors that have inherent uncertainty and could impact the accrual of benefits within the 50-year period of analysis. These environmental risks would be managed by gathering data and making changes to the RP, if necessary, through adaptive management.

Environmental factors that carry uncertainty include, but are not limited to:

- Potential climate change issues, such as SLR, in addition to regional subsidence rates are significant scientific uncertainties. These issues have been incorporated in the alternative evaluation process.
- Future climate change trajectories or projections affect habitat conditions (e.g., subsidence, sea level rise, flood events, drought, growing season lengths, etc.).
- The mitigation area, project infrastructure and/or project operations could be impacted by severe weather events (flooding, structural damage from wind, etc.).
- Changes or increases in the cost of mitigation bank credits;
- Design changes could affect the mitigation need.

Engineering factors that carry uncertainty include, but are not limited to:

- Final construction design;
- Modeling analysis and assumptions;
- Existing or future projects cause unexpected effects on the RP;

6.7.1 Uncertainties in Analysis

Future conditions are inherently uncertain. The forecast of future conditions is limited by existing science and technology. Future conditions described in this FIFR-EIS are based on an analysis of historic trends and the best available information. Some variation between forecast conditions and reality is certain. RP features were developed in a risk-aware framework to minimize the degree to which these variations would affect planning decisions. However, errors in analysis or discrepancies between forecast and actual conditions could affect plan effectiveness.

All the models used to inform the FIFR-EIS are 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 this evaluation. 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 mathematic expressions driven by the simplified interaction of key variables.

Detailed information regarding model analysis, assumptions, and factors may be reviewed in Appendix E: Hydrologic & Hydraulics. To summarize the modeling effort, HEC-RAS modeling was utilized for FRM alternative analysis. Processing of previously-run existing conditions ADCIRC modeling results was conducted for CSRM alternative analysis. The TSP was modeled directly in ADCIRC to inform feasibility level of design and the RP. This modeling approach was utilized to model the impacts of three sources of flood risk within the parish: local rainfall, Pearl River Basin flooding, and coastal storm surge and waves. Uncertainties, risks, and assumptions made in this modeling effort may be reviewed in Appendix E Hydrologic & Hydraulics.

Because the design event is based on current regional best practices for the interior rainfall recurrence interval, 10-Year, the design team assumes limited risk in the overall performance of the interior drainage system by not doing a compound flood risk analysis during the feasibility study since it will not affect the interior drainage design assumption. Additional flood risk hydrologic scenarios will be performed in subsequent phases to quantify potential flood risk, which typically, if it occurs is considered nuisance flooding.

6.7.2 Sea Level Change and Hydrologic Risk

To evaluate potential future changes in project performance due to relative sea level rise (RSLR), Engineer Regulation (ER) 1100-2-8162 requires planning studies and engineering designs to be formulated and evaluated considering all possible rates of RSLC: low, intermediate, and high. Based on the guidance from USACE and data from the available tools, the STPFS PDT has identified climate change risks based on specific project features as depicted in Table 6-7 below. This information was compiled throughout the planning process and will continue to be refined throughout PED. Enhancements to design will reduce the uncertainty of how these project features will perform with RSLR.

Table 6-7. Climate Risks Features and Outcomes

Feature or Measure	Trigger	Hazard	Harm	Qualitative Likelihood
Levee	-Increased precipitation -Land subsidence	-Areas subject to induced flooding may change with sea level rise. The recommended plan and induced flooding analysis	-Flood waters (caused by riverine flooding and surge) may load the levee for longer durations, and more frequently,	High Likelihood

Feature or Measure	Trigger	Hazard	Harm	Qualitative Likelihood
		are based on 2.7 feet of relative sea level rise. -Future flood volumes may be larger than present -Large flood volumes may occur more frequently -Extent and duration of coastal inundation may be greater than present -Land loss rates in southern Louisiana may increase	potentially compromising integrity of the flood control feature -With increasing land loss rates and coastlines receding, location of the flood control feature may be more exposed to coastal surge and wave events	
Floodwall	-Increased precipitation -Land subsidence	-Areas subject to induced flooding may change with sea level rise. The recommended plan and induced flooding analysis are based on 2.7 feet of relative sea level rise. -Future flood volumes may be larger than present -Large flood volumes may occur more frequently -Extent and duration of coastal inundation may be greater than present -Land loss rates in southern Louisiana may increase	-Flood waters (caused by riverine flooding and surge) may load the levee for longer durations, and more frequently, potentially compromising integrity of the flood control feature -With increasing land loss rates and coastlines receding, location of the flood control feature may be more exposed to coastal surge and wave events	High Likelihood
Pump Stations	-Increased	-Future flood	-Designed	Likely

Feature or Measure	Trigger	Hazard	Harm	Qualitative Likelihood
	precipitation	volumes and durations may be larger than present	pumping capacities may not be sufficient to accommodate increased volumetric runoff along with longer flood durations caused by larger precipitation event; this may in turn cause increased flooding to the protected side of flood control structures -Pump stations may be utilized more frequently requiring additional maintenance	
Flood Control Gates	-Increased precipitation	-Future flood volumes and durations may be larger than present	-Designed pumping capacities may not be sufficient to accommodate increased volumetric runoff along with longer flood durations caused by larger precipitation events; this may in turn cause increased flooding to the protected side of flood control structures -Flood control gates may be utilized more frequently requiring additional maintenance	Likely
Channel Excavation	-Increased precipitation -Land subsidence	-Surge may travel further inland as land loss rates in southern Louisiana	-With increasing land loss rates and coastlines receding, surge may travel further inland and impact	-Low Likelihood

Feature or Measure	Trigger	Hazard	Harm	Qualitative Likelihood
		increase	the proposed excavated channel	
Channel Clearing and Snagging	-Increased precipitation -Land subsidence	-Surge may travel further inland as land loss rates in southern Louisiana increase	-With increasing land loss rates and coastlines receding, surge may travel further inland and impact the proposed cleared and snagged channel; a cleared and snagged channel may support sustaining surge height because surge and wave energy will not be dampened by the once present vegetative growth	-Low Likelihood
Diversion	-Increased precipitation	-Future flood volumes may be larger than present -Large flood volumes may occur more frequently	-With increased flood volumes, and higher frequency of larger flood volumes, diversions would be loaded more than anticipated in design. This may lead to unintentional flooding of structures near locations of diversions	-Low Likelihood
Nonstructural Plan Riverine	-Increased precipitation -Land subsidence -Relative sea level rise	Compound flooding	-With increased flood volume, current day projections of the necessary height to raise structures may not be adequate. -The flood plain will migrate upland above the 2.7 feet of relative sea level rise used for the	-Likely

Feature or Measure	Trigger	Hazard	Harm	Qualitative Likelihood
			recommended plan, and in some areas the level of risk reduction cannot be maintained.	
Nonstructural Plan Coastal	-Land subsidence -Relative sea level rise	-Land loss rates in southern Louisiana may increase -Risk increases with RSLR	-The level of risk reduction cannot be maintained above the 2.7 feet of sea level rise used for the recommended plan. -With increasing land loss rates and coastlines receding, surge may travel further inland and impact structures further inland than initially identified in the Non-Structural Plan.	-Likely

Following the identification of climate change risks based on specific project features, the STPFS PDT evaluated impacts based on RSLR scenarios. ER 1100-2-8162 was developed by USACE with the assistance of coastal scientists from the National Oceanic and Atmospheric Administration (NOAA) and the USGS to allow scientific data to be embedded into engineering guidance. This guidance provides three scenarios of RSLR: 1) Low, 2) Intermediate, and 3) High Sea Level Change. Based on available data, the three scenarios are broken down into the following:

- LOW: Based on historic rates of sea-level change (ETL 1100-2-1, Procedures to Evaluate Sea Level Change: Impacts, Responses, and Adaption).
- INTERMEDIATE: Calculated from the modified NRC Curve I considering both the most recent IPCC projections and modified NRC projections with the local rate of vertical land movement added.
- HIGH: Computed from the modified NRC Curve III considering both the most recent IPCC projections and modified NRC projections with the local rate of vertical land movement added.

In order to conservatively estimate the potential physical effects of projected RSLR in formulating and engineering the RP, the USACE Sea Level Analysis Tool (SLAT) was

utilized to develop the range of sea level change projections for the RP defined by the three USACE scenarios s from the midpoint of the 1983 to 2001 national tidal datum epoch. RSLR estimates were also collected from the USACE Sea Level Change Curve Calculator for the three RSLR scenarios as provided in Table 6-8 below. Figure 6-7 shows the 40 year (1983-2024) mean sea level and 19 year moving average trends and projections to the end of the planning period. These trends are currently tracking below the USACE Intermediate scenario used to develop the RP. Table 6-8 shows the range of projected mean sea level between 1992 and 2082 based on the NAVD88 datum (gauge zero mean sea level). The recommended plan is based on 2.7 feet of relative sea level change on the intermediate scenario trajectory to the year 2082.

The intermediate RSLR scenario with a base year of 2032 was selected as the basis of evaluation for the STPFS as it offered the best balance between equally likely scenarios (i.e., the historic rate of sea level rise continuing indefinitely and the high rate including accelerated rates of change caused by warming temperatures and accelerated ice melt).

Table 6-8 - Range of relative sea level rise projections for the RP (USACE Sea Level Chance Curve Calculator)

Sea Level Change Scenario	Cumulative RSLR (1992 to 2082)	Performance Threshold (year)
MSL - USACE 2013 - Low	2.0	2113
MSL - USACE 2013 - Intermediate	2.7	2082
MSL - USACE 2013 - High	5.4	2052

The selected location for computation of the curves is the NOAA New Canal Station, Gauge 8761927. Gauge data for Lake Pontchartrain is available at a gauge local to Mandeville, LA; while this gauge is closer in proximity to the study area, the data cannot be incorporated into SLAT. The rate of sea level change for the two gauges is as follows: for the low RSLR scenario, is 6.7 mm/year at New Canal and 6.6 mm/year at Mandeville. Intermediate RSLR at this location is estimated at 2.7 feet. Figure 6-5 shows the NOAA tide gauges and location of the New Canal gauge. Performance and monitoring of the St. Tammany Parish RP is based on 2.7 feet of relative sea level rise based on the New Canal Station, LA 8761927 NOAA tide gauge. Figure 6-6 shows datums and water levels for the New Canal Gauge.

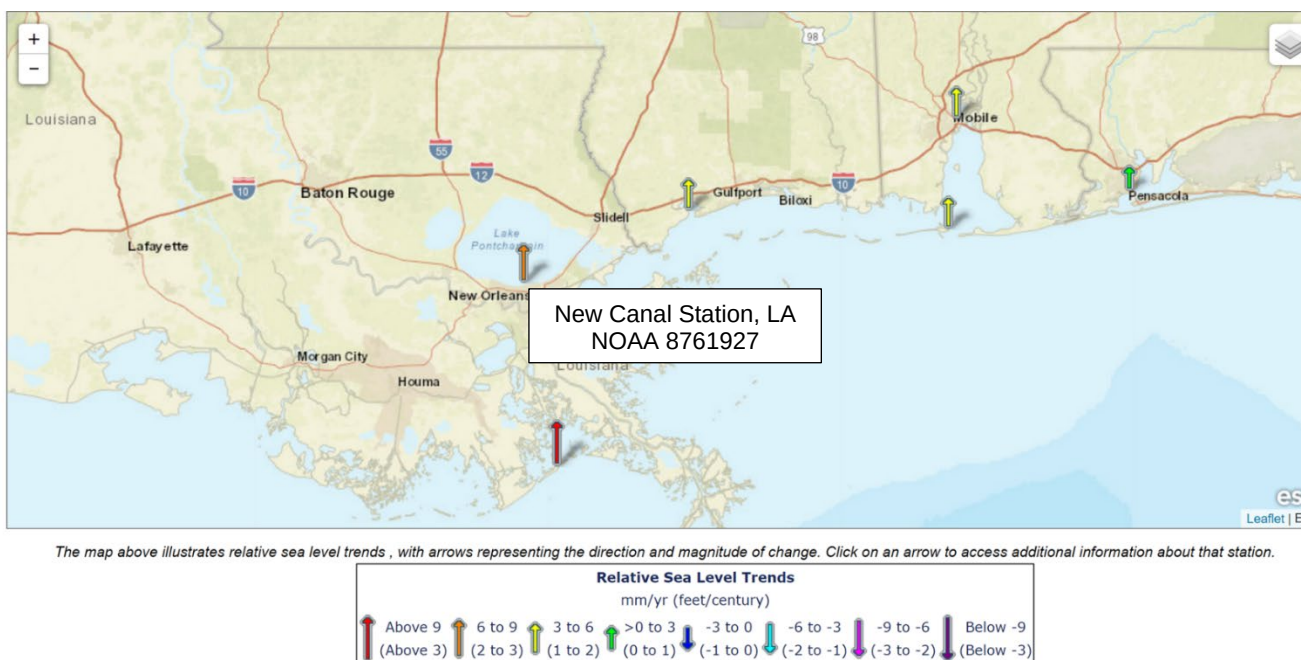


Figure 6-5 - NOAA tide gauges

In recognition of the overall uncertainty of projected RSLR for the study area, adaptation capacity was also incorporated into the final feasibility level design in order to maximize the resiliency of the RP features over the life of the project through redundancy and robustness proficient in high RSLR scenarios. The NFS will continue to monitor local conditions and determine if the intermediate RSLR scenario is reasonably representative of observed conditions. A monitoring plan will be developed to track performance of the RP against local mean sea level change including vertical land motion or subsidence. This would include a target sea level rise amount which would initiate reevaluation and adaptation of the RP. If observed conditions significantly exceed the intermediate RSLR projection during the PED or construction phases, reevaluation of the RP will be required. A draft Adaptation Plan has been developed and is included as Annex E1.

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Scenario Projections:

Use this tab to select sea level projections. The USACE 2013, CARSWG 2016, and NOAA et al. 2012 projections are based on the sea level change (SLC) rate selected below.

Select projection source(s): ?

USACE 2013 x

Projection Summary Table

Choose a water level and projection source from the selections made above and on the Coastal Water Levels tab. Full projection data can be downloaded using the menu in the top-right corner of the chart.

Sea Level Projections: New Canal Station, LA (8761927)

Water level:

MSL

Projection source:

USACE 2013

Units: Feet above North American Vertical Datum of 1988 (1983-2001 epoch)

Year	Low	Intermediate	High
1992	0.04	0.04	0.04
2020	0.66	0.73	0.95
2030	0.88	1	1.41
2040	1.1	1.3	1.95
2050	1.32	1.61	2.56
2060	1.54	1.95	3.25
2070	1.76	2.3	4.01
2080	1.98	2.66	4.85
2090	2.2	3.05	5.76
2100	2.41	3.45	6.74
2110	2.63	3.87	7.8
2120	2.85	4.31	8.93
2130	3.07	4.77	10.13
2140	3.29	5.24	11.41
2150	3.51	5.73	12.77

Sea Level Data and Projections: New Canal Station, LA (8761927)

NOAA Tide Gauge

Feet above North American Vertical Datum of 1988
(1983-2001 epoch)



Click on legend items to hide/show them in the plot

MSL - Monthly Value MSL - USACE 2013 - Low MSL - USACE 2013 - Intermediate MSL - USACE 2013 - High Projected Intermediate RSLR in 2082

SLC rate used in equation based projections: 6.7 mm/yr (2.2 ft/100 yrs)

MSL record span: 1982 to 2024 (42 years)

Missing data: The MSL record for this gauge has a gap of 5 or more years



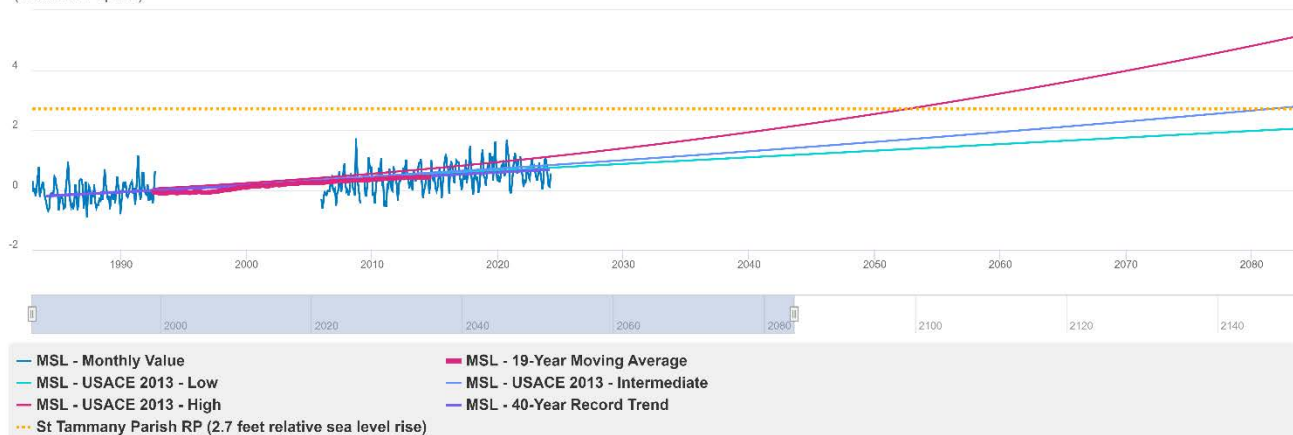
Figure 6-6. USACE Relative Sea Level Change Results for St. Tammany Parish Feasibility Study (Gage – New Canal Station – NOAA Gage ID 8761927)

Figure 6-7 depicts the 40 year (1983-2024) mean sea level and 19 year moving average trends at the New Canal Station, LA gauge and projections to the end of the planning period. These trends are currently tracking below the USACE Intermediate RLSR scenario used for the RP. Figure 6-7 sets the estimated 2.7 feet intermediate RSLR scenario as a critical threshold in order to assess the temporal performance of the RP against the low and high RSLR scenarios.

Sea Level Data and Projections: New Canal Station, LA (8761927)

NOAA Tide Gauge

Feet above North American Vertical Datum of 1988
(1983-2001 epoch)



SLC rate used in equation based projections: 6.7 mm/yr (2.2 ft/100 yrs)

MSL record span: 1982 to 2024 (42 years)

Missing data: The MSL record for this gauge has a gap of 5 or more years

Figure 6-7. Mean Sea Level projections for Lake Pontchartrain, New Canal Station, LA

6.7.2.1 Sea Level Rise Scenarios and Projected Benefits

The projected benefits of the structural and nonstructural features of the RP were also analyzed under the low and high RSLR scenarios to evaluate potential impacts to projected benefits in comparison to the projected intermediate RSLR scenario. The results of the effects of the alternative low and high RSLR scenarios on the performance of the coastal levee are summarized in Table 6-9. The results for the coastal nonstructural aggregates are shown in Tables 6-10 and 6-11. Under the low RSLR scenario, there would be 1,024 fewer structures included in the nonstructural plan due to the Coastal Slidell aggregate not being economically justified at the 2% AEP event. Under the high RSLR scenario, an additional 835 structures would be included in the nonstructural plan due to the Coastal Slidell aggregate being justified at the 1% AEP event.

Table 6-9

Slidell Levee

Relative Sea-Level Rise Scenarios FY23 Price Level and Discount Rate \$1,000s		
	Low	High
Without Project Damages	115,850	203,190
Damages Reduced	113,459	199,350
Average Annual Cost	94,173	94,173
Net Benefits	19,286	105,177
B/C Ratio	1.2	2.1

Table 6-10, Net Benefits, Low Relative Sea-Level Change

Aggregate	10% AEP	5% AEP	2% AEP	1% AEP
Coastal Slidell	13,416	7,766	-1,298	-9,286
Coastal Lacombe	744	370	9	12
Coastal Mandeville	5,567	2,811	971	64
Coastal Madisonville	996	696	583	540

Table 6-11, Net Benefits, High Relative Sea-Level Change

Aggregate	10% AEP	5% AEP	2% AEP	1% AEP
Coastal Slidell	41,212	33,746	31,932	1,139
Coastal Lacombe	1,650	1,528	648	741
Coastal Mandeville	1,366	7,721	19,773	33,490
Coastal Madisonville	9,517	7,028	6,252	1,475

6.7.2.2 RLSR Sensitivity Evaluation

RSLR was further analyzed and a sensitivity evaluation was conducted, which consisted of two parts. First, the average elevation of developed land in each of the 4 nonstructural coastal aggregates was determined: Slidell, Madisonville, Mandeville, and Lacombe. Second, the distribution of major roadway and street elevations in each of the 4

nonstructural aggregates was identified. The identified critical elevations were then plotted against the three RSLR curves utilizing the SLAT tool. In addition, the projected Mean High High Water (MHHW) curve was plotted for each RSLR rate. The MHHW curve is representative of the high tide condition which would occur in association with a particular RSLR rate at any point in time. These plots indicate the projected point in time at which the median developed land, or some increment of roadway infrastructure, would become normally threatened by high tide conditions. The SLAT tool also produces tabular data extracting those intersection points from the plotted data.

The average developed land data was extracted from the 2011 GAP Landfire National Terrestrial Ecosystem database, which includes specific land classification categories for residentially and commercially developed land. The categories for Urban Developed ("Developed & Other Human Use" were used. The broad use of other land classifications to develop an average elevation was found to be confounded by the interspersed of coastal and wetland areas throughout the aggregation polygons.

The roadway elevations were based on sampling major roads and streets at 1,000-foot intervals throughout each aggregation. The distributions of those roadway elevation data points were based on the 25, 50, & 75% chance exceedance elevations within each data set. This provides an indication of when each specific percentage of the sampled roadways would become threatened.

The evaluations for the 4 aggregations are located in the Appendix E: Hydrologic & Hydraulics in Section 3.4. Comparing the two evaluations (average elevation of developed land and the roadway elevations) provides a further rough estimate of the relationship of the potential threat to development and relative access. The results indicate, the NS plan's projected benefits and project performance would remain through the 50-year period of analysis and is not potentially impacted by sea level rise until 70-130 years in the future based on the actual level of sea level rise encountered.

Table 6-12, Estimated Sea Level Rise Risk for Non-structural Plan Performance for Coastal Non-structural Plan Aggregations

	Elev, ft NAVD88	MHHW Low	MHHW Intermediate	MHHW High
Slidell			Year	Year
Ave land elev	5.74	NA	2145	2087
25% road elev	5.97	NA	2149	2089
50% road elev	7.94	NA	NA	2109
75% road elev	11.28	NA	NA	2137
Madisonville				
Ave land elev	6.36	NA	NA	2094
25% road elev	6.25	NA	NA	2092
50% road elev	6.53	NA	NA	2095
75% road elev	10	NA	NA	2127

Mandeville				
Ave land elev	11.77	NA	NA	2141
25% road elev	11.25	NA	NA	2137
50% road elev	14.5	NA	NA	NA
75% road elev	18.97	NA	NA	NA
Lacombe				
Ave land elev	5.54	NA	2141	2085
25% road elev	8.03	NA	NA	2110
50% road elev	10.41	NA	NA	2130
75% road elev	14.47	NA	NA	NA

6.7.3 Residual Damages and Residual Risks

The flood risk that remains in the floodplain after the RP is implemented is known as the residual flood risk. The measures in the RP were modeled in HEC-RAS and ADCIRC. The FIFR-EIS fully describes flood risk to structures and life safety associated with riverine, rainfall, and coastal storm flood events. The measures of the RP were formulated to reduce the risk of flood damages to key infrastructure and structures. The RP would greatly reduce, but not eliminate future damages and residual risk would remain. The structural measures of the RP reduces expected annual damages by approximately 30 percent relative to the without project conditions. The NS plan of the RP reduces annual damages by approximately 40 percent relative to the without project condition. The residual risk, along with the potential consequences, has been communicated to the NFS and will become a requirement of any communication and evacuation plan.

Of the \$573 million in the without project estimated annual damages (EAD) in the study area, about \$383 million in estimated annual damages is due to coastal flooding and \$190 million in estimated annual damages is due to rainfall and riverine flooding. The RP is currently estimated to reduce the EAD caused by coastal flooding by about 80 percent and reduce the EAD caused by rainfall and riverine flooding by about 60 percent.

6.7.4 Potential Induced Flooding

Coastal storm surge and wave modeling was completed for existing conditions, with-project base (year 2032), and future conditions (year 2082) for the levee and floodwall system including in the RP. Water surface elevation results for the Coastal storm surge and wave modeling were statistically computed and provided to the PDT for use in economic, environmental, and engineering analyses for the following return periods: 10, 20, 50, 100, 200, 500, and 1000-year events. ADCIRC modeling of the RP alignment for the 1 percent AEP water levels on the floodside of the alignment indicated estimated “negligible” water surface level increases for 2032 (up to 2” for 100-year and up to 4” for 500-year) and for 2082 (up to 3” for 100-year and up to 5” for 500-year) less than 6 inches of inducement. The larger water surface elevations are on the east side of the proposed alignments with the largest being on the east side of Lakeshore Estates and Kingspoint levees up to 4 inches.

The estimated impacts on the eastern side of the system are expected as these areas are closer to the Gulf of Mexico where storm surge would enter the Lake Pontchartrain basin via Rigolets. See Figure 6-8 for the difference plot of water surface elevation between 2032 with- and without-project values for the 100-year computed Water Surface Elevation (in inches) for coastal surge events at various locations surrounding the footprint.

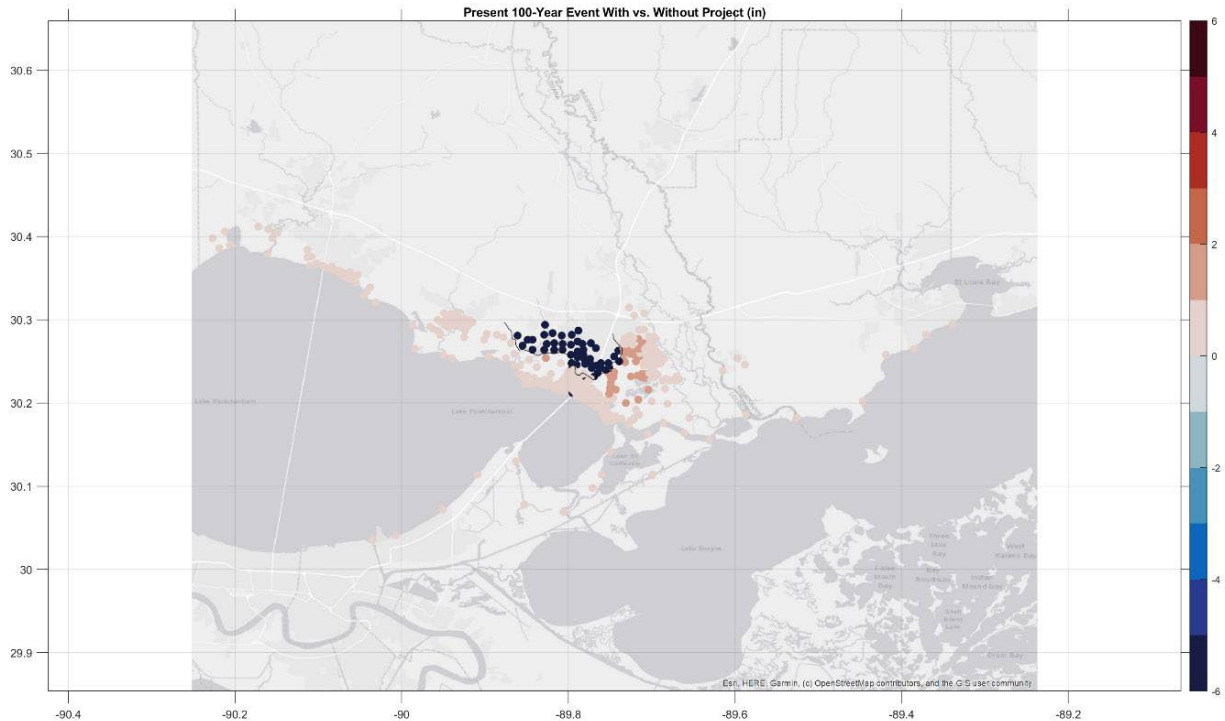


Figure 6-8. Difference plot of WSE between 2032 with- and without-project values for the 100-year computed WSE (in inches) at various locations surrounding the footprint of the Draft TSP. Blue-colored dots represent modeled reductions with the project in place, on the interior of the proposed system. Red dots represent potential increases.

The structural measures of the RP are not expected to cause significant changes to storm surge levels that would be experienced by the USACE Lake Pontchartrain and Vicinity system (part of the post--Katrina Hurricane Storm Damage Risk Reduction System for the New Orleans Metro area) or the USACE West Shore Lake Pontchartrain system on the western end of Lakes Pontchartrain and Maurepas.

Although the modeling may indicate some “negligible” increase in water surface elevation inside and outside of the levee alignment, there is no concrete evidence at this time that the

construction of the levee will induce flooding. The vertical team has concluded that there is no need for a taking analysis at this time. If during the PED phase, further modeling results show actual induced flooding that would give rise to a possible loss of real property rights or would require the acquisition of flowage easements, an analysis would be prepared and the REP would be updated to show any additional real estate requirements (i.e., flowage easements).

Furthermore, the Economic Appendix, Engineering Appendix, and H&H Appendix address the modeling results conducted for the Study. Since additional analysis is not warranted at this time, there is no USACE requirement for the project to mitigate or compensate for damages associated with hypothetical induced flooding. This position is consistent with USACE policy as set forth in ER 1105-2-103 (2023) and ER 1105-2-101 (2019). Specifically, ER 1105-2-103 states that “when a project results in transferring risk by increasing damages within or outside the immediate project area, risk reduction should be investigated and recommended, if cost effective and appropriate. Reduction of induced flooding (mitigation) may be appropriate when the benefits exceed the costs or there are overriding reasons of public safety, economic, or social concerns, or a determination of a real estate taking (such as a flowage easement) has been made. Each Project Delivery Team (PDT) will account for remaining induced damages in the economic analysis, and the impacts of induced damages must be displayed and discussed in the report. Any residual damages associated with remaining induced flooding with or without mitigation measures in place will be accounted for in the economic analysis and displayed and discussed in the feasibility study report.” It has not been demonstrated that the construction of the levee will result in a transference of risk by increasing damages within or outside the immediate project area. Therefore, additional risk reduction measures to address possible “negligible” increases in water surface elevations, with no certainty that any induced flooding will occur, have not been investigated.

6.7.5 Project Cost

USACE decision documents recognize cost risk and uncertainty surrounding implementation. All cost estimates will carry a degree of uncertainty. The total project first cost for the RP is approximately \$5.8B. The fully funded total project cost for the RP is approximately \$7.57B, to which the structural portion (West and South Slidell Levee and Floodwall System) contributes approximately \$3.84B (or roughly 51 percent of the total fully funded project cost) and the NS contributes approximately \$3.73B (or roughly 49 percent of the total fully funded project cost) at the 80 percent confidence level, respectively. The costs are based on a USACE Class 3 level of technical information and design reflecting approximately a 10 percent level of project definition. The fully funded total project cost includes a contingency developed utilizing the Cost and Schedule Risk Analysis (Appendix D8 and D9), and computed contingency for the overall project as 46 percent, with a 51 percent computed contingency for the structural component (West and South Slidell Levee and Floodwall System) and 43 percent computed contingency for the NS. The cost contingencies reflect an 80 percent confidence level in estimated fully funded total project

cost and are intended to cover potential cost and schedule increases associated with identified project risks and their probability of occurrence. An 80 percent confidence level carries some degree of uncertainty. For the RP, the known cost uncertainty drivers are listed below:

6.7.5.1 Structural Cost Uncertainty

West and South Slidell Levee and Floodwall System consists of an approximately 18-mile system surrounding the City of Slidell. This cost estimate is based upon limited existing field data. Design computations were performed utilizing the limited data, informed by engineering judgment and the hydraulic elevations/stages resulting from the modeling performed. Key assumptions for the West and South Slidell Levee and Floodwall System are described below.

(1) Topography/bathymetry used for hydraulic modeling and geotechnical analysis is limited to existing LiDAR datasets. The data utilized is a mosaic terrain data set (NGOM), prepared for the Gulf Coast that is supplemented by bathymetry to cover areas under water and other data subsets to provide more definition where needed. All terrain data is pre-2018. Aerial imagery is from Louisiana NAIP (2021). The bathymetry utilized for AdCIRC modeling represented to current grid.

(2) No subsurface investigations were performed for this study. Existing data was used, which was limited. The available subsurface data used for development of subsurface profiles and design parameters was near a limited reach of the levee. The limited existing data required extrapolation and resulted in soil strength assumptions with high degrees of uncertainty. The available data was largely concentrated at the eastern end of the alignment, consisted of 3-inch borings (not the 5-inch typically utilized by CEMVN for detailed design), and did not necessarily provide coverage directly on the alignment, instead being “near” the alignment in the region between the Norfolk Southern Railroad tracks at the western end and the Kingspoint east levee at the eastern end. Essentially, the western end of System from the Railroad tracks to the western terminus (approximately 9 miles) utilized a single boring near the Railroad tracks at the extreme eastern end of the project. The middle third of the System had nearby existing data and some on the alignment (approximately 5 miles), and the eastern end of the System to the eastern terminus had limited to no existing borings (approximately 4 miles). The team applied best judgment based on the knowledge of the geomorphology of the area and developed what is expected to be conservative assumptions for soil parameters.

(3) No additional alignment survey, topographic survey, bathymetric survey, or detailed utility surveys were performed for this study, with the PDT relying only on the data described above.

(4) From the hydraulic design perspective, AdCIRC models using the latest grid and 2D HEC-RAS modeling was performed to support pump station, drainage structure, and navigation structure sizing. However, no detailed review of adequacy of interior drainage conveyances to handle landside runoff from the levee system were performed.

(5) The PDT utilized conservative design approaches based on recent experiences on the USACE West Shore Lake Pontchartrain (WSLP) project, to include wider levee sections, the need to add a sand base to the levee design, deeper pile tips for structures, etc. Design calculations were performed to size major members utilizing the limited field data available and the hydraulic model results. Given that this is the study phase, a minimum number of typical sections were developed for each feature type (e.g., three typical floodwall sections based on relative height were used) to support cost estimate development.

Given the lack of geotechnical data, there are substantial uncertainties that pose risks for cost growth and schedule growth for the West and South Slidell Levee and Floodwall System during PED and Construction. While the hydraulic analysis is well advanced, there still remains a residual risk of structure number, configuration, and size/capacity changes associated with hydraulic design refinements during PED. There is certainly residual risk of levee footprints/cross-sections increasing in size and pile foundation depths increasing during PED. There is risk of utility/facility relocations creating schedule and cost growth during PED.

Given that there is some underlying field data, and that the hydraulics has been advanced to a high percentage of completion, the estimate for the West and South Slidell Levee and Floodwall System reflects the bare minimum required for Class 3 by meeting the 10 percent design maturity. The contingency derived from the CSRA does fall just outside the upper limit of the typical range defined in ER 1110-2-1302 (20 percent to 50 percent), but major elements of scope have been captured, with uncertainty remaining around scale and magnitude of foundations for project elements. In comparison to an analog project (West Shore Lake Pontchartrain (WSLP)), which also primarily consisted of an 18.5-mile levee system) the overall fully funded cost for the West and South Slidell Levee and Floodwall System is within a similar order of magnitude (e.g., WSLP, which had a fully funded cost of roughly \$3.7B). Therefore, while there are uncertainties and unknown unknowns that will need to be addressed, this estimate still meets the minimum standard for a Class 3.

6.7.5.2 Nonstructural (elevations and floodproofing) Cost Uncertainty

The NS component of the RP consists of the elevation of eligible residential structures and the dry floodproofing of nonresidential structures that will not receive the flood risk reduction benefits from the implementation of the structural measures of the RP. The total estimated Project First Cost for the NS measures is \$3,012,488,000 which includes \$1,832,345,000 for implementation of residential structure elevation measures (for 5583 eligible residential structures at \$95 per square foot and \$2,295,896,000 for implementation of the dry floodproofing measures for 827 eligible nonresidential structures at approximately \$29-\$80 per square foot (dependent on the square footage of the nonresidential structure). The total estimated real estate cost for NS measures, including contingencies is \$170,764,000.00.

Computation of structure elevation costs.

Although no specific design computations were performed for the residential structure elevations, the home sizes were obtained from the structural inventory and quotes for

elevation cost based on a cost per square foot were obtained from FEMA, STPG, local governments executing grant programs, and home elevation/shoring contractors in the greater metropolitan New Orleans area. See Appendix D: Engineering Annex 8 for details on the cost estimation for the NS components of the RP. The cost estimate for the NS component of the RP assumes 100 percent participation by the owners of eligible residential structures, so the overall total project cost has inherent conservatism. The estimate also utilizes the best available information and judgment by the cost estimating community across the enterprise with respect to Preliminary Engineering and Design percentage and Supervision and Administration percentage, given that there is not a strong history of execution of such a program by USACE. However, there were wide difference in the elevation cost per square foot, which could result in some potential cost growth. Another uncertainty that could impact the ultimate cost for the residential structure elevations is the frequency and magnitude of Congressional appropriations to execute the NS component of the RP. Incremental funding or a prolonged overall execution timeline could also result in an increase in cost for the NS component of the RP.

By providing actual contractor quotes and recent historical data, the NS cost estimate fits within the definition of a Class 3 estimate. The CSRA-derived contingency is 43 percent, which fits within the range of typical contingencies for a Class 3.

Computation of dry floodproofing costs

Dry floodproofing costs were developed using information from local contracting companies. Several options were evaluated to dry floodproof commercial building. The flood plank system was chosen for cost estimating purposes. The system is composed of gasketed aluminum planks and steel posts which are quickly mountable and watertight. It is erected when flooding is imminent and then easily disassembled and stored, leaving an unobstructed view of the area with no protrusions. The installation information was implemented in the MII software to estimate a cost for dry floodproofing. See Appendix D: Engineering Annex 8 for details on the cost estimation for the NS components of the RP.

6.7.5.3 Environmental Impact Assessment Uncertainties

A reassessment of impacts would be conducted once designs are finalized in PED to ensure all impacts from construction of the RP are fully identified and mitigated. If additional impacts are identified beyond what has been assessed in this FIFR-EIS, then a supplemental NEPA document would be prepared analyzing those project changes and mitigation needs and released to the public for comment.

6.7.5.3.1 Wetland Value Assessment Model Uncertainties

Some of the remotely sensed data used to classify habitat type used older data. Satellite imagery data used to classify habitat types may be as old as 2005. There is a risk that these data may not accurately represent the existing conditions. There are many general risks associated with using mathematical models and projecting future conditions in a dynamic environment. These risks are covered in other parts of this section.

6.7.5.3.2 Habitat Evaluation Procedures (HEPs)

Impacts to pine savanna fish and wildlife resources was limited to using species specific HEPs in lieu of a pine savanna community model. The HEP approach are species-based models and only quantify habitat quality associated with a single species instead of measuring the overall health of the ecosystem and its ability to support a diversity of fish and wildlife resources. There are a limited number of species with published HEP models that are good indicators of pine savanna forest quality. Some of the best indicator species for this habitat type do not have HEPs developed (e.g., gopher tortoise, eastern indigo snake, eastern diamond-backed rattlesnake, flatwoods salamander, etc.). Species HEPs that are available are often dated and do not include new species information collected since the time of publication.

6.7.5.3.3 Habitat Mitigation Plan

The mitigation sites have been assessed through review of existing information, reports and projects as well as data sources. Section 7 and Appendix I: Mitigation Plan Marsh, Pine Savanna and Riparian Monitoring, Success Criteria, and Adaptive Management Plans identify the adaptive management activities that could address and or manage these risks and uncertainties regarding new habitats to be constructed as compensatory mitigation. Mitigation project designs would be further developed and refined during PED should the RP receive approval and funding. If the identified mitigation sites incur, through construction, additional impacts to habitat, those impacts must also be mitigated.

6.7.6 Economic Factors

The HEC-FDA Version 1.4.2 USACE-certified model was used to calculate the damages and benefits for the study. The economic and engineering inputs necessary for the model to calculate damages and benefits include structure inventory, contents-to-structure value ratios, vehicles, FFE's, and depth-damage relationships, ground elevations, and without-project stage probability relationships.

The uncertainty surrounding each of the economic and engineering variables was also entered into the model. Either a normal probability distribution, with a mean value and a standard deviation, or a triangular probability distribution was entered into the model to quantify the uncertainty surrounding the ground elevations. The number of years that stages were recorded at a given gage was entered for study area reaches to quantify the hydrologic uncertainty or error surrounding the stage-probability relationships. Uncertainty surrounding variables such as population growth, FFEs, structure value, depth damage relationships and additional inputs are consistent with typically accepted uncertainty.

6.7.7 Elevation of Manufactured, Modular and Mobile homes as part of the Nonstructural Plan

For purposes of this FIFR-EIS, the terms "manufactured home," "modular home" and "mobile home" shall have the meanings ascribed to those terms below.

"*Modular home*" and "*modular housing*" mean a factory-built, residential dwelling unit built to the International Residential Code as adopted by the Louisiana State Uniform Construction Code Council. See La. R.S. 51:911.22 as amended from time to time. To be eligible for elevation, a modular home must be permanently affixed to the ground, and must meet the anchoring, construction, installation, and other requirements of La. R.S. 912, ART XIV-B. MINIMUM STANDARDS FOR INSTALLATION OF MANUFACTURED AND MODULAR HOMES AND TRANSPORTATION REQUIREMENTS.

"*Manufactured home*" and "*manufactured housing*" mean a factory-built, residential dwelling unit constructed to standards and codes, as promulgated by the United States Department of Housing and Urban Development (HUD), under the National Manufactured Housing Construction and Safety Standards Act of 1974, 42 U.S.C. 5401 et seq., as amended. Further, the terms "manufactured home" and "manufactured housing" may be used interchangeably and apply to structures bearing the permanently affixed seal of the United States Department of Housing and Urban Development. See La. R.S. 51:911.22 as amended from time to time. To be eligible for elevation, a manufactured home must be permanently affixed to the ground, and must meet the anchoring, construction, installation and other requirements of La. R.S. 912, ART XIV-B. MINIMUM STANDARDS FOR INSTALLATION OF MANUFACTURED AND MODULAR HOMES AND TRANSPORTATION REQUIREMENTS.

"*Mobile home*" means a factory-built, residential dwelling unit built to voluntary standards prior to the passage of the National Manufactured Housing Construction and Safety Standards Act of 1974. This term includes and is interchangeable with the term "house trailer" but does not include the term "manufactured home", as only manufactured homes are built to federal construction standards. See La. R.S. 51:911.22 as amended from time to time. To be eligible for elevation, a mobile home must be permanently immobilized in accordance with the requirements of La. R.S. 9:1149.4 as amended from time to time. A mobile home placed upon a lot or tract of land shall be an immovable when there is recorded in the appropriate conveyance or mortgage records of the parish where the said lot or tract of land is situated an authentic act or a validly executed and acknowledged sale or mortgage or sale with mortgage which contains a description of the manufactured home as described in the certificate of title or manufacturer's certificate of origin and a description of the lot or tract of land upon which the manufactured home is placed, and contains a declaration by the owner of the manufactured home and, when applicable, the holder of a mortgage or security interest under Chapter 9 of the Louisiana Commercial Laws on the manufactured home, that it shall remain permanently attached to the lot or tract of land described in the instrument. Notwithstanding the provisions of La. R.S. 9:1149.6, the original mobile home owner and any subsequent owner of a immobilized mobile home, may not deimmobilize the mobile home in the future by detachment, removal or any other method.

The state of Louisiana classifies property as either immoveable or moveable. Immoveable property refers to things like land and everything permanently attached to the land such as a house or buildings. Moveable property consists of things that physically exist and can be moved from one place to another. If the home is a manufactured, modular or mobile home, it is classified as *moveable personal property* under state law unless it has been permanently

immobilized in accordance with the requirements of state law. Immobilizing means the manufactured, modular or mobile home is made a part of the land, both physically and legally. In order for a manufactured, modular, or mobile home to be legally classified as immoveable real property, the structure owner must comply with the requirements of La. R.S. 9:1149.4 (2022), which include the execution of an act or declaration of demobilization stating that the structure shall remain permanently attached to the lot or tract of land described in the act or declaration. The act or declaration of immobilization must contain the written consent of all owners of the structure and all holders of a mortgage or security interest. Upon recordation of the act of immobilization in the public records, the structure is subject to all laws concerning immoveable property.

Although an act of immobilization must state that the manufactured, modular, or mobile home shall remain permanently attached to the land, the act of immobilization can be “undone.” Even if a manufactured, modular, or mobile home has been immobilized in accordance with state law, another state statute authorizes the owner (and subsequent owners) to thereafter deimmobilize the manufactured, modular and mobile home. This process effectively transforms the immobilized corporeal immoveable manufactured, modular or mobile home back to the legal status of a corporeal moveable thing and personal as opposed to real property. La. R.S. 9:1149.6 (2022), provides that an owner may deimmobilize a manufactured, modular or mobile home by detachment or removal. To be effective against third person, the owner must comply with statutory provisions requiring the execution of an act of deimmobilization, recording of the act in the public records, and the submission of application to the Department of Public Safety, Office of Motor Vehicles, for a new certificate of title. Upon issuance of a new certificate of title, the deimmobilization process is complete, and the manufactured, modular or mobile home shall be deemed moveable and subject to all laws concerning moveable personal property.

At this time, there are approximately 417 homes that are either manufactured, modular or mobile homes included in the total number of 5,583 residential structures that are preliminarily eligible for elevation. The PDT has not researched how many of the 417 structures in this count are manufactured homes, or modular homes, or mobile homes. Further investigation into the legal classification of these 417 structures will be conducted by the PDT before PED. The PDT is continuing to work with the vertical team, the Offices of Counsel, the USACE National NS Committee and others, to reach consensus on the propriety of including these types of structures for elevation in the NS Plan. This collaboration will continue to evaluate how to best protect the federal investment and enforce requirements to ensure that these kind of homes remain immoveable real property and permanently affixed to the ground in perpetuity.

SECTION 7

Mitigation Assessment

7.1 COMPENSATORY HABITAT MITIGATION

The authority and requirements for compensatory habitat mitigation are set forth in federal laws and regulations. The legal foundation for habitat mitigation to offset unavoidable habitat losses caused by USACE water resources projects includes but is not limited to, the Clean Water Act, Section 906 of the Water Resources Development Act (WRDA) of 1986, as amended by subsequent WRDAs, the Fish and Wildlife Coordination Act and other applicable environmental laws. The specific procedures followed to develop the mitigation plan is contained in Engineer Regulation 1105-2-100, Appendix C: Environmental. Compensatory habitat mitigation is defined as “the restoration (re-establishment or rehabilitation), establishment, enhancement, and/or in certain circumstances preservation of aquatic resources for the purposes of offsetting unavoidable adverse impacts which remain after all appropriate and practicable avoidance and minimization has been achieved” (see 40 CFR 230.92). Implementation guidance for Section 1163 of the Water Resources and Development Act (WRDA) of 2016 requires functional assessments be performed to define habitat impacts and to set mitigation requirements for impacted habitats.

The goal of the Mitigation Plan is to fully compensate for the unavoidable impacts to significant fish and wildlife habitat resources that would occur with the implementation of the RP for the St Tammany Parish Feasibility Study which includes construction of a levee and floodwall system in West and South Slidell. CEMVN made a concerted effort to avoid and minimize environmental impacts of the Draft TSP, Optimized TSP, and the RP to the maximum extent practicable. However, unavoidable impacts to fresh/intermediate marsh, and pine savannah habitats including impacts to pine savannah habitat on the BBNWR will occur. Throughout the plan formulation, CEMVN conducted multiple meetings with the BBNWR to identify a levee and floodwall alignment that would avoid and minimize impacts to the BBNWR. Notwithstanding these efforts, there are still unavoidable impacts to fish and wildlife resources associated with the implementation of the RP that require the development of a compensatory habitat mitigation plan. The efforts to avoid, minimize, rectify, or reduce impacts, not directly related to fish and wildlife habitat impacts are not covered in this Compensatory Mitigation Plan, but are addressed in Sections 3 and 5 and in Appendix C of the FIFR-EIS for the St. Tammany Parish Feasibility Study.

The preparation of the Mitigation Plan required extensive coordination and collaboration between CEMVN, the NFS, and state and federal agencies. An interagency team comprised of state and federal resource agencies assisted in the identification of habitat impacts and the development of the Mitigation Plan. MVN will continue to coordinate and seek input from these organizations during the design and implementation phases in executing the Mitigation Plan upon approval of the RP and receipt of project construction funding.

This Mitigation Plan documents and details the mitigation assessment performed, including coordination, plan formulation, and environmental compliance, to develop the recommended compensatory habitat mitigation plan. See Appendix I: Mitigation Plan. Factors considered by the PDT include compliance with laws, regulations and policies, watershed and ecological site considerations, implementation timing, risk and reliability, environmental impacts, and cost effectiveness.

The objectives of the Mitigation Plan are defined by the results of the habitat impact assessment model using quantified units. The same habitat assessment model was used to estimate potential study impacts and potential mitigation project outputs. Compensatory mitigation objectives were to:

- Compensate for the loss of 48 average annual habitat units of fresh and intermediate marsh wetland habitat in the Mississippi Alluvial Plain, Deltaic Coastal Marshes and Barrier Islands ecoregion within Louisiana.
- Compensate for the loss of 67 average annual habitat units (9.7 red-cockaded woodpecker AAHU; 57 pine warbler AAHU) of Pine Savanna habitat in the Lake Pontchartrain Watershed.
- Compensate for the loss of 9 average annual habitat units (7 red-cockaded woodpecker AAHU; 2 pine warbler AAHU) of Pine Savanna habitat on refuge land within BBNWR or on within other USFWS within the Lake Pontchartrain Watershed.

A description of the evaluation of the mitigation measures, alternatives, and sites considered and selected for each habitat type and the proposed ecological success criteria, monitoring and adaptive management for the Mitigation Plan is included in Appendix I: Mitigation Plan. The Mitigation Plan was developed (and revised) for the Draft TSP, Optimized TSP and the RP. The final Mitigation Plan includes proposed alternatives that applied to the Optimized TSP, but after the Optimized TSP was refined and the RP formulated, some of the alternatives in the Mitigation Plan no longer apply to the RP. Therefore, this section only addressed the alternative mitigation measure in the Mitigation Plan that apply to the RP for the FIFR-EIS for the St. Tammany Parish Feasibility Study.

The recommended mitigation consists of a combination of mitigation bank credit purchases as well as marsh restoration and pine savanna (refuge) mitigation projects to be constructed by USACE, either before or concurrent with the construction of the RP, if approved. The BBNWR has reviewed the Mitigation Plan and concurs with and supports the mitigation alternatives set forth in the Plan. The mitigation measures that apply to the RP which are included in the Mitigation Plan address the following impact types:

- o Fresh and intermediate marsh (non-refuge)- mitigation to be constructed.
- o Pine Savanna (non-refuge)- mitigation bank credits to be purchased.
- o Pine Savanna (refuge)-mitigation to be constructed.

The following summarizes the selected mitigation plan applicable to the implementation of the RP:

Alternative MA 2-3. Non-refuge Fresh and Intermediate Marsh - East Fontainebleau (Site M2)- to be constructed.

This mitigation alternative includes a 220 acre marsh restoration site within the acquisition boundary of the BBMNWR, which is privately owned. There is a proposed CWPPRA project (Bayou Cane Marsh Creation) #PO181 adjacent to this site. Approximately 16,067 linear ft of new temporary retention dike will be required along the limit of the project footprint. The dike will be built with borrow from within the footprint. The site would require borrow of approximately 2,200,000 cubic yards of material sourced from Lake Pontchartrain. A borrow site of 134 acres would accommodate this requirement. The dike will be built with a 5 feet crown width to elevation +4.8 feet NAVD88, to provide 1 foot of freeboard during pumping operation and allow for settlement. This dike will be degraded in year 1, upon settlement and dewatering of the created marsh platform. The degraded material can be disposed of in the original borrow canal if settlement allows or cast into the open water immediately outside of the project footprint. Spill boxes or weirs will be constructed at pre-determined locations within the retention dike to allow for effluent water release from within the marsh creation area.

Alternative MA 4-1. Pine Savanna (non-refuge)- purchase mitigation bank credits

This mitigation alternative consists of the purchase of mitigation bank credits (PS-MB) for pine savanna impacts resulting from construction of the levee and floodwall system in Slidell. Any mitigation bank that can meet the eligibility requirements and has the appropriate resource type of credits can 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 the compensatory mitigation requirements for the particular habitat type. This alternative is expected to provide 67 AAHUS.

PSR-1 Pine Savanna (refuge) to be constructed

This mitigation alternative consists of the restoration of up to (~)70 acres of degraded wet Long-leaf Pine Savanna Forest for coastal zone Pine Savanna impacts resulting from construction of the West and South Slidell Levee and Floodwall System. The restoration area is located entirely within the BBNWR (reference Figure 7-1) and is south and east of Bayou Bonfouca, west of the Norfolk Southern Railroad tracks and Pontchartrain Drive (U.S. Route 11), and north of the Lake Pontchartrain. This mitigation alternative also includes: eradication of invasive species such as tallow; the removal of undesirable hardwood species, the reintroduction of fire across the entire site; and the removal of undesirable hardwood species, all as explained in greater detail in Appendix I- Mitigation Plan.

A summary of the mitigation costs for the RP is provided in Table 7-1.

Table 7-1. Summary of Mitigation Costs for the RP

Habitat Type	St Tammany Project Feature Impacts	Mitigation Site	AAHUs/ Acres	Cost*
Non-Refuge Marsh	Levee and Floodwall System	M2 – East Fontainebleau	48 AAHUs	\$25,566,938
Non-Refuge Pine Savanna	Levee and Floodwall System	Mitigation Bank	67 AAHUs	\$11,687,041
Refuge Pine Savanna	Levee and Floodwall System	Pine Savanna BBMNWR PSR-1	9 AAHUs	\$2,719,533
Total Mitigation Cost				\$39,973,512

*Constructed project costs include construction, monitoring and adaptive management and any necessary OMRR&R.

7.2 PROGRAMMATIC AGREEMENT

In compliance with NHPA Section 106, CEMVN developed a Programmatic Agreement (PA) that establishes procedures to satisfy the CEMVN's Section 106 responsibilities pursuant to 36 CFR Part 800.14(b). The final PA is contained in Appendix C and will be executed prior to signing of the ROD. Signatories, Invited Signatories, and Concurring Parties agree that the Undertaking (RP) shall be implemented in accordance with the stipulations outlined in the PA (Appendix C: Environmental).

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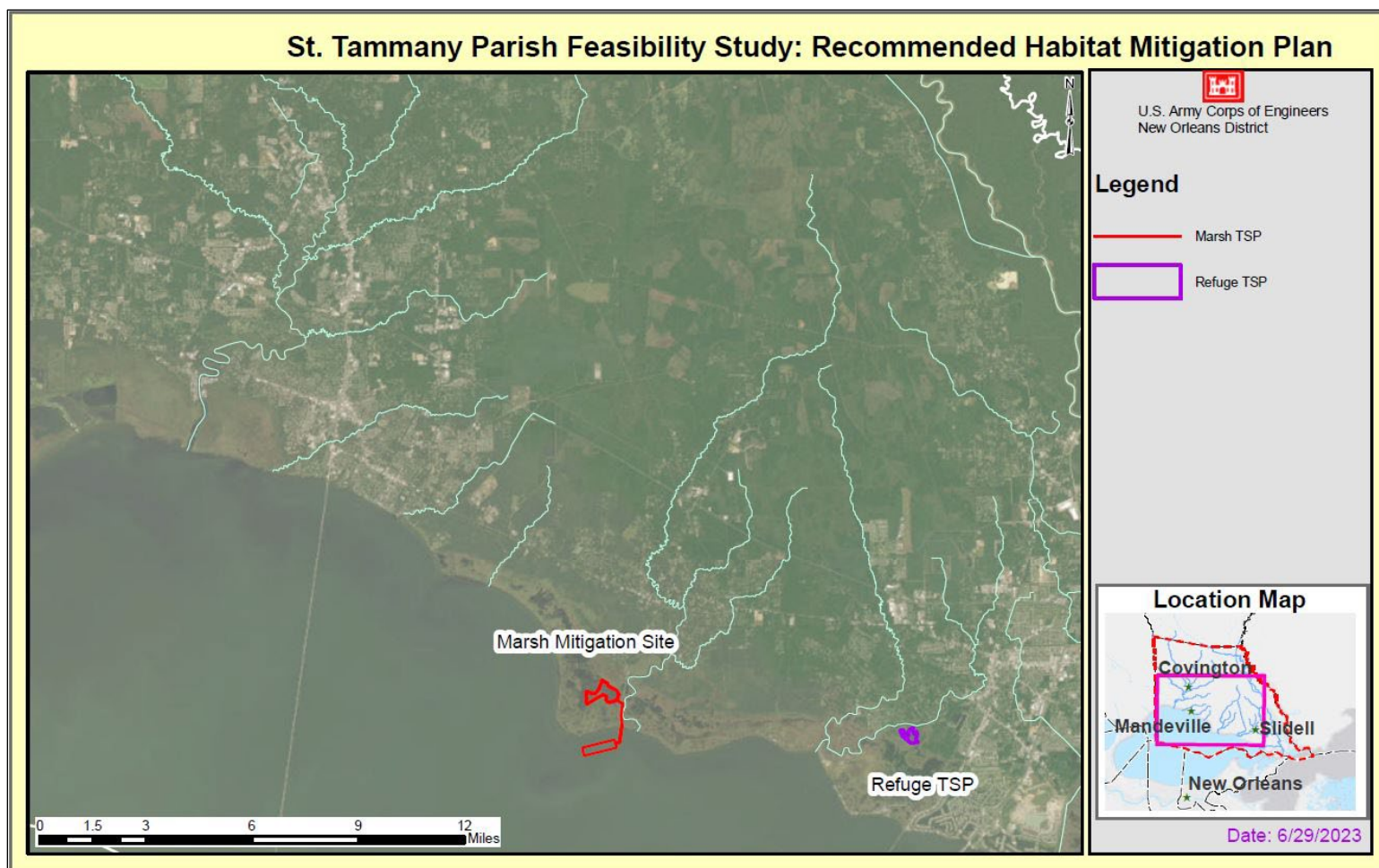


Figure 7-1. Site Map for the Recommended Habitat Mitigation Plan

SECTION 8

Environmental Laws and Regulations

All correspondence and coordination documents are located in Environmental Appendix C within the applicable Environmental Law Annex folder.

8.1 EXECUTIVE ORDER 12898, FEDERAL ACTIONS TO ADDRESS ENVIRONMENTAL JUSTICE IN MINORITY POPULATIONS AND LOW-INCOME POPULATIONS DATED 11 FEBRUARY 1994

Executive Order 12898 directs federal agencies to: identify and address the disproportionately high and adverse human health or environmental effects of their actions on minority and low-income populations to the greatest extent practicable and permitted by law. No high adverse disproportionate impacts were identified. However, mitigation of high, adverse impacts is provided. See status of compliance per this EO in section 8.1.

8.2 EXECUTIVE ORDER 14008, TACKLING THE CLIMATE CRISIS AT HOME AND ABROAD DATED 27 JANUARY 2021, SEC 219: SECURING ENVIRONMENTAL JUSTICE AND SPURRING ECONOMIC OPPORTUNITY; OFFICE OF MANAGEMENT AND BUDGET MEMORANDUM M-21-28

Executive Order 14008, Sec 219, states that agencies shall make achieving environmental justice part of their missions by developing programs, policies, and activities to address the disproportionately high and adverse human health, environmental and climate-related impacts as well as the accompanying economic challenges of such impacts. An EJ assessment identified high, adverse human impacts and determined that these impacts are not disproportionate to minority or low-income residents. Additionally, areas of EJ concern are shown to benefit from flood risk reduction in the RP.

Federal agencies are to assess Environmental Justice pursuant to Executive Order #12898: Environmental Justice (1994) and EO #14008, Tackling the Climate Crisis at Home and Abroad (2021). For USACE water resource projects, compliance with these EOs is mandatory pursuant to Section 112(b)(1) of WRDA 2020 (Public Law 116-260). ("In the formulation of water development resources projects, the Secretary shall comply with any existing Executive Order regarding environmental justice . . . to address any disproportionate and adverse human health or environmental effects on minority communities, low-income communities, and Indian Tribes.") Pursuant to P.L. 116-260, E.O. 12898 of 1994 and the Department of Defense's Strategy on Environmental Justice of 1995 USACE identifies and addresses any disproportionately high and adverse human health or environmental effects of its actions to minority and/or low-income populations.

Areas of EJ concern are identified to help inform planners as to the location of those areas needing a particular focus and attention when determining the impacts of the federal action, as described in EOs #12898 and #14008.

Direct impacts to EJ areas of concern from the structural plans are high and adverse due to the need for residence acquisitions in those areas to accommodate the project footprint. The acquisitions of private residences, however, is not expected to disproportionately impact areas of EJ concern. The NS plan is unlikely to cause high, adverse disproportionate impacts, but further analysis would be completed during the PED phase.

8.3 EXECUTIVE ORDER 14096; REVITALIZING OUR NATION'S COMMITMENT TO ENVIRONMENTAL JUSTICE FOR ALL

Executive Order 14096 states that advancing environmental justice will require investing in and supporting culturally vibrant, sustainable, and resilient communities. The Flood Risk Management system, recommended as the RP, benefits areas of EJ concern by reducing flood risk to those living in vulnerable communities.

8.4 EXECUTIVE ORDER 11988: FLOODPLAIN MANAGEMENT

Executive Order 11988 directs federal agencies to reduce flood loss risk; minimize flood impacts on human safety, health, and welfare; and restore and preserve the natural and beneficial values served by flood plains. Agencies must consider alternatives to avoid adverse and incompatible development in the flood plain. If the only practical alternative requires action in the floodplain, agencies must design or modify their action to minimize adverse impacts. Some project features would extend into floodplains; however, the RP would not promote future development within the floodplain that otherwise would not occur. The study is compliant with the order.

8.5 EXECUTIVE ORDER 11990 - PROTECTION OF WETLANDS

Executive Order 11990 directs federal agencies to assess the likely impacts to wetlands associated with any proposed action. This is met through the following: (a) avoid long and short term adverse impacts associated with the destruction or modification of wetlands; (b) avoid direct or indirect support of new construction in wetlands; (c) minimize the destruction, loss or degradation of wetlands; (d) preserve and enhance the natural and beneficial values served by wetlands; and (e) involve the public throughout the wetlands protection decision-making process. The RP was developed to avoid and minimize impacts to wetlands where practicable. All unavoidable impacts would be mitigated as described in Chapter 7 and Appendix I.

8.6 CLEAN AIR ACT OF 1970, AS AMENDED

The Clean Air Act (CAA) sets goals and standards for the quality and purity of air and requires the EPA to set national ambient air quality standards (NAAQS) for pollutants considered harmful to public health and the environment. The study area is currently in attainment of NAAQS. No general conformity determination is required.

The CEQ, CEQ-2022-0005, on 09 January 2023 introduced interim guidance on Greenhouse Gas (GHG). USACE, in coordination with USACEHQ, developed a methodology to analyze the components for GHG and incorporate them within USACE

environmental assessments documented in National Environmental Policy Act (NEPA) documents. USACE has assessed the potential for GHG increases and reductions as a result of the RP in Section 5.

8.7 CLEAN WATER ACT OF 1972, AS AMENDED – SECTIONS 401, 402 AND 404

The Clean Water Act (CWA) sets and maintains goals and standards for water quality and purity. Section 401 requires a Water Quality Certification from the LDEQ that a proposed project does not violate established effluent limitations and water quality standards. A Section 401 Water Quality Certificate application was submitted to LDEQ on 13 March 2023. In a letter dated 13 July 2023, LDEQ concluded that the deposit of spoil will not violate water quality standards as provided for in LAC 33:IX. Chapter 11 and issued Water Quality Certification, WQC 230516-01.

As required by Section 402 of the CWA, Louisiana Pollution Discharge Elimination System (LPDES) permit coverage for the proposed project would be obtained prior to construction via the General Permit for Discharges of Storm Water from Construction Activities Five Acres or More from the Louisiana Department of Environmental Quality.

As required by Section 404(b)(1) of the CWA, an evaluation to assess the short- and long-term impacts associated with the placement of fill materials into waters of the United States resulting from implementation of the TSP (including RP) was approved 22 September 2023 is contained in Appendix C, Environmental. No comments were received on the draft Section 404(b)(1).

8.8 COASTAL ZONE MANAGEMENT ACT

The Coastal Zone Management Act (CZMA) 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, CEMVN submitted a Consistency Determination to LDNR in 2021, LDNR submitted comments with respect to USACE's Coastal Zone Consistency Determination (C20210082) on 23 July 2021. CEMVN submitted a modified Consistency Determination based on the optimized TSP on 30 June 2023. The Coastal Zone Consistency modification 1 C20210082 was received on 18 September 2023. A letter was provided to LDNR on 19 December 2023 advising that the Mile Branch feature from the optimized TSP and is not a part of the RP. LDNR responded on 28 December 2023 that the removal of the Miles Branch feature will not change its comment letter, as Mile Branch is outside of the Louisiana coastal zone.

8.9 ENDANGERED SPECIES ACT O F 1973

The ESA helps to protect and recover T&E species of fish, wildlife, and plants. A biological assessment (BA) dated 27 April 2023, was submitted to NOAA on 01 May 2023 and a BA dated 22 June 2023, was submitted to USFWS on 3 July 2023. The BA's were submitted as part of the on-going coordination with USFWS and NOAA for listed T&E species, including

the Gulf sturgeon and Gulf sturgeon critical habitat, West Indian manatee, Gopher tortoise, Red-cockaded woodpecker, Eastern black rail, giant manta ray, three species of sea turtles (green, Kemp's ridley and loggerhead), migratory shorebirds, and species of management concern (i.e. rare and very rare species) that are known to occur or are believed to occur within the area. The RP would have no effect on the Louisiana quillwort. Upon CEMVN submission of a revised BA dated 1 September 2023, NOAA concurred with CEMVN's determinations that the proposed action was not likely to adversely affect T&E species or critical habitat under NOAA's jurisdiction in a letter dated 05 September 2023. Upon CEMVN submission of a revised BA dated 31 August 2023, USFWS concurred with CEMVN determinations that the proposed action was not likely to adversely affect T&E species under USFWS' jurisdiction in a letter dated 20 September 2023. The biological assessments and coordination documents are included in Environmental Appendix C.

The implementation of the RP would include Standard Manatee Conditions for In-Water Activities, Protected Species Construction Conditions, and Vessel Strike Avoidance Measures. In summary, the contractor will be responsible for instructing all personnel regarding the potential presence of protected species in the area and the need to avoid collisions with these animals. If protected species are sighted within 150 feet of the construction area, all operations of moving equipment must cease until the species has departed the area on its own volition. There also would be reporting requirements, restrictions on vessel operation, and restrictions on the use of siltation barriers. Construction guidelines can be found in Environmental Appendix C.

8.10 FARMLAND PROTECTION POLICY ACT

The Farmland Protection Policy Act of 1981 is intended to minimize the impact federal programs have on the unnecessary and irreversible conversion of farmland to non-agricultural uses. The USDA-NRCS is responsible for designating prime or unique farmland protected by the act. Prime farmland is land with the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops that is available for these uses. It can be cultivated land, pastureland, forestland, or other land, but is not urban or built-up land or water areas. Unique farmland is land other than prime farmland that is used for the production of specific high value food and fiber crops, such as citrus, tree nuts, olives, and vegetables. NRCS responded in a letter dated 02 June 2023 and provided a CPA-106 Farmland Conversion Impact Rating for Corridor Type Projects for the levee and floodwall construction and an AD-1006 Farmland Conversion Impact Rating form for the borrow area. NRCS stated that they do not predict impacts for NRCS work in the vicinity. NRCS responded that the proposed construction area will potentially impact the following prime or unique farmland soils:

Levee and Floodwall

Soil Map unit Symbol and Name	Acres	Rating Value (RV)
Aa – Abita silt loam, 0 to 2 percent slopes	7.5	93
Bg – Brimstone-Guyton silt loams, 0 to 1 percent slopes	0.1	69
Pr – Prentiss fine sandy loam, 0 to 1 percent slopes	2.0	93
St – Stough fine sandy loam, 0 to 1 percent slopes	31.4	93
Total Acres 41.0		Weighted Average RV 93

Borrow Area (MS2)

Soil Map unit Symbol and Name	Acres	RV
Gt – Guyton silt loam, 0 to 1 percent slopes	78.7	69
St – Stough fine sandy loam, 0 to 1 percent slopes	15.8	93
Total Acres 94.5		Weighted Average RV 73

The Louisiana Department of Agriculture & Forestry submitted a response letter dated 01 September 2023 of no objection to or further comment on the proposed project. USACE has determined that the proposed conversion of prime and unique farmland soils is consistent with the Farmland Protection Policy Act.

8.11 FISH AND WILDLIFE COORDINATION ACT

The Fish and Wildlife Coordination Act (FWCA) provides authority for the USFWS and NMFS involvement in evaluating impacts to fish and wildlife from proposed water resource development projects. It requires that fish and wildlife resources receive equal consideration to other project features. It requires federal agencies that construct, license, or permit water resource development projects to first consult with the USFWS, NMFS, and state resource agencies regarding the impacts on fish and wildlife resources and measures to mitigate these impacts. Section 2(b) requires the USFWS to produce a Coordination Act Report (CAR) that details existing fish and wildlife resources in a study area, potential impacts due to a proposed project and recommendations for a project. The draft CAR (DCAR) on the initial DEIS was received 28 April 2021. The revised DCAR with recommendations on the Optimized TSP was received on 15 May 2023. The final CAR (FCAR) is dated 26 September 2023. Post public review additional analysis was conducted and the Mile Branch measure was eliminated from the RP. CEMVN coordinated this change with the Resource agencies and as a result USFWS provided a subsequent FCAR version 2.0 on 22 January 2024. The FCAR version 2.0 eliminated recommendations specific to Mile Branch and included two additional recommendations at the request of NMFS from what was included in the revised DCAR. USFWS correspondence, the DCAR, FCAR and FCAR version 2.0 are included in Environmental Appendix C. CEMVN responses to the recommendations are set forth below.

The Service requests the following recommendations are implemented concurrently with project construction:

1. The Service recommends that the levee alignment be moved off the BBMNWR. If the alignment cannot be altered, lands would need to be purchased and exchanged with the refuge to construct flood control features. These exchanged lands must be within the

approved refuge acquisition boundary. The USACE or the non-federal sponsor would then own the lands needed to build and maintain flood control features.

CEMVN Response: Concur. Following release of the initial draft IFR-EIS, the TSP was optimized. Meetings were held with the resource agencies including personnel from the BBNMWR to identify ways to avoid and minimize impacts to the refuge. The Optimized TSP reflects those efforts. CEMVN understand that lands directly impacted by the levee alignment are to be exchanged with USFWS for approved lands within the refuge acquisition boundary. CEMVN and the Refuge have been in close communication, and it is understood that the required BBNMWR conformity determination and land exchange would be handled during PED if the project is authorized and funded.

2. Indirect impacts to pine savannah habitat (-6.62 AAHUs) on the BBNMWR are required to be mitigation for on refuge lands.

CEMVN Response: Concur. A mitigation site (PSR-01) has been selected on the BBNMWR to offset indirect impacts (-6.62 AAHUs) on the refuge. The mitigation plan and project description for the mitigation site are located in Appendix I: Mitigation Plan.

3. Species of vegetation, planted and maintained on levees or levee slopes on BNMNWR, should be closely coordinated with the Service.

CEMVN Response: Concur. CEMVN will coordinate closely with the refuge and Service regarding construction plans and specifications and species of vegetation planted on the levee/levee slopes.

4. All project related activities on the refuge must be coordinated with Refuge Project Leader Neil Lalonde (985-882-2000).

CEMVN Response: Concur. CEMVN will coordinate and work closely with the Refuge Project Leader. The CEMVN will work with the Refuge to obtain necessary Special Use Permits since proposed project features will impact the refuge including mitigation for pine savanna habitat impacts.

5. The Service and other natural resource agencies should be coordinated with throughout the engineering and design of project features including levees, floodgates, water control structures, and clearing and snagging at Mile Branch to ensure that those features are designed, constructed, and operated consistent with wetland restoration and associated fish and wildlife resource needs as required by the FWCA. In addition, the Service recommends these actions and plans, as they are further developed, be provided to the Service and other resource agencies for review, comment, and input.

CEMVN Response: Concur. CEMVN will maintain close coordination with the Service

and natural resource agencies during PED should the project become authorized and funded. The Service, natural resource agencies and Refuge will be provided opportunities to review and comment on project plans and specifications as well as operation manuals as they are developed.

6. Water control structure operation manuals or plans should be developed in coordination with the Service and other natural resource agencies. All drainage features through the levee system should be sized to match the existing drainage system and mimic the existing drainage patterns when the system is not closed. The operation plan should maintain hydrologic connectivity through water control structures except during closure for hurricanes or tropical storms.

CEMVN Response: Concur. CEMVN will maintain close coordination with the Service and natural resource agencies during PED should the project become authorized and funded. The Service, natural resource agencies and Refuge will be provided opportunities to review and comment on project plans and specifications as well as operation manuals as they are developed.

7. To minimize impacts to fisheries, flood protection water control structures in any watercourse should maintain pre-project cross section in width and depth to the maximum extent practicable. Water control structures within a waterway should include shoreline baffles and/or ramps (e.g., rock rubble, articulated concrete mat) that slope up to the structure invert to enhance organism passage. Various ramp designs should be considered. Please coordinate with the NMFS, Alexis Rixner (alexis.rixner@noaa.gov) on this issue.

CEMVN Response: CEMVN will maintain close coordination with the Service, Refuge and natural resource agencies during PED should the project become authorized and funded. The natural resource agencies would be provided opportunities to review and comment on project plans and specifications as they are developed. Design features for water control structures would consider shoreline baffles and/or ramps (e.g., rock rubble, articulated concrete mat) that slope up to the structure invert to enhance organism passage to the extent feasible. CEMVN will consider various ramp designs.

8. Bayou Liberty is a Louisiana designated Natural and Scenic River. LDWF should review the projects affecting each stream and determine if a Scenic Stream Permit would be required. The USACE should initiate consultation with the LDWF Scenic Rivers Program prior to conducting any activities within or adjacent to the banks of that bayou. Scenic Rivers Coordinator Chris Davis can be contacted at (225) 765-2642.

CEMVN Response: Noted, however federal supremacy has not been waived with respect to the Louisiana Natural and Scenic Rivers Act. CEMVN has coordinated with the LDWF regarding its concerns for the Scenic Stream to determine how to address

its concerns and to provide additional information as warranted. Plans and specifications for the scenic streams will be shared with LDWF for input and comment during PED.

9. Full, in-kind compensation (quantified as Average Annual Habitat Units) is recommended for unavoidable direct impacts to 146 acres (-9.7 RCW AAHUs; -45 pine warbler AAHUs) of pine savannah; 39.9 acres (-48 AAHUs) of fresh/intermediate marsh; and 34.9 acres (-22.9 AAHUs) of riparian habitat. Unavoidable indirect impacts to 3.3 acres (-6.6 RCW AAHUs; -13.8 pine warbler AAHUs) of pine savannah. should be mitigated. To help ensure that the proposed mitigation features meet their goals, the Service provides the following recommendations.

a. If applicable, a General Plan should be developed by the USACE, LDWF, and the Service in accordance with Section 3(b) of the Fish and Wildlife Coordination Act for mitigation lands.

b. Mitigation measures should be constructed concurrently with the flood damage reduction features that they are mitigating (i.e., mitigation construction should be initiated no later than 18 months after levee construction has begun).

c. If mitigation is not implemented concurrent with levee construction, the amount of mitigation needed should be reassessed and adjusted to offset temporal losses.

d. The USACE should remain responsible for the required mitigation until the mitigation is demonstrated to be fully compliant with interim success and performance criteria. At a minimum, this should include compliance with the requisite vegetation, elevation, acreage, and dike gapping criteria.

e. The acreage restored and/or managed for mitigation purposes and adjacent affected wetlands should be monitored over the project life. This monitoring should be used to evaluate mitigation project impacts, the effectiveness of the compensatory mitigation measures, and the need for additional mitigation should those measures prove insufficient.

CEMVN Response: Concur in part. USACE has developed a mitigation plan in coordination with USACE, FWS and LDWF; compensatory mitigation would be implemented concurrent with levee construction; USACE is responsible for the mitigation until initial success criteria are met, at which time the NFS would be responsible for monitoring and maintenance; the mitigation sites would be monitored over the project life.

10. With the new definition of the Waters of the United States (WOTUS, published 29 Aug 2023) all enclosed (protected side) wetlands may be redefined as non-jurisdictional wetlands because of this project, thus impacting all enclosed wetlands. There is concern that this would increase developmental pressures on enclosed wetlands. Currently, the USACE is awaiting guidance on implementation of that new rule. The Service

recommends the USACE coordinates with us once that guidance is received to ensure protection of enclosed wetlands.

CEMVN Response: The USACE will continue to work closely with the Service on this project and coordinate closely regarding implementation of the proposed action. Should it become apparent that there may be additional impacts beyond what has been disclosed a supplemental NEPA document would be prepared if appropriate prior to construction implementation.

11. The construction of levees can result in temporary and/or permanent impacts to migratory birds and the habitats upon which they depend for various life requisites. The Service has concerns regarding the direct and cumulative impacts resulting from the loss and fragmentation of forest and grassland habitats, and the direct and indirect impacts that these losses would have upon breeding migratory birds of conservation concern within the West Gulf Coast Plain Bird Conservation Region. The Service recommends avoiding impacts to forested areas to the maximum extent practicable.

CEMVN Response: Concur. CEMVN has worked closely with the Service and natural resource agencies to find ways to avoid and minimize impacts to habitats to the extent possible. Any changes to the proposed project resulting from further engineering and design during PED would be closely coordinated with the Service and natural resource agencies.

12. Due to the importance of the project area as nesting habitat for bird species of conservation concern, the Service recommends that the project be constructed in a manner that would minimize bird impacts. The Migratory Bird Treaty Act prohibits the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests, except when specifically authorized by the U.S. Department of the Interior. While the Act has no provision for allowing unauthorized take, the Service realizes that some birds may be harmed or killed as a result of project-related activities even when reasonable measures to protect birds are implemented. The Service's Office of Law Enforcement (LE) carries out its mission to protect migratory birds through investigations and enforcement, as well as by fostering relationships with individuals, companies, and industries that have taken effective steps to minimize their impacts on migratory birds, and by encouraging others to enact such programs. As such, LE focuses its resources on investigating and prosecuting individuals and entities that take migratory birds without regard for their actions or without effort to implement Service recommendations or conservation measures. In this case, we recommend that no habitat alteration work be performed during the nesting period (01 March to 31 July).

CEMVN Response: Noted. Reference Section 8.14 which includes language that captures this requirement.

13. To aid in water quality improvements, any pumping stations associated with the project should not discharge directly into canals or other open water bodies, but rather into wetland systems that can assimilate nutrients being discharged.

CEMVN Response: Noted. during PED should the proposed project become authorized and funded, consideration would be given to designing pump stations such that the discharge would not flow directly into open water bodies. CEMVN will closely coordinate design activities during PED with the Service.

14. If it becomes necessary to use borrow sources other than the previously proposed environmentally cleared sites, the Service recommends USACE begin investigating potential borrow sources in coordination with the Service. Borrow sites to be considered should have minimal impacts to fish and wildlife resources.

CEMVN Response: Concur. CEMVN will continue to work closely with the Service regarding the proposed project and any changes that may occur during PED should the project become authorized and funded.

15. To avoid adverse impacts to bald eagles and their nesting activities the Service and LDWF recommend that a qualified biologist inspect the construction site for the presence of new or undocumented bald eagle nest within 1,500 feet of the levee construction area.

CEMVN Response: Concur. Reference Section 8.16 which includes language that captures this requirement.

16. To avoid adverse impacts to nesting wading bird colonies the Service and LDWF recommend that a qualified biologist inspect the construction site for the presence of undocumented nesting colonies during the nesting season (i.e., 01 September through 15 February).

CEMVN Response: Concur. Reference Section 8.16, which includes language that captures this requirement.

17. West Indian manatees occasionally enter Lakes Pontchartrain and Maurepas, and associated coastal waters and streams during the summer months (i.e., through September). 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. For more detail on avoiding contact with manatees contact this office.

CEMVN Response: Concur. Manatee protection language is a part of our contract specifications and contractors are trained in the necessary requirements and best management practices to avoid adverse impacts to Manatee.

18. Consideration should be given to minimize adverse impacts to species currently designated as “at-risk” that may occur within St. Tammany Parish. Those species include the: golden winged warbler, frecklebelly madtom, saltmarsh topminnow, monarch butterfly, Southern snaketail butterfly, Eastern beard grass skipper, tri-colored bat, Alabama hickory nut, Correll’s false dragon-head, alligator snapping turtle, Eastern diamondback rattlesnake and Pearl River map turtle.

CEMVN Response: Noted. CEMVN will continue to work closely with the Service during development of plans and specifications as well as project implementation regarding species at risk and opportunities to avoid or minimize adverse impacts.

19. The USACE completed informal consultation with the Service on 20 September 2023. The Service concurred with USACE’s “not likely to adversely affect” determination for the gopher tortoise, Gulf sturgeon, red-cockaded woodpecker and West Indian manatee. The USACE, CPRA and any contractors or personnel involved with the STP project should adhere to the Best Management Practices outlined in the Biological Assessment.

CEMVN Response: CEMVN will ensure that any Contractors working on the project would adhere to the BMP as outlined in the BA.

20. 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.

CEMVN Response: Concur. Coordination with the Service will continue throughout the preconstruction, engineering, design and implementation phases should the project become authorized and funded.

The NMFS reviewed the USFWS DCAR and submitted a letter to the USFWS on 05 June 2023. The NMFS agrees with the recommendations in the CAR related to direct and indirect impacts, recommendations for in-kind compensation, and recommendations requesting USACE provide extensive additional project information. To ensure the conservation of EFH and associated marine fishery resources, NMFS requests expanding the CAR recommendations to include:

1. As required by the Magnuson-Stevens Act, a revised complete EFH assessment should be provided to NMFS to conclude EFH consultation with USACE. The revised assessment should clarify, delineate, and quantify direct and indirect impacts to EFH by habitat type differentiating between the flood side and the protected side of all structures. All activities associated with this project including a description of measures to avoid, minimize, mitigate, or offset the adverse impacts of the proposed activities on EFH should be incorporated.

CEMVN Response: Concur. The RDIFR-EIS included an updated section on essential fish habitat existing conditions (Section 3.2.1.7) and impact assessment (Section 5.1.1.5). Impacts to EFH resulting from the Optimized TSP have been more fully described to clarify, delineate, and quantify direct and indirect impacts. Impacts are described for both the protected side and floodside of the proposed structures. The mitigation plan summarized in Section 7 and included in Appendix I: Mitigation Plan, describe measures to avoid, minimize and mitigate for the adverse impacts of the proposed plan.

2. Sufficient information should be provided to assess impacts to fisheries access and water exchanges in the Lake Pontchartrain Basin from construction of levees and water control structures. All structures (e.g., roller floodgate and culverts with sluice gates) should remain open under normal conditions. An operational plan for these structures should be provided that includes triggers for gate closures (e.g., named storm events in the Gulf of Mexico, fixed water level elevations, crest setting, estimated frequency of closures, etc.). The USACE should also provide a reference to the specific flood protection authorization and hydrological modeling results for all structures justifying: (1) how particular locations were selected for each structure, (2) why each structure is needed, and (3) how the size and type of each structure was determined.

CEMVN Response: Concur. Potential impacts to fisheries resulting from proposed structures is included within final report. A preliminary draft operating plan is included in Appendix C, Annex Q for operations of the water control structures. This operating plan will be further defined during PED following additional H&H modeling and engineering design. USACE will continue to closely coordinate with USFWS and NMFS in the development of plans and specifications.

3. The USACE should develop, in coordination with NMFS, a mitigation and monitoring plan which fully compensates for all direct and indirect EFH impacts. To avoid additional mitigation for temporal impacts, the NMFS recommends implementation of the mitigation plan concurrent with the construction of the development. The quantity of EFH to be impacted should be clarified to inform determination of mitigation. Specifically, a functional assessment should be used to evaluate the compensatory mitigation requirements for unavoidable impacts to wetlands and water bottoms. Water column and estuarine mud/sand bottoms EFH impacts should also be included among the habitat types requiring mitigation. The USACE should: (1) refine the final assessment of EFH impacts by habitat type, (2) provide the information required to conduct a final Wetland Value Assessment (WVA), (3) provide the types of mitigation required, and (4) provide the final mitigation plans. Estimates

of all direct and indirect project related impacts to tidally influenced habitat should be refined for inclusion in the project's final CAR.

CEMVN Response: Concur. The USACE has developed a mitigation plan in close coordination with USFWS and NMFS. The impact assessment for EFH has been updated to include an impact assessment by habitat type, a wetland value assessment has been conducted and coordinated with NFS and the mitigation plan has been developed with input from NMFS.

8.12 HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE

Pursuant to USACE policy, potential Hazardous, Toxic, and Radioactive Waste concerns are to be identified early and construction in HTRW-contaminated areas is to be avoided to the extent practicable. A Phase I ESA site reconnaissance was conducted on 1-22 October 2021 to assess the potential for HTRW materials within the footprints for each of the alternatives in the Final Array of Alternatives. An American Society for Testing and Materials (ASTM) E 1527-13 Phase I Environmental Site Assessment (ESA) was completed on 8 March 2023, on the Optimized TSP and is on file within the CEMVN-PDC database. Within the Optimized TSP footprint, Mile Branch alignment, South and West Slidell alignment, ST 5 Borrow Site, ST 6 Borrow Site, ST 9 Borrow Site, MS-1 & MS-2 Borrow Site, East Fontainebleau Mitigation Site, and PSR-1 Mitigation Site, it was found that there is a low probability of encountering HTRW during construction. Prior to initiation of construction, another ASTM E 1527-13 Phase I ESA would be completed to ensure that the information is current at the time of construction. Reference Appendix C: Environmental.

8.13 MAGNUSON-STEVENSON FISHERY CONSERVATION AND MANAGEMENT ACT

The Magnuson-Stevens Fishery Conservation and Management Act, as amended, addresses the protection of Essential Fish Habitat (EFH) by NMFS in association with regional Fishery Management Councils. The NMFS has a "findings" with the CEMVN on the fulfillment of coordination requirements under provisions of the Magnuson-Stevens Fishery Conservation and Management Act. In those findings, the CEMVN and NMFS have agreed to complete EFH coordination requirements for federal civil works projects through the review and comment on National Environmental Policy Act documents prepared for those projects. See 50 CFR 600.920(f) (allowing use of existing environmental review procedures).

The initial DEIS was provided to NMFS 3 March 2021. Comments received from NMFS were significant and required further analysis and revisions to the EIS, which are addressed in this RDEIS. NMFS comments received on the initial DEIS were incorporated into this RDEIS. NMFS submitted their response letter to our request to initiate consultation under the Magnuson-Stevens Act dated 14 August 2023, 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 Act. The NMFS did not include any Conservation Recommendations in their comment letter. CEMVN held a meeting with NMFS on 07 September 2023, and 10 October 2023, to gain further understanding of their comments. CEMVN formalized the meetings through a

response letter to NMFS comments dated 8 September 2023 and 20 October 2023. The following are NOAA's comments and CEMVN's responses:

1. Based on the information provided in the revised DEIS, revisions to the EFH assessment will be required to further refine and quantify EFH impacts to determine the mitigation required for the final EFH assessment and EIS. A complete final EFH assessment should be provided to the NMFS incorporating all activities associated with this project, including a description of measures to avoid, minimize, mitigate, or offset the adverse impacts of the proposed activities on EFH. Avoidance and minimization of direct wetland impacts should be pursued to the greatest extent practicable. The final EIS should include in the EFH Section 5.1.1.5, details delineating and quantifying impacts to EFH by habitat type, as well as differentiating between the flood side EFH and the protected side of all structures.

CEMVN Response: Revisions to the EFH assessment were addressed in the RDIFR-EIS and submitted to the NMFS on 21 July 23. Section 5.1.1.5 in the RDIFR-EIS details the potential impacts to EFH. Engineering details on all structures, both flood side and protected side, is in Appendix D Annex 3. The mitigation plan (Appendix I) includes avoidance and minimization efforts to reduce project impacts. If after surveys are conducted in preconstruction engineering and design (PED, (pending approval and funding from Congress)), it is determined that project changes may be warranted, a supplemental NEPA document would be prepared. Coordination and consultation with NMFS would be re-initiated.

2. The NMFS recommends the final EFH assessment and EIS should include final operation plans, which assess potential structures related to fisheries access impacts in the Pontchartrain Basin.

CEMVN Response: The preliminary draft Operations Plan (Appendix C) was provided to NMFS on 7 September 23 and is considered to be adequate at the feasibility stage of the study. Both parties agreed that no changes were necessary for the final IFR-EIS (FIFR-EIS). If the project is authorized and funded to proceed to PED, a detailed Operations Plan will be developed and coordinated with the resource agencies, including NMFS.

3. The NMFS recommends conducting additional hydrologic modeling on project features to mitigate for any potential to reduce water exchange and increased hydroperiod of the Pontchartrain Basin. The USACE should provide hydrological modeling results for all structures justifying: 1) how particular locations were selected for each structure, 2) why each structure is needed, and 3) how the size and type of each structure was determined. The final EFH assessment and EIS should include the results of the assessment and associated mitigative measures.

CEMVN Response: The hydrologic analysis as presented in the RDIFR-EIS (Appendix E) is adequate at the feasibility stage and no additional modifications are required for the FIFR-EIS. If the project is authorized and funded to proceed to PED, the hydrologic modeling and analysis will be further refined. If determined necessary, supplemental

NEPA would be conducted. Coordination and consultation with NMFS would be re-initiated.

4. The revised DEIS included an EFH mitigation and monitoring plan, which states mitigation measures will be considered in the following order 1) potential USACE constructed marsh mitigation sites in approximately 221 acres of open water, and/or 2) purchase of mitigation bank credits to offset impacts to tidal fresh/intermediate marsh. If the purchase of wetland credits from an USACE approved mitigation bank within the appropriate watersheds is not available, then the USACE should work with NMFS to develop an appropriate plan to fully compensate for all EFH impacts.

CEMVN Response: The draft mitigation plan as presented in the RIFR-DEIS (Appendix I), is sufficient and no additional changes are necessary for the FIFR-EIS. Coordination between our agencies will continue through completion of the FIFR-EIS and signing of the Record of Decision. It is understood that if the project is authorized and funded to proceed to the PED, the mitigation plan may be refined if determined necessary based on results from additional modeling and project design changes.

5. The proposed mitigation and monitoring plan should be presented to NMFS for review prior to release of the final EFH assessment and EIS. To avoid additional mitigation for temporal impacts, NMFS recommends implementation of the mitigation plan concurrent with the construction of the development. The preliminary mitigation analysis, approximate total acres, and Average Annual Habitat Units of impacts to tidal fresh/intermediate marsh provided in the revised DEIS should be refined to verify: 1) the final assessment of acres of impacts to EFH, 2) the final WVA analysis, 3) the types of mitigation required, and 4) the final project design. Open water should also be included among the habitat types requiring mitigation. Estimates of all direct and indirect project related impacts to tidally influenced habitat should be refined for inclusion in the project's final EFH assessment and EIS.

CEMVN Response: See Comment 1 Response and Comment 4 Response regarding mitigation and monitoring. Implementation of the mitigation plan would occur concurrently with construction.

NOAA submitted a letter on 5 December 2023 indicating that CEMVN has satisfied their EFH consultation requirements for the feasibility study. Further coordination with NOAA and EFH consultation would continue should the study proceed to PED.

8.14 MIGRATORY BIRD TREATY ACT, AS AMENDED:

The MBTA is the primary legislation in the United States established to conserve migratory birds. The MBTA prohibits taking, killing, or possessing of migratory birds unless permitted by regulations promulgated by the Secretary of the Interior. The USFWS and the Department of Justice are the federal agencies responsible for administering and enforcing the statute. The study area is known to support colonial nesting wading/water birds (e.g., herons, egrets, ibis, night-herons and roseate spoonbills) and shorebirds (terns and gulls). USFWS and USACE biologists would survey the proposed action areas before construction

to confirm no nesting activity as suitable habitat and the potential for nesting exist within the area. If active nesting exists within 1,000 feet (water birds) or 1,300 feet (shorebirds) of construction activities then USACE, in coordination with USFWS, would develop specific measures to avoid adverse impacts to those species. A detailed nesting prevention plan may be necessary in order to deter birds from nesting within the aforementioned buffer zones of the area footprints in order to avoid adverse impacts to these species. If a nesting prevention plan is necessary, it would be prepared in coordination with USFWS.

The bald eagle is protected under the Bald and Golden Eagle Protection Act (BGEPA) and the MBTA. USFWS 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:

<https://www.fws.gov/northeast/ecologicalservices/pdf/NationalBaldEagleManagementGuidelines.pdf>

These 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. During construction of the RP, on-site personnel should be informed of the possible presence of nesting bald eagles in the vicinity of the project boundary, and should identify, avoid, and immediately report any such nests to the USACE. If a bald eagle nest occurs or is discovered within 660 feet of the RP footprint, then an evaluation must be performed to determine whether the construction and/or operation of the project is likely to disturb nesting bald eagles. An evaluation would be conducted in accordance with the procedures outlined by the USFWS at: <http://www.fws.gov/southeast/es/baldeagle>. Following completion of the evaluation, a determination would be made as to whether additional consultation is necessary or not. During nesting season, construction must take place outside of FWS/LDWF buffer zones. A USACE Biologist and an USFWS Biologist would survey for nesting birds prior to the start of construction.

CEMVN recommends that on-site contract personnel be trained to identify colonial nesting birds and their nests and avoid affecting them during the breeding season. Coordination with the USFWS pursuant to the BGEPA and MBTA has been initiated and is ongoing. Surveys for bald eagle nests and colonial nesting waterbird nests would continue. BMPs, included the development of a NPP, would be used. Coordination with the USFWS and the LDWF is ongoing for MBTA and BGEPA trust species.

8.15 NATIONAL HISTORIC PRESERVATION ACT OF 1966, AS AMENDED .

The consideration of means to preserve important historic and cultural resources is included among the Government's responsibilities under § 101(b)(4) of National Environmental Policy Act (NEPA) and its implementing regulations at 40 C.F.R. Parts 1501-1508. Compliance with Section 106 of the National Historic Preservation Act (NHPA) takes a narrower focus on historic properties. The NHPA Section 106 process, implemented by regulations of the

Advisory Council on Historic Preservation, 36 CFR § 800, requires agencies to define a project's APE, identify historic properties in that area that may be directly or indirectly affected by the project, assess the potential for adverse effects, resolve those adverse effects, and provide the Advisory Council on Historic Preservation a reasonable opportunity to comment on the undertaking.

The consideration of impacts to historic and cultural resources is mandated under § 101(b)(4) of NEPA as implemented by 40 C.F.R. Parts 1501-1508. NEPA calls for the consideration of a broad range of historic and cultural resources, including sites of religious and cultural importance to federally-recognized Tribal governments. Cultural resources include historic properties, archeological resources, and Native American resources including sacred sites and traditional cultural properties. Common cultural resource sites include prehistoric Native American archeological sites, historic archeological sites, shipwrecks, and structures such as bridges and buildings. Historic properties have a narrower meaning and are defined in § 101(a)(1)(A) of the NHPA; they include districts, sites (archaeological and religious/cultural), buildings, structures, and objects that are listed in or determined eligible for listing in the NRHP. Historic properties are identified by qualified agency representatives in consultation with LA SHPO, Tribes, and other consulting parties.

In compliance with NHPA Section 106, CEMVN initiated Section 106 consultation for the proposed action (Proposed Undertaking) as described in the CEMVN correspondence dated 20 August 2020 to the LA SHPO. In partial fulfillment of the CEMVN's Section 106 responsibilities, CEMVN submitted a NOI to develop a project-specific Programmatic Agreement to the LA SHPO, ACHP, and the following tribes on 26 August 2020: (the Alabama-Coushatta Tribe of Texas (ACTT), the Choctaw Nation of Oklahoma (CNO), the Coushatta Tribe of Louisiana (CT), the Jena Band of Choctaw Indians (JBCI), the Mississippi Band of Choctaw Indians (MBCI), and the Tunica-Biloxi Tribe of Louisiana (TBTL)) (Appendix C: Environmental). On 25 September 2020, the CNO submitted written correspondence stating that: "St. Tammany Parish lies in our area of historic interest. The Choctaw Nation has sites of significance, including village locations, located in St. Tammany Parish. We request to be a consulting party on the project PA."

On 10 September 2020, the CEMVN received a written response from the ACHP stating that "Based upon the information you provided, we have concluded that Appendix A, *Criteria for Council Involvement in Reviewing Individual Section 106 Cases*, of our regulations, "Protection of Historic Properties" (36 CFR Part 800), does not apply to this undertaking. Accordingly, we do not believe that our participation in the consultation to resolve adverse effects is needed." No other responses to this letter were received from any of the other potential stakeholders consulted. Additionally, on 31 August 2020, the CEMVN posted a NHPA/NEPA Public Notice to the designated project website <https://www.mvn.usace.army.mil/About/Projects/BBA-2018/studies/St-Tammany> for a 30-day comment period requesting the public's input concerning the proposed undertaking and its potential to significantly affect historic properties, assistance in identifying any relevant parties who may have an interest in participating in this consultation, and the CEMVN's proposal to develop a project-specific PA pursuant to 36 CFR § 800.14(b). No comments were received by CEMVN.

On 21 May 2021, CEMVN submitted a continued consultation to develop a project-specific PA to the LA SHPO, CPRAB, and tribes (ACTT, CNO, CT, JBCI, MBCI, and TBTL) (Appendix C: Environmental). The letter provided information regarding the TSP for the Project and requested consulting parties' input regarding CEMVN's proposal to develop a project-specific PA that establishes procedures to satisfy CEMVN's Section 106 (NHPA) responsibilities for this undertaking and potential consulting parties' interest in participating in the development of the PA. On 24 May 2021, CEMVN received a written response from the NFS who concurred with CEMVN's proposal to develop a project-specific PA and requested to be a consulting party in the PA. On 17 June 2021, the CNO requested to be a consulting party to the PA. On 21 June 2021, the LA SHPO also accepted CEMVN's plan to develop and adopt a PA pursuant to 36 CFR § 800.14(b) and confirmed they would participate in the development of this agreement.

On 13 October 2021, CEMVN held an initial Section 106 (NHPA) consultation meeting to develop the PA for the St. Tammany Parish, Louisiana Feasibility Study. Subsequent Section 106 PA development meetings were held on 17 November 2021, 8 December 2021, 12 January 2022, and 28 June 2022. Consulting parties to the PA include the CEMVN (Signatory), LA SHPO, (Signatory), USFWS (Signatory), CPRA (Invited Signatory), Choctaw Nation of Oklahoma (Invited Signatory), and the Certified Local Government (CLG) of Slidell (Concurring Party).

As a result of the above described consultation, CEMVN developed a Programmatic Agreement (PA) establishing procedures to satisfy the CEMVN's Section 106 responsibilities pursuant to 36 CFR Part 800.14(b). The PA addresses the potential to affect historic properties that are eligible for or listed in the NRHP, including archaeological sites, districts, buildings, structures, and objects that are significant in American history, architecture, archaeology, engineering, and/or sites of religious and cultural significance on or off Tribal Lands (as defined in 36 CFR § 800.16(x)) that may be affected by this undertaking. The PA will be executed before the ROD is signed. Once the PA is executed a copy of the executed agreement will be submitted to the ACHP. The final PA is contained in Appendix C of this FIFR-EIS.

8.16 NATIONAL WILDLIFE REFUGE SYSTEM (16 U.S.C. 668DD, 50 CFR PART 29)

The National Wildlife Refuge System Administration Act provides authority, guidelines and directives for the Service to improve the National Wildlife Refuge System; administers a national network of lands and waters for the conservation, management, and restoration of fish, wildlife and plant resources and habitat; ensures the biological integrity, diversity, and environmental health of refuges is maintained; defines compatible wildlife-dependent recreation as appropriate general public use of refuges; establishes hunting, fishing, wildlife observation and photography, and environmental education as priority uses; establish a formal process for determining compatible uses of refuges; and provide for public involvement in developing comprehensive conservation plans for refuges.

The RP would impact property of the BBNWR and as such if the proposed action is authorized and approved to proceed to PED, the Refuge would initiate a Compatibility Determination per their guidelines to determine if the RP is compatible with the designated uses of the BBNWR. If it is determined that the portion of the RP to be constructed on Refuge lands is not compatible with their designated uses, the USACE would need to identify lands of equal dollar value and habitat quality to swap with the NWR. Following the exchange of lands, the NWR lands on which the RP would be constructed becomes the property of the NFS and the exchanged lands would be incorporated in the BBNWR.

In addition, any work proposed within the BBNWR, such as the proposed mitigation site PSR-01, would require the Refuge to grant a Special Use Permit. CEMVN would apply for that permit once the project is authorized and funded for preliminary engineering and design.

8.17 WILD AND SCENIC RIVERS ACT (16 U.S.C. §1271)

There are no federally designated Wild and Scenic Rivers under the Federal Wild and Scenic Rivers Act, 16 U.S.C. §1271, *et seq* within the study area. However, there are natural and scenic streams designated by the Louisiana Scenic Rivers Act of 1988 within the study area. The LDWF is the lead state agency in the Louisiana Scenic Rivers Program. There are approximately 3,000 miles of water that are currently designated as state Scenic Rivers in Louisiana. The Liberty Bayou is located within the study area. Archaeological resources within scenic river corridors are protected by law under the Louisiana Scenic Rivers Act of 1988 (LSRA).

The LDWF has expressed concerns for the potential impacts to the scenic streams that could occur due to alternatives considered in the course of this study and has stated that channelizing a stream does not comply with the Louisiana Scenic Rivers Act. Liberty Bayou is listed as a Louisiana scenic stream and would be impacted by the RP.

SECTION 9

Public, Agency, Stakeholder Coordination

9.1 PUBLIC, STAKEHOLDER INPUT INTO THE PLANNING PROCESS

Early and continued coordination with the public, stakeholders, and other agencies is an essential part of the study development and planning process (the USACE's planning process is further described in Section 4). This coordination helps in determining the appropriate level of documentation and analysis necessary, developing and refining the study purpose, goals, objectives, and constraints, the range of alternatives to consider, impacts to resources, possible mitigation measures, and opportunities for environmental enhancement as well as identifying the NEPA and permit requirements of other agencies.

Bi-weekly meetings were held between the PDT, NFS, cooperating agencies and resource agencies. During the early phases of project planning, CEMVN held two public information meetings within 90 days after the commencement of the study, which was on 14 January 2020 when the FCSA was signed with the NFS: (1) 11 February 2020, at the Mandeville Community Center, and (2) 12 February 2020, at the Slidell Civic Auditorium.

There is ongoing coordination between the CEMVN, NFS, and key stakeholders, such as the STPG; the St. Tammany Levee, Drainage, and Conservation District (STLDCD); cities of Slidell, Covington, and Mandeville; towns of Madisonville, Pearl River, Abita Springs; villages of Folsom and Sun; the community of Lacombe; other local municipalities; and the State of Louisiana Congressional Delegation. Select meetings held with key stakeholders during plan development and after the release of the DIFS-EIS in 2021 are shown in Table 9-1.

Table 9-1. List of Meetings Held with Key Stakeholders

Date of Meeting	Purpose of Meeting
14MAY21	NFS meeting to discuss levee alignment and potential changes during feasibility level design
24MAY21	Stakeholder meeting to discuss investigation into structural protection around the Eden Isle area
26AUG22	Meeting with landowners for West Slidell Levee to discuss
26OCT22	Phone call Levee District President and Exec Office to update study process
07NOV23	Stakeholder updates with Executive Office and PDT on study progress and optimized levee
12JAN23	Col. Jones personal meeting Levee District President
19JAN23	Stakeholder, NFS and Exec Office brief on efforts for Military Rd. optimization
24JAN23	Stakeholder, NFS and Exec Office discussion of Economics for STPFS
27MAR23	Stakeholder, Project Management and Landowner site visit in West Slidell area
02MAY23	PDT and Stakeholder working meeting for Mile Branch measure
05MAY23	Exec Office and Stakeholder engagement with landowners in West Slidell area
17MAY23	Project management attendance at St. Tammany Levee Conservation and Drainage District Monthly Meeting to update on project status.
23MAY23	Project management hosted call with St. Tammany Levee Conservation and Drainage District Board Members to discuss Eden Isle
12JUN23	Project management, NFS and Exec Office hosted St. Tammany Levee Conservation and Drainage District to discuss feasibility study and levee alignments
21JUN23	Project management attendance at St. Tammany Levee Conservation and Drainage District Monthly Meeting to update on project status.
01AUG23	Project manager and engineer attended meeting hosted by Bayou Liberty Association to answer questions regarding study.
24OCT23	Homeowner meeting with Military Rd. Community to discuss concerns from homeowners in the Military Rd. area.

9.2 OVERVIEW OF PUBLIC AND AGENCY COORDINATION

Initial coordination with the resource agencies began on 15 January 2020 with the NFS, CPRA, USFWS, NMFS, and various state and local officials attending a planning charette conducted by CEMVN. This charette was a collaborative workshop in which an overview of the study's authority, purpose, study area and timeline were presented; the attendees discussed planning objectives, initial solutions, concepts to reduce flooding, and other relevant studies and data that could be used to inform the study process. From that point, individuals from each of those agencies were invited to attend the bi-weekly PDT meetings and contribute to alternative development. GIS files and information from past studies performed by state and local officials were assessed by CEMVN to determine what work had previously been studied and what could be used for this study. Information exchange between CEMVN, the state, and local partners is ongoing and would continue throughout the study.

As part of early coordination, two general public information meetings were held: (1) 11 February 2020, at the Mandeville Community Center, and (2) 12 February 2020, in the Slidell Civic Auditorium. PowerPoint presentations presented information about the study and PDT members were available to discuss alternative development and issues of local concern that would factor into the planning process and analysis. Both public meetings were well attended by municipal and parish officials, along with a large contingent of local residents. Information received from the public was incorporated into the planning process. Information was distributed regarding how to submit comments via letter, email, and telephone.

A public website page was created in June 2020 to aide interested parties in obtaining study information and provide feedback. <https://www.mvn.usace.army.mil/About/Projects/BBA-2018/studies/St-Tammany/>

A Notice of Intent was published on 19 June 2020 (FR vol 85 No. 119) notifying the public of the USACE intent to prepare an IFR–EIS and to conduct scoping for a study to evaluate potential CSRM and FRM measures in the study area. Public scoping meetings were held virtually on 14–15 July 2020. The virtual meetings were broadcast from the CEMVN office and the public was notified about the meetings through publication of the NOI, as well as through multiple social media channels and local newspaper. Recorded presentations of the scoping meetings were uploaded to the study website for those who could not attend. Questions were answered live by the PDT during both meetings.

The meeting videos are available on the [CEMVN YouTube Channel, Facebook](#), & study website. Scoping comments were received through 3 August 2020, which was established as the last day to provide comments to inform the study planning process.

Input received from public meetings assisted the PDT in refining study problems and opportunities, goals, objectives, potential measures, and alternative plans.

Themes of common concern include, but are not limited to:

- Local drainage issues throughout the Parish;
- Concern for potential adverse impacts/induced flooding resulting from the construction of the USACE West Shore Lake Pontchartrain Levee (which is a separate CEMVN flood risk reduction project) to Eden Isle neighborhood;
- Resource agency concerns for potential impacts to Gulf sturgeon, red cockaded woodpecker, and gopher tortoise habitats from the any proposed construction.

See Appendix C: Environmental for the public notices, coordination letters, Scoping Report, and public comments received to date.

Cooperating agencies include the USFWS, NMFS, LDWF, the city of Slidell and the City of Mandeville. As cooperating agencies they were invited to participate in the study planning and in the PDT meetings. The following Federally recognized tribes that have historic interest in Louisiana and the study area were also invited to participate in the planning process: Alabama-Coushatta Tribe of Texas (ACTT), the Choctaw Nation of Oklahoma (CNO), the Coushatta Tribe of Louisiana (CT), the Jena Band of Choctaw Indians (JBCI), Mississippi Band of Choctaw Indians (MBCI), and Tunica-Biloxi Tribe of Louisiana (TBTL).

9.3 PUBLIC COMMENT PERIOD

9.3.1 First Release

A Notice of Availability (NOA) was published in the Federal Register (Vol 86, No 111) on 11 June 2021 kicking off the 45-day public comment period for the DIFR-EIS. In addition, a public notice was published in the Baton Rouge and New Orleans Advocate on 11 June 2021. Two virtual public meetings were held on 28 June and 29 June 2021 (held virtually due to USACE policies during the covid pandemic). Approximately 725 people were reached during the first meeting and approximately 746 people were reached during the second meeting. One hundred 159 comments from 88 individuals and 11 agencies/NGOs were received. The top reoccurring themes were regarding modeling (20 percent), plan formulation (30 percent), non-structural plan (16 percent), potential impacts or insufficient discussion of impacts (14 percent) and induced flooding (8 percent). Nine percent of the comments expressed opposition to the Draft TSP. One petition was received that was signed by 36 individuals. Comments received are described below:

9.3.1.1 First Release Federal Agency Comments and NFS

Comments received from the resource agencies expressed concerns regarding potential impacts of the proposed levee alignment to the BBNWR and implementation of avoidance and minimization measures to reduce impacts to wetlands. Agencies requested greater engineering detail such as cross sections and plan views, H&H modeling, and operating guidelines for flood control structures. At the time of the release of the DIFR-EIS, impacts had not been assessed utilizing a certified habitat evaluation model and the compensatory mitigation plan was incomplete. Additional time and project details were necessary to complete the field work and data collection critical to conducting a wetland value

assessment, and the development of an adequate compensatory mitigation plan. The resource agencies requested a revision of the DIFR-EIS and a second 45-day public comment period due to the lack of project information, resource impact analysis, wetland value assessment and mitigation plan. The NFS expressed concerns with the alignment and the associated costs.

9.3.1.2 First Release Public Comments

Many of the comments received from the general public were related to concerns for induced flooding, the NS plan, inadequate or insufficient H&H modeling, and the Draft TSP alignment. The public questioned the alignment along the Military Road and Old Spanish Trail areas. The residents of the communities in and around Military Road criticized the lack of inclusion of their community within the levee alignment and they requested reconsideration of the levee alignment. Eden Isle residents, in Eastern Slidell, expressed concerns regarding the lack of protection the Draft TSP provided to Eden Isle. Comments received highlighted the previous work by the State/Parish regarding possible benefits of the Rigolets Barrier measure that was screened out due to the cost outweighing the benefits.

Additional information was requested regarding the implementation of the NS plan such as which homes would be raised and the cost burden of elevations. In addition, concern was expressed for induced flooding impacts to structures outside of the structural protection.

A recurring theme in the comments was in regard to localized flooding, floodplain development and permitting. Many comments received described areas prone to flooding and the effects of flooding caused by Hurricane Katrina as well other rain events. Many individuals commented on real estate development within the parish floodplain and critiqued the permitting process.

9.3.2 EJ Outreach and Meetings

EJ Outreach was conducted after the DIFR-EIS was released to the public in June 2021 to gain insight from residents in areas of EJ concern regarding the Final Array and potential positive and adverse impacts. The outreach and meeting coincided with the general public meeting that took place in July 2020, after the DIFR-EIS was released. Project information sheets were sent to church pastors in the vicinity of the Mile Branch Channel Improvement Measure and the West Slidell Levee alignment who were asked to inform their congregation of the meeting taking place concerning the DIFR-EIS.

On 4 April 2023 and 5 April 2023, EJ outreach meetings were conducted. Public outreach focused on civic and environmental organizations that serve residents in areas of EJ concern, which included local churches, libraries, and non-profits. Initial and follow up calls were made to 45 churches, 13 public libraries, and 12 civic and environmental organizations. Of all community entities contacted 6 churches, 8 public libraries, and 11 civic and environmental organizations agreed to disseminate a one-page summary to residents and their contacts. The Good Samaritan Ministries organization specifically agreed to help disseminate our 1-pager to 30 additional local churches.

9.3.3 Second Release and Public Comment Period

Due to the significance of the comments received on the initial DIFR-EIS, the TSP was optimized to incorporate additional modeling and evaluation that was performed. Wetland value assessments and Habitat Evaluation Procedures were conducted. Anticipated impacts resulting from the implementation of the proposed plan were further developed including identification of mitigation sites and development of the mitigation plan.

The RDIFR-EIS containing the Optimized TSP was released for a second public comment period beginning 21 July 2023 and ending 6 Sep 2023. The NOA for the second 45-day public comment period was published in the Federal Register (Vol 88 No. 86) on 21 July 2023. Public hearings were held on 15 August and 16 August, 2023 in Slidell and Covington, LA respectively. The release was coordinated with appropriate Congressional, Federal, tribal, state, and local interests, as well as environmental groups and other interested parties.

The Optimized TSP garnered a good deal of attention with the submission of approximately 212 emails and 17 comment cards constituting 767 comments from individual citizens, non-government organizations, city, parish, state, and federal agencies. There were submissions of 4 different form letters with many commenters modifying the standard form letter with their own specific comments. If the same form letter was submitted without changes by multiple respondents, then the comments within the letter was counted as a single comment submitted by the number of individuals that submitted that form letter. If the form letter was modified from the standard format then it counted as a separate comment. Of the 767 comments received, a majority of the individuals expressed opposition to the plan or were skeptical of risk reduction limits of the plan. The top reoccurring themes were plan formulation and support for another alternative, social effects from increased taxes, insurance, emergency services, induced flooding or risk of increased height of flooding for those outside the system. The lack of support was generally in regard to being excluded from the proposed levee system and concerns for increases to their taxes, home and flood insurance.

SECTION 10

District Engineer's Recommendation

I, Cullen A. Jones, District Engineer for the CEMVN, have given consideration to all significant aspects of the RP in the overall public interest, which include but are not limited to, environmental, social, and economic effects; engineering feasibility; public safety and other considerations set forth and addressed in this report. The following is description of the Plan that I am recommending for authorization as a federal project and implementation, which also includes compensatory mitigation. The RP is being recommended with such modifications thereto as in the discretion of the Commander, Headquarters, U.S. Army Corps of Engineers, may be advisable.

The non-federal sponsor is in support of the RP and is in basic agreement with the terms of the model PPA that will be used for the project. The items of local cooperation that shall be the responsibility of the non-federal sponsor are contained in Section 6.4 of this report and are incorporated herein by reference in this, my recommendation. Prior to the implementation of the RP, the non-federal sponsor, shall agree in writing to perform the required items of cooperation.

My recommendations reflect the information available at this time and current USACE policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to Congress as proposals for authorization and implementation funding. However, prior to transmittal to Congress, the non-federal sponsor, interested federal agencies, and other parties will be advised of any significant modifications and will be afforded an opportunity to comment further.

This report has been prepared in accordance with all applicable laws, policies and regulations. In addition, the requirements of the NEPA and all applicable environmental laws and regulations have been complied with throughout the course of this study and in the preparation of the RP and this FIFR-EIS.

The RP (also the National Economic Development Plan) is a comprehensive plan to address flooding parish-wide and includes structural and nonstructural (NS) measures. The measures of the RP were formulated to reduce the risk of flood damages to key infrastructure and structures. The RP would greatly reduce, but not eliminate future damages and residual risk would remain. The structural measures of the RP reduce expected annual damages by approximately 30 percent relative to the without project conditions. The NS component of the RP reduces annual damages by approximately 40 percent relative to the without project condition. The residual risk, along with the potential consequences, has been communicated to the non-federal sponsor and will become a requirement of any communication and evacuation plan.

The structural component of the RP consists of the construction of a 15-mile (97,700 feet) levee and 3.5 mile (18,200 feet) floodwall system (combined levee and floodwall total length of 18.5 miles or 79,500 linear feet) in West and South Slidell (West and South Slidell Levee and Floodwall System) that includes 8 pump stations, 13 culverts/sluice gates/lift gates, 18 vehicular floodgates, 1 pedestrian floodgate, 1 railroad floodgate, and 6 road ramps. The construction of the floodwall and levee system would be based on a 1 percent probability storm level of risk reduction and a 2032 intermediate RSLR condition. The levee alignment would impact approximately 102 acres of staging area and 483 acres of permanent Right-of-way. The levee alignment would require approximately 7,239,000 cubic yards of fill for construction (includes 30 percent contingency). The I-10 road surface would be raised to a construction elevation of 22.0 feet in order to ramp over the new levee and remain above the hydraulic design elevation for year 2082.

The only features of the RP that need borrow material are West and South Slidell levees which will require approximately 7 million cubic yards of material. Borrow material for construction will come from sites estimated to be within no more than 17 miles of the West and South Slidell Levee and Floodwall System. A total of 3,000,000 cubic yards of soil is needed for initial construction and a grand total of 7,239,000 cubic yards is needed over the entire authorized 50-year period to sustain the 1 percent AEP design elevations out to year 2082. All levee and floodwall features (the West and South Slidell Levee and Floodwall System) are based on the design standards developed by USACE for the Hurricane and Storm Damage Risk Reduction System (HSDRRS) design standards for the greater New Orleans area which includes St. Tammany Parish.

Approximately 110 acres of the BBMNWR, generally along the south side of Bayou Bonfouca westward of the Norfolk Southern Railroad tracks, is required from the USFWS for the West and South Slidell Levee and Floodwall System feature of the RP. The USFWS is authorized to exchange property with the NFS. Accordingly, property determined to be suitable and desirable by USFWS in a location where it is authorized to acquire property for the BBMNWR would be identified by USFWS, then the identified property may be acquired by the NFS and exchanged with USFWS for the LERRDs required within the Refuge. The exchange of BBMNWR is authorized under the National Wildlife Refuge System Administration Act administered by the National Wildlife Refuge System. In the case of an exchange, an Exchange Agreement is to be executed between the NFS and USFWS.

The NS component of the RP includes all of St. Tammany Parish and consists of the elevation of approximately 5,583 eligible residential structures to the future 100-year flood stage (not to exceed 13 feet above the existing grade), and the floodproofing of 827 eligible nonresidential structures up to 3 feet above grade. Elevation includes the entire structure or the habitable area of a structure to allow floodwaters to flow and recede underneath. Dry floodproofing consists of a 3 foot flood planking system to reduce damage caused by coastal storm surge inundation by making walls, doors, windows and other openings impermeable and resistant to penetration by water. The dry floodproofing system is composed of gasketed aluminum planks and steel posts which are quickly mountable and watertight. It is erected when flooding is imminent and then easily disassembled and stored, leaving an unobstructed view of the area with no protrusions. The risk evaluation and forecast, plan

selection, and risk reduction design heights are based on the projection of an intermediate rate of relative sea level rise.

Eligible structures must be outside of the area of influence of the structural features recommended in the RP and not be receiving flood risk reduction benefits from the West and South Slidell Levee and Floodwall System in the form of lowering stages). Eligible structures must have a first-floor elevation (FFE) at or below the 25, 50 or 100 -year storm surge floodplain (depending on location within the study area), based on hydrologic conditions predicted to occur in 2032 (the beginning of the 50-year period of analysis). This included consideration of underserved communities as identified by the Justice 40 criteria. In addition, the structure must have a permanent foundation and be permanently immobilized and affixed or anchored to the ground as required by applicable law and must be legally classified as immoveable real property under state law. Notwithstanding the provisions of La. R.S. 9:1149.6, a manufactured, modular or mobile homeowner and any subsequent owner of an immobilized manufactured, modular or mobile home, may not deimmobilize the manufactured, modular or mobile home in the future, by detachment, removal, act of deimmobilization, or any other method. Manufactured, modular and mobile homes that do not meet these requirements are not eligible for elevation. This criteria only applies to residential uses of manufactured, modular, and mobile homes.

The NS elevations and floodproofing are voluntary; property owners who have preliminarily eligible structures that wish to participate in the flood proofing measures would be required to submit an application and provide a right-of-entry to their structure to undergo site assessment, appraisal, and other inspections and evaluations to determine the final eligibility of the structure.

Implementation of the RP would be a cost shared responsibility with the non-federal sponsor that would be conducted in coordination with FEMA, the FHA, and other applicable state and federal resource agencies, to cost effectively reduce flood risk through a series of risk reduction increments that either could be implemented simultaneously, where the entire project is implemented in an expedited manner or implemented sequentially, where measures are implemented on a rolling incremental basis. The NFS supports the implementation of the RP and is in basic agreement with the applicable model PPA that will be signed if the RP is approved and funded.

The NS measures are anticipated to reduce annual damages by approximately 40 percent relative to the without project condition. The NS plan (using 4 percent, 2 percent, and 1 percent AEP) was efficient and incrementally justified because it provided the most net benefits to reduce flood damages. The NS plan also had positive National Economic Development (NED), Regional Economic Development and Other Social Effects benefits and the least Environmental Quality impacts of any alternative in the Final Array of Alternatives.

The RP would reduce flood risk to approximately 26,350 structures and approximately 70,000 residents. The RP will produce an estimated \$145,331,000 in net benefits, has a benefit to cost ratio of 1.6, and is consistent with USACE policies, laws, and regulations. The

RP will decrease annual damages from \$537,780,000 (without-out project condition) to \$165,289,000 under the “with project” condition. Approximately 20 percent of the NED benefits provided by the RP would accrue to disadvantaged communities (Justice 40 Initiative). The construction of the West and South Slidell Levee and Floodwall System and related components would occur from 2025-2076. Additional levee lifts would occur three times post initial construction at 5-7 years, 15-20 years, and 30 years. The construction of the NS component would be implemented over a period of 12 years from 2025-2037. Upon completion of construction of the project, or functional portions thereof, the NFS would be fully responsible for Operation, Maintenance Repair, Replacement, and Rehabilitation. The non-federal sponsor will be 100 percent responsible for the OMRR&R. For the NS component of the plan, these responsibilities include inspection of the elevations and floodproofing measures on properties to ensure compliance with the restrictions provided within the non-standard estate(s) to be acquired by the non-federal sponsor for continued effectiveness of the measures. The total average OMRR&R annual cost is currently estimated at \$7,753,000.

The estimated total Project First Cost for the RP is \$5,894,229.00 at an October 2023 (FY 24) price level. The Project First Cost (Current Price Level) is the cost estimate that will serve as the basis for providing the cost of the project for which authorization is sought. The fully funded total project cost includes a contingency developed utilizing the Cost and Schedule Risk Analysis, and computed contingency for the overall project as 46 percent, with a 51 percent computed contingency for the structural component (West and South Slidell Levee and Floodwall System) and 43 percent computed contingency for the NS. The cost contingencies reflect an 80 percent confidence level in estimated fully funded total project cost and are intended to cover potential cost and schedule increases associated with identified project risks and their probability of occurrence.

The total estimated Project First Cost for the Structural measure (West and South Slidell Levee and Floodwall System) is \$2,882,000. The construction of the levee and floodwall system will impact an estimated 290 private landowners and the NS measures will impact 6,410 private landowners. The total estimated real estate cost for the West and South Slidell Levee and Floodwall System, including contingencies, borrow sites and environmental mitigation costs, is estimated as \$81,476,000.

The total estimated Project First Cost for the NS measures is \$3,012,488,000 which includes \$1,832,345,000 for implementation of residential structure elevation measures (for 5583 eligible residential structures at \$95 per square foot and \$2,295,896,000 for implementation of the dry floodproofing measures for 827 eligible nonresidential structures at approximately \$29-\$80 per square foot (dependent on the square footage of the nonresidential structure). The total estimated real estate cost for NS measures, including contingencies is \$170,764,000.

The RP includes a compensatory Mitigation Plan to mitigate for habitat losses that will result with the implementation of the RP. The Mitigation Plan consists of a combination of mitigation bank credit purchases and marsh restoration and pine savanna (refuge) mitigation projects to be constructed by USACE either before or concurrent with the construction of the

RP. The total costs of mitigation for the RP is \$ 39,973,512, which is included in the estimated Total Project First Costs. See Appendix I: Mitigation Plan.

The RP will not reduce all flood risk within St Tammany Parish, but rather is intended to provide benefits in concert with other ongoing efforts, programs and projects by other federal agencies, state and local government and community efforts. The residual risk, along with the potential consequences, has been communicated to the NFS and will become a requirement of any communication and evacuation plan. The full engineering project description and assumptions for the Structural Plan are included in Appendix D: Engineering. The NS Plan is further described in Appendix F: Economics and Appendix H: NS Implementation Plan.

CULLEN A. JONES, P.E., PMP
COL, EN
District Commander

SECTION 11

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11.1 DISTRIBUTION OF THE FIFR-EIS

Electronic copies of the Notice of Availability of the FIFR-EIS were sent to Federal, state, and local agencies, federally recognized Tribal Nations, newspapers, NGOs, and other interested parties (See Section 9). An electronic file of the complete distribution list is available by request.

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List of Acronyms and Abbreviations

AAHU	Average Annual Habitat Unit
ACHP	Advisory Council on Historic Preservation
ACS	American Community Survey
ACTT	Alabama-Coushatta Tribe of Texas
ADCIRC	Advanced Circulation Model
AEP	Annual Exceedance Probability
AMM	Alternatives Milestone Meeting
APE	Area of Potential Effects
AQCR	Air Quality Control Region
ASA(CW)	Assistant Secretary of the Army for Civil Works
ASCII	American Standard Code for Information Exchange
ASTM	American Society for Testing Materials
BBA	Bipartisan Budget Act
BCR	Benefit to Cost Ratio
BGEPA	Bald and Golden Eagle Protection Act
BMP	Best Management Practice
BBNWR	Big Branch National Wildlife Refuge
BLH	Bottomland Hardwood
CAA	Clean Air Act
CAR	Coordination Act Report
CDP	Census Designated Place
CEMVN	USACE New Orleans District
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFS	Cubic Feet Per Second
CNO	Choctaw Nation of Oklahoma
CO	Carbon Monoxide
CPRA	Coastal Protection and Restoration Authority
CPRAB	Coastal Protection and Restoration Authority Board
CSRM	Coastal Storm Risk Management
CSRA	Cost Schedule Risk Analysis
CT	Coushatta Tribe of Louisiana
CWA	Clean Water Act
DEIS	Draft Environmental Impact Statement
DIFR	Draft Integrated Feasibility Report
EAD	Estimated Annual Damages
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement

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EJ	Environmental Justice
EO	Executive Order
EPA	Environmental Protection Agency
EQ	Environmental Quality
ER	Engineer Regulation
ESA	Endangered Species Act
FCSA	Federal Cost Share Agreement
FDR	Federal Discount Rate
FEIS	Final Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FIFR	Final Integrated Feasibility Report
FLOAT	Flood Loss Outreach and Awareness Taskforce
FRM	Flood Risk Management
FWCA	Fish and Wildlife Coordination Act
FWCAR	Fish and Wildlife Coordination Act Report
FWS	Fish and Wildlife Services
FWOP	Future With Out Project
GIS	Geographic Information System
GOMESA	Gulf of Mexico Energy Security Act
H&H	Hydraulics and Hydrology
HEC-FDA	The Flood Damage Reduction Analysis
HEC-RAS	Hydrologic Engineering Center- River Analysis System
HMGP	Hazard Mitigation Grant Program
HSDRRS	Hurricane & Storm Damage Risk Reduction System
HTRW	Hazardous, Toxic, and Radioactive Waste
HQUSACE	Headquarters United States Army Corps of Engineers
IER	Individual Environmental Report
IFR	Integrated Feasibility Report
IR	Integrated Report
IUCN	International Union for Conservation of Nature
JBCI	Jena Band of Choctaw Indians
LACPR	Louisiana Coastal Protection and Restoration
LADOTD	Louisiana Department of Transportation and Development
LDEQ	Louisiana Department of Environmental Quality
LDNR	Louisiana Department of Natural Resources
LDOA	Louisiana Division of Archaeology
LDRIPs	Long Term Disaster Recovery Investment Plans
LDWF	Louisiana Department of Wildlife and Fisheries
LERRD	Lands, Easements, Rights-of-way, Relocations and Disposal Areas
LIDAR	Light Detection and Ranging
LPP	Locally Preferred Plan

LSRA	Louisiana Scenic Rivers Act
LWCF	Land and Water Conservation Fund
LWFMP	Louisiana Statewide Comprehensive Water Based Floodplain Management Program
MAV	Mississippi Alluvial Valley
MBCI	Mississippi Band of Choctaw Indians
MBTA	Migratory Bird Treaty Act
MCACES	Micro-Computer Aided Cost Estimating System
MDAH	Mississippi Division of Archives and History
MSA	Metropolitan Statistical Area
MSC	Major Subordinate Command
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
MSL	Mean Sea Level
MVD	Mississippi Valley Division
NAAQS	National Ambient Air Quality Standards
NAWMP	North American Waterfowl Management Plan
NB	Nature Based
NBEM	National Bald Eagle Management
NCDC	National Climatic Data Center
NED	National Economic Development
NEPA	National Environmental Policy Act
NFS	Non- Federal Sponsor
NGVD	National Geographic Vertical Datum
NHL	National Historic Landmarks
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NLAA	Not Likely to Adversely Affect
NO2	Nitrogen Dioxide
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPS	National Park Service
NRCS	Natural Resource Conservation Service
NRHD	National Register of Historic District
NRHP	National Register of Historic Places
NS	Nonstructural
O&M	Operation and Maintenance
OCD	Office of Community of Development
OMRR&R	Operations, Maintenance, Repair, Rehabilitation, and Replacement
OSE	Other Social Effects
O3	Ozone
PA	Public Assistance
PA	Programmatic Agreement

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Pb	Lead
PPA	Project Partnership Agreement
PBF	Physical Biological Features
P&G	Principles and Guidelines
PED	Pre-Construction Engineering and Design
PDT	Project Delivery Team
Phase 1 ESA	Phase 1 Environmental Site Assessment
PM	Particulate Matter
PMP	Project Management Plan
PPA	Project Partnership Agreement
PPT	Parts Per Thousand
RCRA	Resource Conservation and Recovery Sites
REC	Recognized Environmental Condition
RED	Regional Economic Development
REP	Real Estate Plan
ROD	Record of Decision
RMP	Risk Management Plan
ROE	Right of Entry
ROM	Rough Order of Magnitude
ROW	Right Of Way
RP	Recommended Plan
RPEDS	Regional Planning and Environment Division South
RSLC	Relative Sea Level Change
RSLR	Relative Sea Level Rise
S	Structural
SELA	Southeast Louisiana Urban Flood Control Project
SHPO	State Historic Preservation Officer
SLC	Sea Level Change
SMART	Specific Measurable Attainable Risk Informed Timely
SO2	Sulfur Dioxide
STLDCCD	St. Tammany Levee, Drainage and Conservation District
STPG	St. Tammany Parish Government
SWPPP	Stormwater Pollution Prevention Plan
T&E	Threatened and Endangered
TBTL	Tunica-Biloxi Tribe of Louisiana
TCP	Traditional Cultural Property
TIF	Tag Image File Format
TRI	Toxic Release Inventory
TSCA	Toxic Substances Control Act
TSP	Tentatively Selected Plan
URA	Uniform Relocation Assistance Act

USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VOC	Volatile Organic Compound
VRAP	Visual Resources Assessment Procedure
WBDHU12	U.S. Geological Survey Watershed Boundary Dataset Hydrologic Unit 12
WIIN	Water Infrastructure Improvement Act for the Nation
WSE	Water Surface Elevation
WMA	Wildlife Management Area
WQC	Water Quality Certification
WRDA	Water Resources Development Act
WRRDA	Water Resources Reform and Development Act
WVA	Wetland Value Assessment