Draft Fish and Wildlife Coordination Act Report
For the
ST. TAMMANY PARISH, LOUISIANA FEASIBILITY STUDY

SUBMITTED TO
NEW ORLEANS DISTRICT
U.S. ARMY CORPS OF ENGINEERS
AND
COASTAL PROTECTION AND RESTORATION AUTHORITY
OF LOUISIANA

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EXECUTIVE SUMMARY

The U.S. Army Corps of Engineers (USACE) and the Coastal Protection and Restoration Authority of Louisiana (CPRA) are proposing to construct, operate, and maintain the proposed St. Tammany Parish, Louisiana, project. This study investigates flood risk management (FRM) and coastal storm risk management (CSRM) solutions to reduce flood damages caused by rainfall and coastal storm flooding in St. Tammany Parish.

The St. Tammany Parish Feasibility Study (STP FS) 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 (P.L. 114-322). The Study was 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 of 2014 (33 U.S.C. 2282d). The Study was funded by the Bipartisan Budget Act of 2018 (P.L. 115-123), Division B, Subdivision 1, Title IV, (BBA 2018) 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. The study was authorized for inclusion as a BBA 2018 study in September 2019.

This report contains a description of existing fish and wildlife resources in the project area, discusses the future with the Tentatively Selected Plan (TSP) and the future with the No Action Alternative (NAA, or sometimes referred to as Future Without Project [FWOP]) habitat conditions, identifies fish and wildlife-related impacts, and provides recommendations to improve the proposed project. This document does not constitute the report of the Secretary of the Interior as required by Section 2(b) of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.). The Fish and Wildlife Service (Service) has coordinated with the National Marine Fisheries Service (NMFS) and the Louisiana Department of Wildlife and Fisheries (LDWF). Their comments are incorporated into the draft report.

As currently described, the TSP consists of:

• **Nonstructural Elevations and Flood Proofing**

Approximately 5,800 eligible residential structures would be elevated. The entire foundation of the structure will be lifted and placed on a new foundation (i.e., columns, piers, posted or raised foundation walls) so that the lowest habitable finished floor is above 13 feet North American Vertical Datum of 1988 (NAVD88). All utilities and mechanical equipment, such as air conditioners and hot water heaters, will also be raised to this elevation.

Additionally, 884 eligible nonresidential structures would be flood-proofed up to 3 feet. Dry flood-proofing consists of sealing all areas of a structure up to a maximum of approximately 3 feet above ground level to reduce damage caused by coastal storm surge inundation by making walls, doors, windows, and other openings resistant to penetration by water. Walls are coated with sealants, water-proofing compounds, or plastic sheeting. 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.

• South Slidell and West Slidell and Floodwall System

The levee and floodwall system would consist of a total of approximately 18.5 miles (97,700 ft) of earthen levee and floodwall which includes approximately 15 miles (79,500 ft) of levees constructed in separate (non-continuous) segments, and 3.5 miles (18,200 ft) of separate (non-continuous) segments of a floodwall. Construction of the levee alignment would impact approximately 521 acres of permanent right-of-way (ROW) and it would require approximately 7,079,000 cubic yards of fill, including fill material required for future levee lifts (estimates include a 30 percent contingency). There would be five pump stations and five floodgates.

• Floodgates

The TSP would include a total of 13 gates. Three gates would be lift gates and one gate would be a sector gate. These gates would allow navigation of recreational vessels. There are nine sluice gates which would be control structures (non-navigable).

• Vehicular, Pedestrian and Railroad Gates

The proposed project includes eighteen vehicular gates, one pedestrian gate, and one railroad gate along the Norfolk Southern Railroad.

• Pump Stations

The TSP would include a total of eight pump stations. These pump stations are divided into large pumping capacity and small pumping capacity. In West Slidell there would be two pump stations with large pumping capacity and two pump stations with small pumping capacity. In South Slidell there would be four pump stations with small pumping capacity.

• Ramps

The TSP would include the construction of six ramps, which would include the Interstate Highway (I-10) ramp in the vicinity of Oak Harbor and the ramp in the Western High Ground Tie-In. The I-10 road surface would be raised to construction elevation of 21.5 ft to extend over the new levee section and stay above the hydraulic design elevation for year 2082, as well as to ensure the entire pavement section remains above the hydraulic design elevation across the interstate. All ramps would be constructed during initial construction except for the ramp in the Western High Ground Tie-In which would be constructed during the fourth levee lift of West Slidell in year 2076.

• Access Routes and Staging Areas

The staging areas required during initial construction of the levee alignment would be the same staging areas required for construction of future levee lifts. For Real Estate purposes, the staging areas were included in the permanent ROW. For floodwall segments, staging areas would be

included in the 80-ft wide permanent ROW. Except for the utility corridor on South Slidell, in the vicinity of Northshore Drive, there would be a 0.5 acre staging area outside of the 80-ft wide corridor.

• Mile Branch Channel Improvements

The Mile Branch channel improvements start at the intersection of Mile Branch and Highway 190, cross Highway 190 Business, and end at the intersection of Mile Branch and the Tchefuncte River. The channel improvements would be conducted on the lower 2.15 miles (11,341 feet channel) of Mile Branch in Covington. 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 ft 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.

• Borrow Areas

The construction of the TSP is estimated to require approximately 1.5 million cubic yards of fill or borrow material. The only features of the TSP that require borrow material are the South and West Slidell Combined Levee and floodwalls. Feasibility level borrow site investigations were conducted to confirm there are available borrow quantities within the vicinity to support the TSP decision and evaluate the anticipated impacts associated with the potential borrow sites. A total of 34 potential sites were identified in the vicinity of the TSP and evaluated and narrowed down to three potential borrow sites within St. Tammany Parish and two additional sites in Mississippi.

Coastal marshes, pine savannah, and riparian habitats are considered by the Service to be resources of national importance due to their increasing scarcity and high habitat value for fish and wildlife within Federal trusteeship (i.e., migratory waterfowl, wading birds, other migratory birds, threatened and endangered species, and interjurisdictional fisheries).

Construction and related activities for the St. Tammany Parish, Louisiana, project will result in the direct loss of approximately 146.5 acres (-9.7 red-cockaded woodpecker [RCW] Average Annual Habitat Unit [AAHUs], -45.0 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. Indirect impacts are anticipated to be 3.3 acres (-6.6 RCW AAHUs; -13.8 pine warbler AAHUs) of pine savannah. Said another way, there will be 221.3 acres (-70.9 AAHUs; -9.7 RCW AAHUs; and -45.0 pine warbler AAHUs) of unavoidable adverse direct (levee and structure footprints) construction impacts. Indirect (interior and exterior wetlands) impacts that would reduce the habitat quality of 3.3 acres (-6.6 RCW AAHUs; -13.8 pine warbler AAHUs) of pine savannah habitat associated with levee construction, resulting in a total (direct and indirect impacts) of 224.6 acres and -70.9 AAHUs, -16.3 RCW AAHUs and -58.8 pine warbler AAHUs of project area habitats.

Of the total losses, there are direct losses on Big Branch Marsh National Wildlife Refuge (BBMNWR) of approximately 1.2 acres (-9.7 RCW AAHUs; -2.5 pine warbler AAHUs) of pine savannah and 28.8 acres (-33.1 AAHUs) of fresh/intermediate marsh and indirect impacts to 0.25 acre (-6.6 RCW AAHUs; -1.7 pine warbler AAHUs) of pine savannah. Total direct loss to BBMNWR is 30.0 acres (-33.1 AAHUs; -9.7 RCW AAHUs; -2.5 pine warbler AAHUs) of pine savannah and fresh/intermediate marsh habitats and the indirect impacts to 0.25 acre (-6.6 RCW AAHUs; -1.7 pine warbler AAHUs) of pine savannah habitat. The total direct and indirect impacts for pine savannah and fresh/intermediate marsh on BBMNWR is 30.3 acres and -33.1 AAHUs, -16.3 RCW AAHUs and -4.2 pine warbler AAHUs.

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.
2. Indirect impacts to pine savannah habitat (-6.62 AAHUs) on the BBMNWR are required to be mitigated for on refuge lands.
3. Species of vegetation, planted and maintained on levees or levee slopes, should be closely coordinated with the Service.
4. All project related activities on the refuge must be coordinated with Refuge Project Leader Neil Lalonde (985-882-2000).
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.
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.
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 to enhance organism passage. Various ramp designs should be considered. Please coordinate with the National Marine Fisheries Service (NMFS), Alexis Rixner (alexis.rixner@noaa.gov) on this issue.
8. To offset fish and wildlife impacts to the Mile Branch stream bottom, the Service recommends the USACE develop a backwater area project feature to account for stream bottom impacts as proposed during the planning phase of the STP FS.

9. To minimize impacts to Mile Branch, the USACE should assess whether the existing culverts are of sufficient size to allow for adequate drainage or if larger size culverts are needed. If larger culverts are being installed, the USACE should assess whether these larger structures would preclude the need to widen and deepen the channel. In addition, the USACE should assess whether debris build-up at bridges and/or culverts is blocking/limiting conveyance of floodwaters. If obstructions in the waterway are present and removal would allow for adequate flow during flood events, then the less damaging snagging and clearing should be conducted in place of widening and deepening the canal. Should snagging and clearing be included as a feature of the project, those activities should follow the techniques described within the Stream Obstruction Removal Guidelines (Appendix 1) or nature-based engineering techniques should be used to accomplish the work in the least damaging manner possible.
10. Mile Branch and Bayou Liberty are each a Louisiana designated Natural and Scenic River. LDWF should review the projects affecting each stream and determine if a Scenic River Permit will be required. The USACE shall initiate consultation with the LDWF Scenic Rivers Program prior to conducting any activities within or adjacent to the banks of either stream. Scenic Rivers Coordinator Chris Davis can be contacted at (225)765-2642.
11. 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.
12. The Service recommends the development of a Pine Savannah Community Model and a Stream/Riparian Community Model, including Ecosystem Restoration Planning Center of Expertise (ECO-PCX) approval. These tools will be used for evaluating mitigation credits and refining project impacts during later project phases. The

Service is currently using FWS Habitat Evaluation Procedures (HEP) for pine savannah habitat evaluations and bottomland hardwood WVAs because there are no user-friendly ECO-PCX approved evaluation tools for pine savannah and stream/riparian habitats. These more appropriate tools would be community models based on the habitat's ecology and important indicator species. Without these models, the analysis of impacts and mitigation may be inaccurately estimated.

13. 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 will 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.
14. 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 (March 1 to July 31).
15. 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.
16. If it becomes necessary to use borrow sources other than the previously proposed environmentally cleared sites, the Service recommends the 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.
17. 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.
18. 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., September 1 through February 15).
19. West Indian manatees occasionally enter Lakes Pontchartrain and Maurepas and associated coastal waters and streams during the summer months (i.e., June 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.

20. 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 dragonhead, alligator snapping turtle, Eastern diamondback rattlesnake, and Pearl River map turtle.
21. A Biological Assessment should be prepared to identify potential direct and indirect impacts to federally listed threatened and endangered species that occur within the project impact area. Those species include the West Indian manatee, Gulf sturgeon, gopher tortoise, and red-cockaded woodpecker. The USACE should determine if the potential impacts identified would "likely (or not likely) adversely affect" those species.
22. 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.

We appreciate the cooperation of your staff on this project and look forward to our continued coordination to further protect fish and wildlife resources. Provided that the above recommendations are included in the project report and related authorizing documents, the Service does not object to the construction and implementation of the St. Tammany Parish, Louisiana project. If you need additional assistance or have questions regarding this report, please contact Karen Soileau (337/291-3132) of this office.

INTRODUCTION

The U.S. Fish and Wildlife Service (Service) has prepared a draft Fish and Wildlife Coordination Act Report on the U.S. Army Corps of Engineers' (USACE) St. Tammany Parish, Louisiana Feasibility Study (STP FS or Study). The non-federal sponsor (NFS) for the Study is the Coastal Protection and Restoration Authority (CPRA) of Louisiana. The objectives of this Study are to evaluate the feasibility of reducing the severity of flood damages caused by heavy rainfall, riverine flooding, and tropical storms and hurricanes for communities located within St. Tammany Parish, Louisiana.

The STP FS 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 (P.L. 114-322). The Study was 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 of 2014 (33 U.S.C. 2282d). The Study was funded by the Bipartisan Budget Act of 2018 (P.L. 115-123), Division B, Subdivision 1, Title IV, (BBA 2018) 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. The study was authorized for inclusion as a BBA 2018 study in September 2019.

This draft report contains a description of existing fish and wildlife resources in the project area; discusses the future with the Tentatively Selected Plan (TSP) and the future with the No Action Alternative (NAA; or sometimes referred to as the Future Without Project [FWOP]) habitat conditions; identifies fish and wildlife-related impacts; and provides recommendations to improve the proposed project. This document does not constitute the report of the Secretary of the Interior as required by Section 2(b) of the Fish and Wildlife Coordination Act (FWCA)(48 Stat. 401, as amended; 16 U.S.C. 661 et seq.). The Service has coordinated with the National Marine Fisheries Service (NMFS) and the LDWF. Their comments are incorporated into this draft report.

DESCRIPTION OF THE STUDY AND PROJECT AREAS

The study area encompasses all of St. Tammany Parish, which is approximately 1,124 square miles and located in southeastern Louisiana. The study 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 Pearl River runs along the Mississippi-Louisiana state border and is the eastern boundary of the study area. Lake Pontchartrain, one of the largest estuaries in the United States (U.S.), serves as the southern border. Tangipahoa Parish is located along the western boundary, and Washington Parish is located to the north. The study area includes 36 sub-basins, as defined by the U.S. Geological Survey (USGS) 12-digit hydrologic unit delineations (Figure 1).

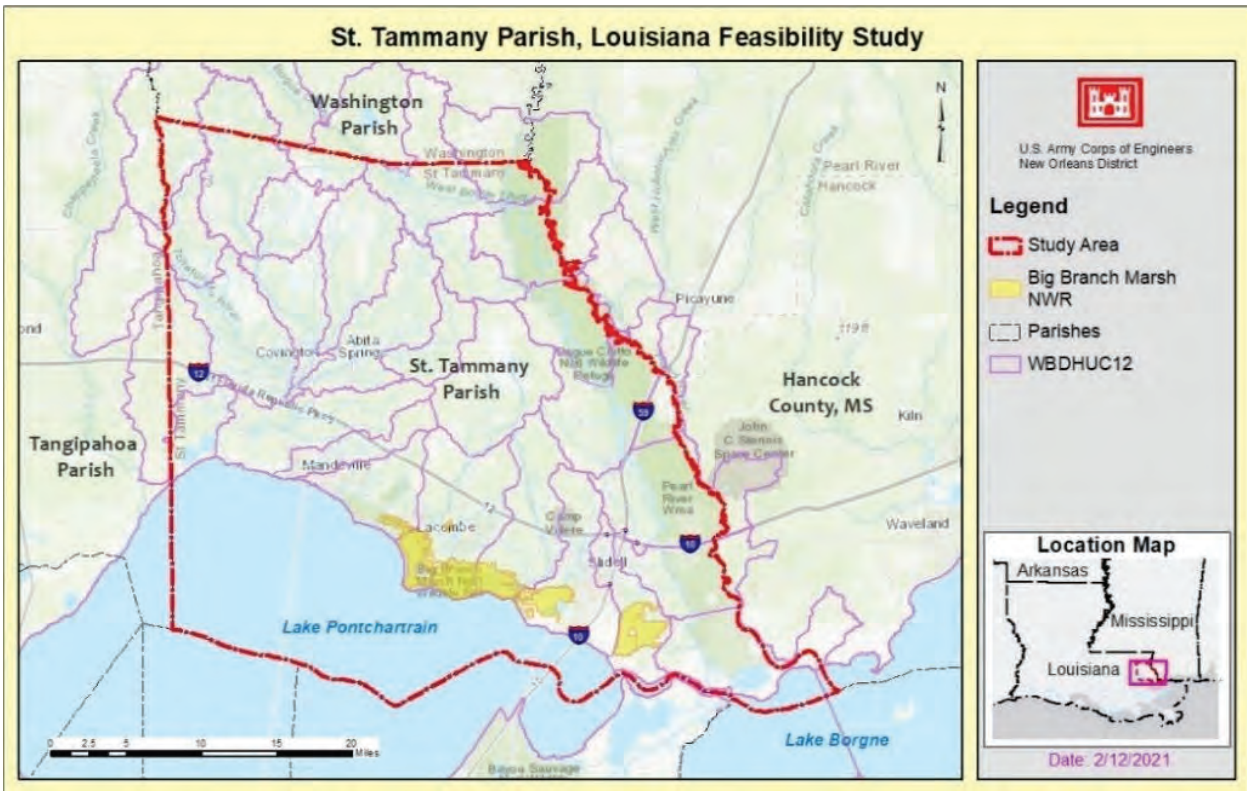

Figure 1. STP FS Study Area and Hydrologic Units

Figure 2 highlights the 18 hydrologic units in the parish with documented flooding, whether from coastal or riverine, and repetitive flood loss. These 18 areas comprise the project area. Table 1 identifies the 18 hydrologic units and describes the type of flooding associated with each. The project area is the area where the measures and alternatives for the study were located.

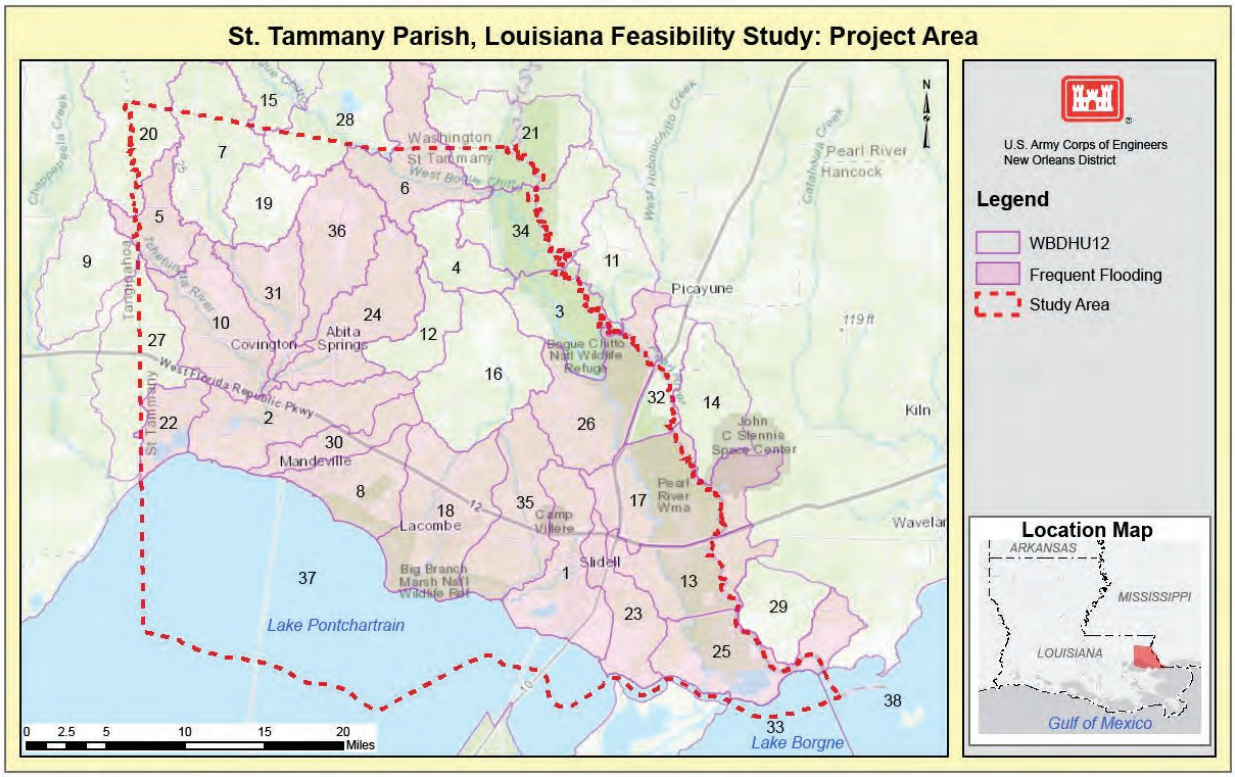

Figure 2. Hydrologic Units with Frequent Flooding

	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

Table 1. STP FS Project Area Hydrologic Sub-basins

The project area is located within the Lake Pontchartrain Basin (LPB) of southeast Louisiana (Figure 3) and encompasses the flood-prone sections of the Slidell vicinity, in St. Tammany Parish, Louisiana.

Figure 3. Lake Pontchartrain Basin Image Credit: USGS

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 4).

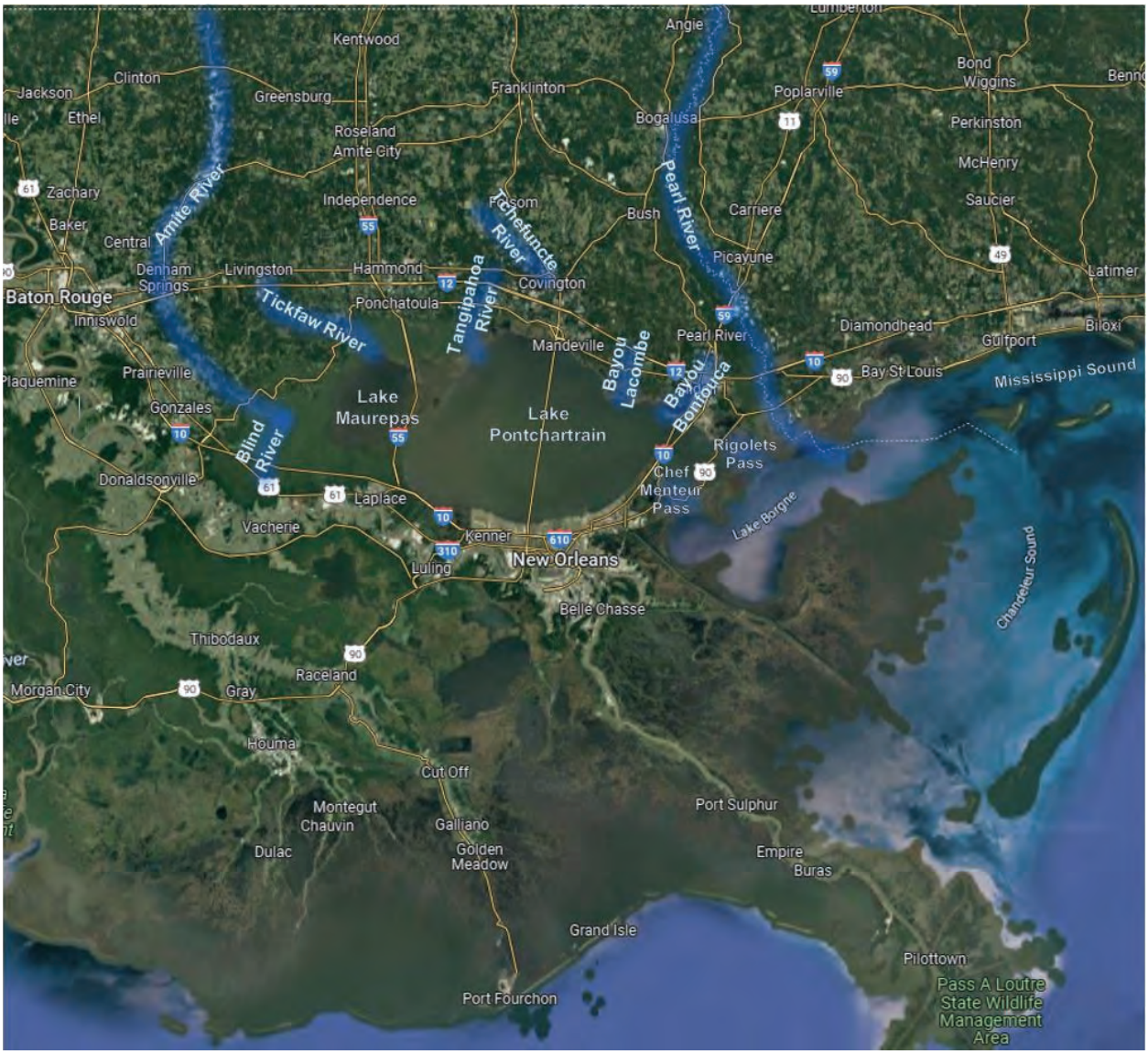

Figure 4. Major Rivers and Bayous Within the Study Area

The LPB can be divided into three distinct geomorphic regions. First is the Pleistocene Terraces Region that lies north of Lakes Maurepas, Pontchartrain, and Borgne. To the south of these lakes lies the Mississippi River Deltaic Plain Region. Separating these two geomorphic regions, Lakes Maurepas, Pontchartrain, and Borgne represent the Marginal Deltaic Basin Region where fresh water from coastal plain rivers and salt water of the Gulf of Mexico mix, creating an estuary with a decreasing salinity gradient from east to west through the Basin. Included in this Region are the wetlands surrounding the lakes. Features analyzed in the STP FS occur in the Pleistocene Terrace Region and the Marginal Deltaic Basin Region.

Each of the three geomorphic regions can be further subdivided into areas with distinct habitat characteristics, plant communities, and assemblages of fauna (Figure 5).

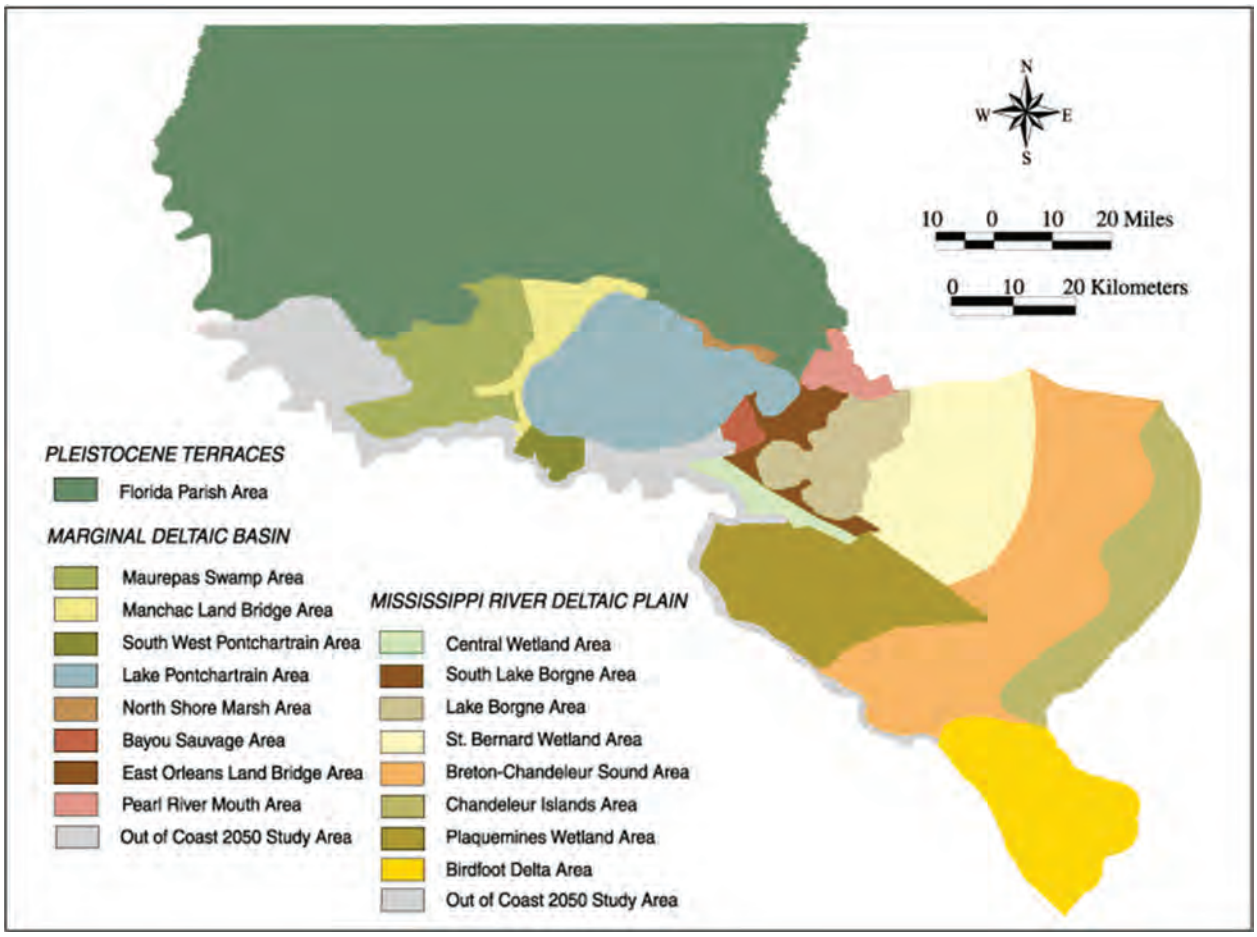

Figure 5. Areas within the geomorphic regions of the Pleistocene Terraces, Marginal Deltaic Basin, and Mississippi River Deltaic Plain (source: www.coast2050.gov)

The Pleistocene Terraces region (Florida Parish Area) is characterized by its underlying geology of Pleistocene and older sediments, which form terraces of decreasing elevation from north to south. The Pleistocene Terraces region has a distinct relief created by the stream valleys that cut into the underlying sands, gravels, and clays.

The Marginal Deltaic Basin may be defined as the northern margin of the Mississippi River Deltaic Plain and the lowlands surrounding Lakes Pontchartrain and Maurepas. It comprises mostly estuarine marshes and forested wetlands of the north, south, east, and west shores of Lakes Pontchartrain and Maurepas. Within the Marginal Deltaic Basin are some of the largest remaining tracts of forested wetlands in the Lower Mississippi River Valley and, as such, they provide habitat for an abundance of wildlife. The Marginal Deltaic Basin region lies within the coastal zone of Louisiana, and therefore, is influenced by many of the same stressors as other regions of the coast, including wetland loss, subsidence, saltwater intrusion, and shoreline erosion.

The North Shore Marsh Area (NSMA) within the Marginal Deltaic Basin comprises 14,257 acres of intermediate and brackish marsh with a small amount of bottomland hardwood forest stretching along the northern shoreline of Lake Pontchartrain between Fontainebleau State Park and the Eden Isles development in St. Tammany Parish. The waterways draining this area include Bayous Castine, Cane, Lacombe, and Liberty.

The above information was taken from (and additional information regarding these geomorphic regions can be found on) the U.S. Geological Survey's Environmental Atlas of the Lake Pontchartrain Basin..

The project features are located north of Lake Pontchartrain where the primary influence is freshwater from local rivers and bayous as well as saltier tidal influence coming from Lake Pontchartrain. Saline water enters Lake Pontchartrain through the Rigolets which is an outlet to Lake Borgne and Chandeleur Sound. Previously there were additional openings that were closed to help prevent saltwater intrusion and storm surge. These included the Mississippi River Gulf Outlet (MRGO), closed in 2009; the Inner Harbor Navigation Canal-Lake Borgne Surge Barrier (surge barrier), closed in 2010; and the Seabrook floodgate complex, completed in 2012. Since these closures, average salinities and salinity spikes have been reduced in the Pontchartrain basin and the project area. Salinities seemed to have leveled out by 2014.

PROPOSED ACTION

St. Tammany Parish is the fastest-growing parish in Louisiana and one of the fastest-growing areas in the nation. The study area consists of the entire parish including but not limited to, the communities of Slidell, Mandeville, Covington, Abita Springs, Lacombe, and Madisonville. The Bogue Chitto and Pearl River have the biggest flooding impacts to communities in the eastern and northeastern portion of the parish. Critical infrastructure in the parish includes numerous hospitals, schools, and local government facilities. Interstate Highways 10 and 12 (I-10 and I-12, respectively) 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 City of Mandeville directly with the greater New Orleans area in Metairie (Jefferson Parish). The study 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. Most of the population resides along the edge of Lake Pontchartrain, and many residents commute into New Orleans from Mandeville, Slidell, Covington, Abita Springs, Pearl River, and Madisonville.

The plan formulation process for this study identified potential solutions to rainfall, riverine, and coastal storm related flooding across St. Tammany Parish. The study area has discrete hydrologic sub-basins, which allowed for measures and alternatives to be developed for each of these areas independently. Throughout the study, measures within the alternatives were independently evaluated and screened so that the justified measures to address flooding in each area could be identified. Measures and alternatives from one geographic area were not compared to measures or alternatives from other areas of the parish that address a different flooding source. The measures that were determined to be incrementally justified from the Final Array of Alternatives were combined to form the TSP. The TSP is a comprehensive plan to address flooding parish-wide, which includes Coastal Storm Risk Management, Flood Risk Management, and nonstructural measures (Figure 6).

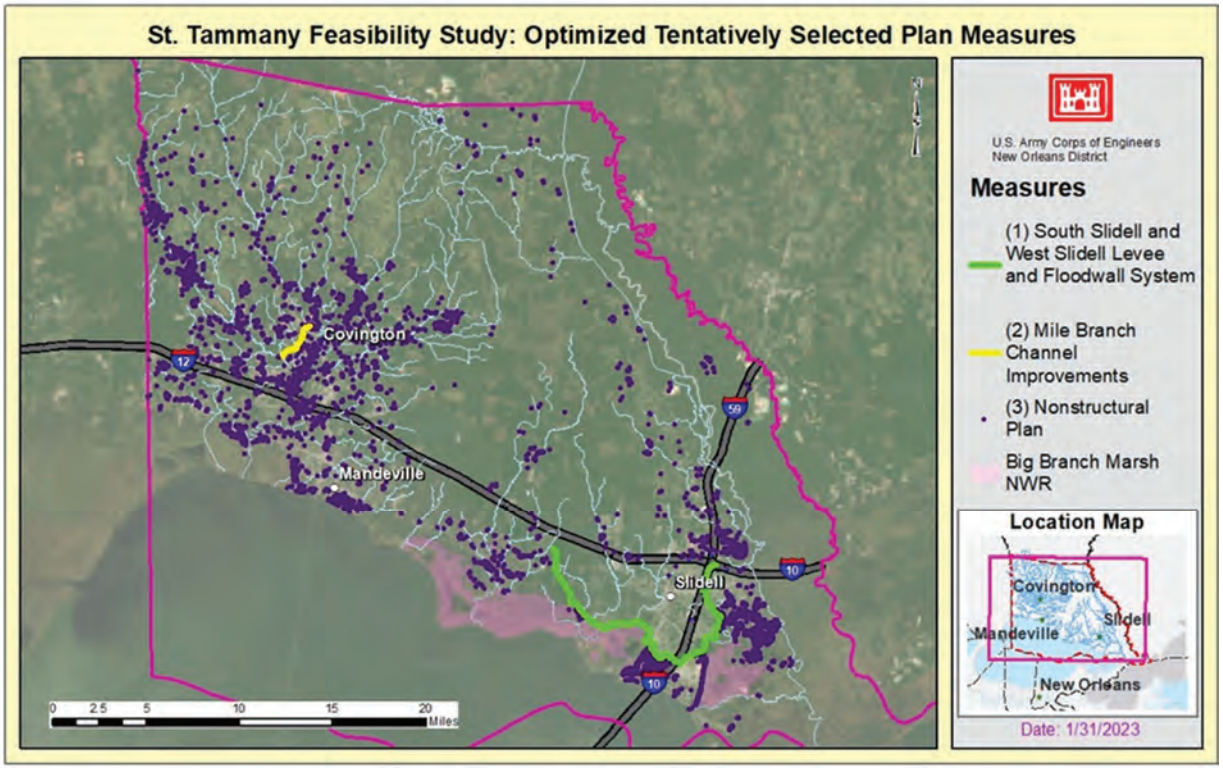

Figure 6. Tentatively Selected Plan

The TSP includes:

• **Nonstructural Elevations and Flood Proofing**

Approximately 5,800 eligible residential structures would be elevated. The entire foundation of the structure would be lifted and placed on a new foundation (i.e., columns, piers, posted or raised foundation walls) so that the lowest habitable finished floor is above 13 feet North American Vertical Datum of 1988 (NAVD88). All utilities and mechanical equipment, such as air conditioners and hot water heaters, will also be raised to this elevation.

Additionally, 884 eligible nonresidential structures would be flood-proofed up to 3 feet. Dry flood-proofing consists of sealing all areas of a structure up to a maximum of approximately 3 feet above ground level to reduce damage caused by coastal storm surge inundation by making walls, doors, windows, and other openings resistant to penetration by water. Walls are coated with sealants, water-proofing compounds, or plastic sheeting. 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.

To be considered preliminarily eligible for participation, a structure must meet the following criteria:

- structure must be economically justified meaning that the cost of the flood-proofing measure for the structure must not cost more than the total monetary value of the flood damages anticipated to be avoided over the 50-year period of analysis;

- have a first-floor elevation (FFE) at or below the 25, 50, or 100 -year storm surge floodplain, based on hydrologic conditions predicted to occur in 2032 for the sub aggregate the structure is included in (the beginning of the 50-year period of analysis); and,

- structure must be outside of the area of influence of the structural features recommended in the TSP and not receiving flood risk reduction benefits from the structural features (i.e., outside of the area of influence of the West Slidell, South Slidell Levees, and Mile Branch Channel Improvements).

The nonstructural elevations and floodproofing are voluntary. Property owners who have preliminarily eligible structures that wish to participate in the flood proofing measures will be required to 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.

• **South and West Slidell Combined Levee and Floodwall System**

The levee and floodwall system would consist of a total of approximately 18.5 miles (97,700 ft) of earthen levee and floodwall which includes approximately 15 miles (79,100 ft) of levees constructed in separate (non-continuous) segments, and 3.5 miles (18,200 ft) of separate (non-continuous) segments of a floodwall (Figures 7 and 8). Construction of the levee alignment would impact approximately 521 acres of permanent ROW and it would require approximately 7,079,000 cubic yards of fill, including fill material required for future levee lifts (estimates include a 30 percent contingency).

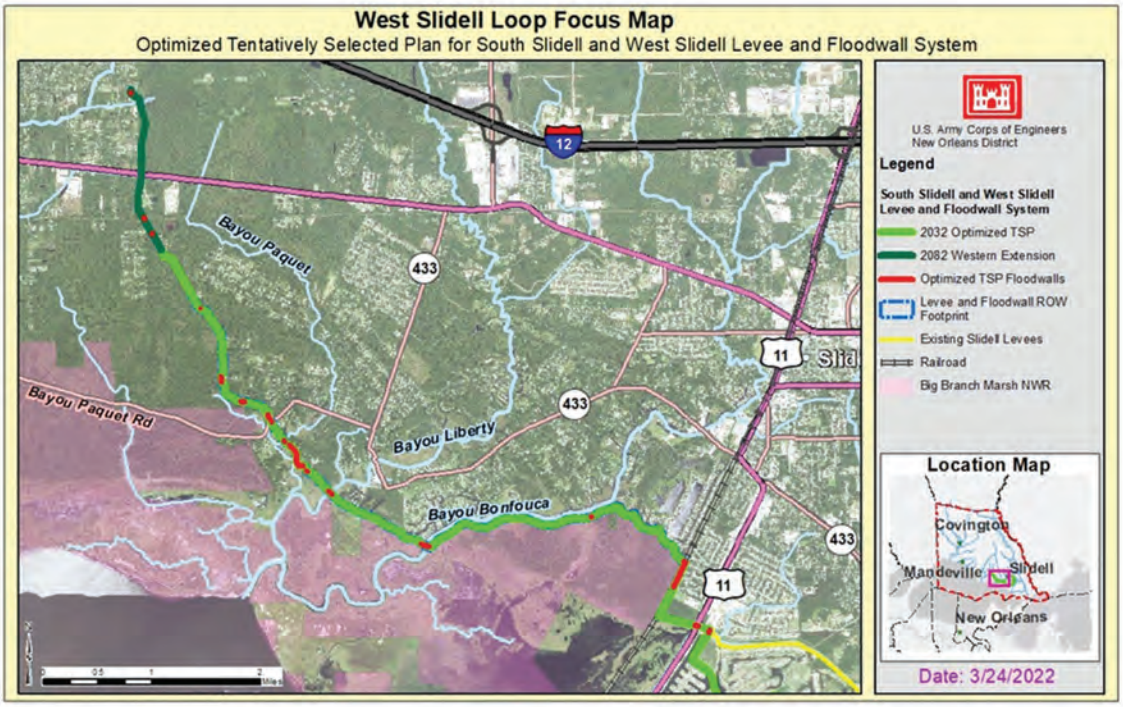

Figure 7. West Slidell Levee and Floodwall System

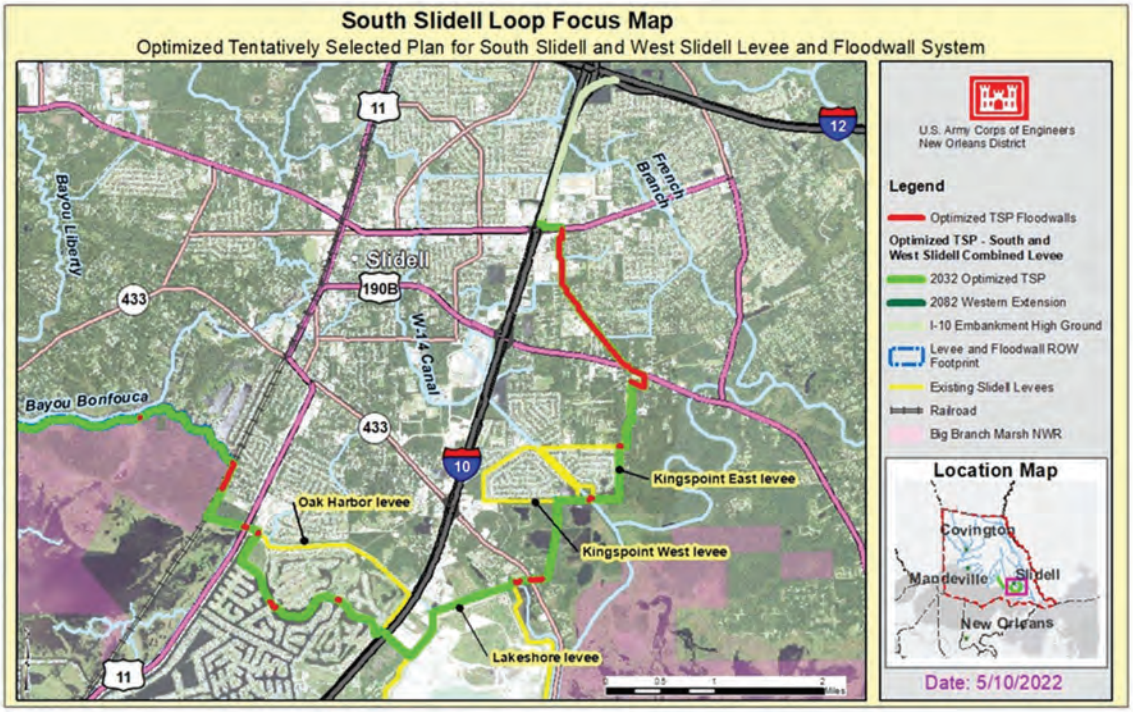

Figure 8. South Slidell Levee and Floodwall System

Western High Ground Tie-in for Year 2082

The Western High Ground alignment (Figure 7) would commence north of U.S. Highway 190 in the neighborhood near the intersection of North Tranquility Road and Shannon Drive between two properties. The alignment would be a berm with hydraulic design elevation of 17.5 ft for year 2082. The alignment would switch to levee (hydraulic design elevation of 17.5 ft (Year 2082)) and would continue south on the edge of the properties and cross U.S. Highway 190, the Tammany Trace Bike Trail, and South Tranquility Road on the eastern side of Pineridge Road. The alignment would run south southeast an additional 890 ft past the intersection with South Tranquility Road and connect with the existing year 2032 alignment for West Slidell.

West Slidell Levee Segment

The West Slidell Levee (Figure 7) construction would commence on the south side of U.S. Highway 190 and South Tranquility Road, and on the eastern side of Pineridge Road. For the West Slidell portion of the alignment, the levee segments would have a hydraulic design elevation of 13.5 ft (Year 2032).

The alignment would run southward and would run on the west side of Tranquility Road (CC Road) and then it would turn in the southeast direction crossing Bayou Paquet Road and would stay on the east side of Bayou Paquet Channel to avoid impact to BBMNWR. The alignment would cross Bayou Paquet and Bayou Liberty and would continue eastward on the northside of BBMNWR. The alignment would cross Bayou Bonfouca and would continue on the south bank of the bayou (northern side of the refuge) until reaching the Norfolk Southern Railway Corp. tracks west of U.S. Highway 11 in the vicinity of Dellwood Pump Station in Slidell.

South Slidell Levee Segment

The South Slidell Levee and floodwall system (Figure 8) 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 running parallel along the east side of the railroad tracks. The floodwall by the railroad tracks would have a hydraulic design elevation of 16.5 ft for year 2082.

The alignment would transition to levee when it turned east toward U.S. Highway 11. The alignment would cross U.S. Highway 11 and would turn south in the vicinity of the existing Schneider Canal Pump Station and then turn east (on 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 levee along the south side of Oak Harbor would have a hydraulic design elevation of 14 ft for year 2032.

The alignment would run on a portion of the existing Oak Harbor ring levee. The alignment would turn north and then east in the vicinity of I-10. Interstate Highway 10 would be raised to extend over the new levee section (hydraulic design elevation of 18.5 ft for year 2082).

The alignment would continue southeast and would connect to an existing portion of the Lakeshore Estates ring levee. The alignment then would turn north and then east and cross Old Spanish Trail/Highway 433. The alignment would continue north and tie to a portion of the

existing King's Point west levee. The section of levee would have a hydraulic design elevation of 16 ft for year 2032.

The alignment would cross the W-14 Canal and connect to a portion of the existing King's Point east levee and would turn north. The levee would have a hydraulic design elevation of 16 ft for year 2032. The levee would turn east and then north. Immediately south of Highway 190 Business the alignment would turn from levee to floodwall to provide risk reduction to the existing Hardin Road power substation. The floodwall would have a hydraulic design elevation of 18.5 ft for year 2082.

The alignment (floodwall) 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 alignment would turn east on Manzella Drive and turn north in the middle of the block between Yaupon Drive and Malbrough Drive.

The alignment (floodwall) would cross Gause Boulevard and would turn west (hydraulic design elevation for floodwall of 18.5 ft for year 2082). There would be a vehicular gate across Gause Boulevard, a vehicular gate for access to a private road, and a vehicular gate for the I-10 Service Road. The floodwall would transition to a berm that would connect to the I-10 embankment. There would be a ramp for the on-ramp for I-10 eastbound at Gause Boulevard.

For the berm, it was assumed a hydraulic design elevation of 16 ft for year 2032 and 19.5 ft for year 2082. The berm was assumed to be 1V:3H. This area of the alignment would be further developed during Pre-construction Engineering and Design (PED). The drainage on the grass area where the ramp merges to the I-10 would need to be reworked during PED.

The existing highway embankment would serve as the means of risk reduction for the project to form a continuous system up to the elevation required in 2082. There would be floodgates at Reine Canal and French Branch. Refer to light green portion of the alignment.

• **Floodgates**

The TSP would include a total of 13 gates (Table 2). Three gates would be lift gates and one gate would be a sector gate. These gates would allow navigation of recreational vessels. There are nine sluice gates which would be control structures (non-navigable).

Description of the Floodgate	Type of Gate
Western High Ground Tie-in for Year 2082	
Sluice Gate near Shannon Drive	Sluice
Tammany Trace Sluice Gate	Sluice
West Slidell	
Sluice Gate # 7 (Near CC Road)	Sluice
Sluice Gate # 6 (Bayou Paquet North Tributary)	Sluice
Bayou Paquet Gate Nav. Gate	Lift
Bayou Liberty Nav. Gate	Lift
Bayou Bonfouca Nav. Gate	Lift
Sluice Gate # 2 (Bayou Bonfouca Sluice Gate)	Sluice
South Slidell	
W-14 Canal Nav. Gate	Sector
Sluice Gate # 8 (Kings Point East)	Sluice
Sluice Gate # 10 (Near Eastern Terminus)	Sluice
Reine Canal	Sluice
French Branch at I-10	Sluice

Table 2. Type and Description of Floodgates

For Bayou Paquet, Bayou Bonfouca and Bayou Liberty, the proposed navigable gates would be designed to have a small amount of restriction and a gradual slope so that fish and larvae may traverse the structures. The navigable gates would consist of a lift gate which would be raised during open mode to let water and recreational vessels traverse. This design would include smaller sluice gates on both sides of the lift gate to simulate the natural opening of the bayous.

During pre-construction engineering and design (PED), the Project Delivery Team (PDT) would consider additional fish-friendly studies and input provided by the NFS, USFWS and National Marine Fisheries Service criteria, including the rock arch and rock ramp designs.

• **Vehicular, Pedestrian and Railroad Gates**

The proposed project includes eighteen vehicular gates, one pedestrian gate, and one railroad gate along the Norfolk Southern Railroad (Table 3).

Name	Description	Type	Mode
Tammany Trace Pedestrian Gate and Culvert	10-ft Pedestrian Gate at Tammany Trace with Lift Gate for Culvert on south side	Swing	Pedestrian
Tranquility Road	20-ft Vehicular Gate at Tranquility Road	Roller	Vehicle

Vehicular Gate			
West Slidell			
Bayou Paquet Road Floodgate # 2	60-ft Floodgate at Bayou Paquet Road	Roller	Vehicle
Mayer Drive Vehicular Gate	20-ft Vehicular Gate at Mayer Road	Roller	Vehicle
Railroad Floodgate	60-ft floodgate for Railroad	Swing	Railroad
South Slidell			
Hwy 11 Vehicular Gate	75-ft Roller Gate at Hwy 11 (Pontchartrain Drive)	Roller	Vehicle
Mariners Cove Floodwall and Vehicular Gate	500 linear ft of floodwall for narrow section of Oak Harbor levee at Mariners Cove Blvd	Roller	Vehicle
Oak Harbor Vehicular Gate	Floodwall and 20-ft Vehicular Gate for Oak Harbor	Roller	Vehicle
Oak Harbor Country Club Vehicular Gate	Floodwall and 20-ft Vehicular Gate for access to Oak Harbor Country Club	Roller	Vehicle
Old Spanish Trail Floodgate (Hwy 433)	30-ft roller gate at Hwy 433 east crossing (Old Spanish Trail)	Roller	Vehicle
Hardin Rd Substation Gate	20-ft roller gate for access from Hardin Road to power substation	Roller	Vehicle
Hwy 190-B Floodgate	50-ft roller gate at Hwy 190-B east crossing (Fremaux Road)	Roller	Vehicle

(East Floodwall)			
South Holiday Drive Vehicular Gate	20-ft roller gate at South Holiday Drive	Roller	Vehicle
North Holiday Drive Vehicular Gate	20-ft roller gate at North Holiday Drive	Roller	Vehicle
Jaguar Drive Vehicular Gate	20-ft roller gate at Jaguar Avenue	Roller	Vehicle
Natchez Drive Vehicular Gate	20-ft roller gate at Natchez Avenue	Roller	Vehicle
Kisatchie Drive Vehicular Gate	20-ft roller gate at Kisatchie Avenue	Roller	Vehicle
Manzella Drive Vehicular Gate	20-ft roller gate at Manzella Drive (Added to extend floodwall to 18.5 ft ground elevation south of Hwy 190)	Roller	Vehicle
Gause Boulevard Vehicular Gate	80-ft roller gate crossing Gause Boulevard	Roller	Vehicle
Private Road Vehicular Gate	65-ft roller gate crossing private road north of Gause Boulevard	Roller	Vehicle

Table 3. Vehicular, Pedestrian and Railroad Gates

• Pump Stations

The TSP would include a total of eight pump stations (Table 4). These pump stations are divided into large pumping capacity and small pumping capacity. In West Slidell there would be two pump stations with large pumping capacity and two pump stations with small pumping capacity. In South Slidell there would be four pump stations with small pumping capacity.

Pump Station Location	Pump Station Capacity
Western High Ground Tie-in for 2082	
N/A	
West Slidell	
Bayou Liberty	1,800 cfs
Bayou Bonfouca	2,000 cfs
Bayou Paquet North Tributary	300 cfs
Bayou Paquet	500 cfs
South Slidell	
W-14 Canal	1,000 cfs
Kings Point	200 cfs
Reine Canal	200 cfs
French Branch at the I-10	450 cfs

Table 4. Pump Stations

- **Ramps**

The TSP would include the construction of six ramps (Table 5), which would include the ramp over I-10 in the vicinity of Oak Harbor and the ramp in the Western High Ground Tie-In. All ramps would be constructed during initial construction except for the ramp in the Western High Ground Tie-In which would be constructed during the fourth levee lift of West Slidell in year 2076.

Ramps
Western High Ground Tie-in for 2082
Highway 190
West Slidell
N/A
South Slidell
Oak Harbor Boulevard
Islander Drive
Grand Champions Lane
I-10 would be raised to ramp over the new levee section
I-10 On-Ramp

Table 5. Ramp Locations

• Access Routes and Staging Areas

Table 6 provides a summary of the necessary staging areas and permanent ROW required for construction of the levee and floodwall segments for the 50-yr period of analysis. The staging areas required during initial construction of the levee alignment would be the same staging areas required for construction of future levee lifts. For Real Estate purposes, the staging areas were included in the permanent ROW. For floodwall segments, staging areas would be included in the 80-ft-wide permanent ROW. Except for the utility corridor in South Slidell, in the vicinity of Northshore Drive, there would be a 0.5-acre staging area outside of the 80-ft-wide corridor. New access roads (acres) do not include areas where the access is within the permanent ROW.

SUMMARY of STAGING AREAS AND PERMANENT ROW		
Levees	**Staging Areas (Acres)**	**Permanent ROW (Acres)**
Western High Ground Tie In	2	30
West Slidell	8.5	240
South Slidell (includes 23 acres for I-10)	30	120
Sub-Total for Levees	**40.5**	**390**
Floodwall Segments		
Western High Ground Tie In	NA	NA
West Slidell	0	4
South Slidell	0.5	23
Sub-Total for Floodwall Segments	**0.5**	**27**
Floodgates and Pump Stations		
Western High Ground Tie In	1.5	2.5
West Slidell	11	21
South Slidell	3.75	6.25
Sub-Total for Floodgates and Pump Stations	**16.25**	**29.75**
Vehicular, Pedestrian, and Railroad Gates		
Western High Ground Tie In	1.5	1.5
West Slidell	2.25	0
South Slidell	11.25	0
Sub-Total for Vehicular, Pedestrian, and Railroad Gates	**15**	**1.5**
Road Ramps		
Western High Ground Tie In	0.5	0
West Slidell	0	0
South Slidell	2	0
Sub-Total for Road Ramps	**2.5**	**0**
Access Roads - New		
Western High Ground Tie In	0	0
West Slidell	0	0.84
South Slidell	0	1.75
Sub-Total New Access Roads	**0**	**2.59**
Access Roads- Existing		
Western High Ground Tie-In	0	0
West Slidell	15.8	0
South Slidell	9.9	0
Sub-Total for Existing Access Roads	**25.7**	**0**
Sub-Total for Access Roads	**25.7**	**2.59**
Total for Levee and Floodwall System for 50-year Period of Analysis	**101**	**450**

Table 6. Staging Areas and Permanent ROW Acreages

Mile Branch Channel Improvements

The Mile Branch channel improvements start at the intersection of Mile Branch and Highway 190, crossing Highway 190 Business, and end at the intersection of Mile Branch and the Tchefuncte River (Figure 9). The channel improvements would be conducted on the lower 2.15 miles (11,341 feet channel) of Mile Branch in Covington. The proposed work would consist of approximately 21 acres of channel that would be cleared and grubbed prior to mechanical dredging.

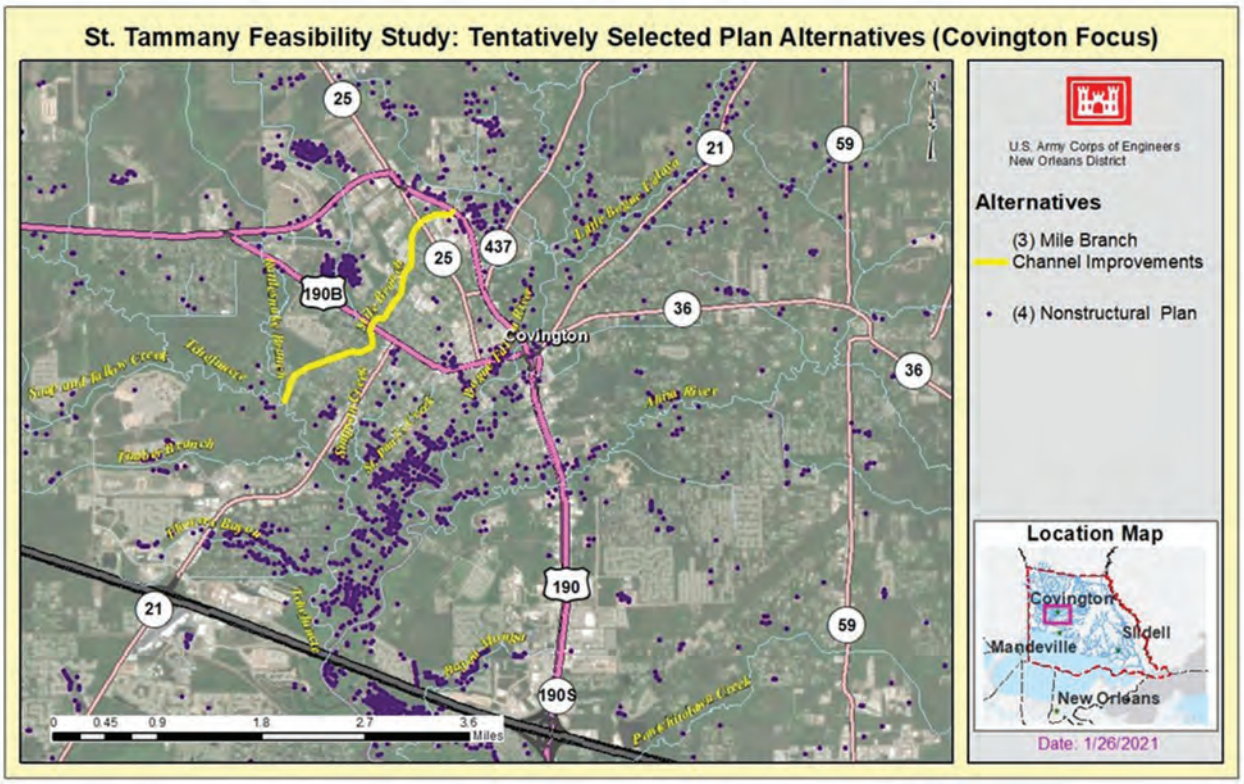

Figure 9. Mile Branch Chanel Improvements

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 ft 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, and no surveys will be conducted during the study phase. 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 sponsors as shown on Table 1.2 in the main report.

Design refinements would 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 would be incorporated as appropriate during PED in coordination with the Non-Federal Sponsor (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. Mile Branch improvements would include seven (7) bridge replacements. Approximately 2.2 acres would be required as temporary ROW for staging along the various areas of the bridge replacements.

• Borrow Areas

The construction of the TSP is estimated to require approximately 1.5 million cubic yards of fill or borrow material. The only features of the TSP that require borrow material are the South and West Slidell Combined Levee and floodwalls. Feasibility level borrow site investigations were conducted to confirm there are available borrow quantities within the vicinity to support the TSP decision and evaluate the anticipated impacts associated with the potential borrow sites. A total of 34 potential sites were identified in the vicinity of the TSP and evaluated and narrowed down to three potential borrow sites within St. Tammany Parish (STP-5, STP-6, STP-9) and two additional sites in Mississippi (MS-1, and MS-2) (Figure 10). Final selection will be conducted prior to acquisition of the site by the NFS.

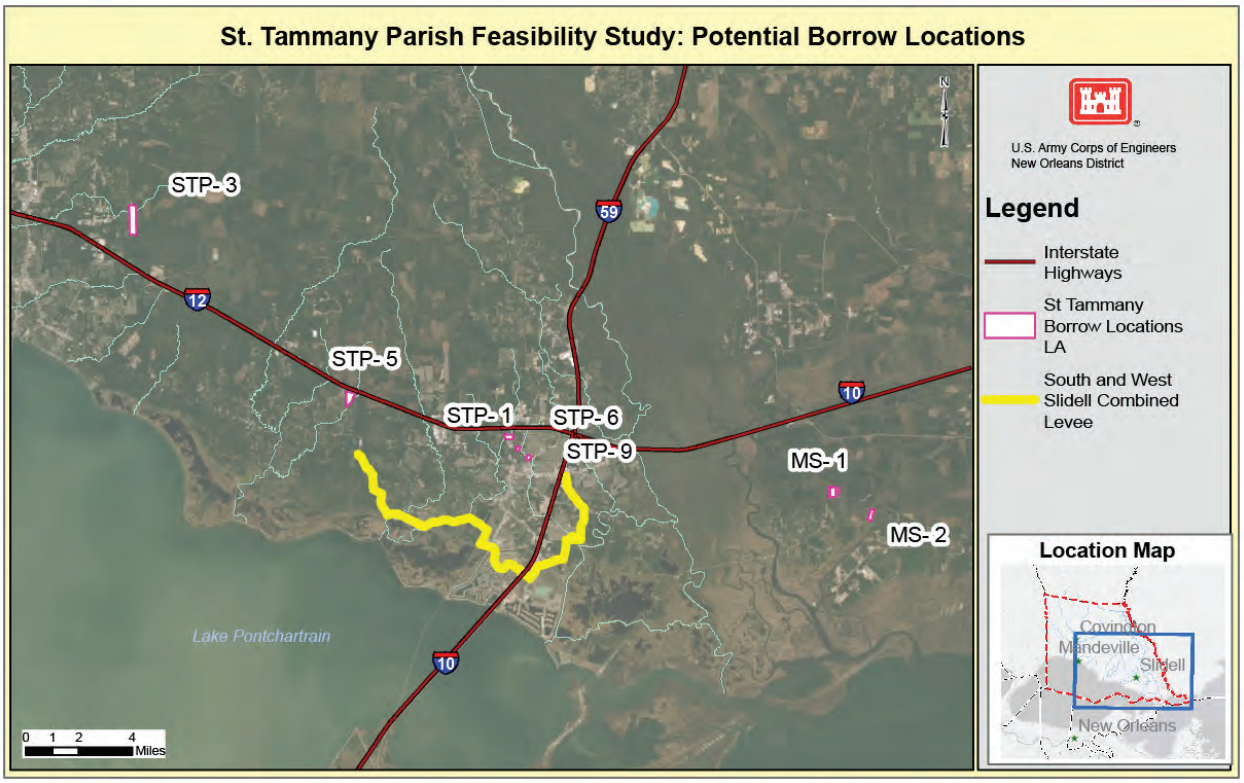

Figure 10. STP FS Borrow Areas

The sites include land cleared of vegetation and were previously investigated HSDRRS borrow sources. The three sites in St. Tammany Parish would be acquisition that would have no mitigation requirements. The two sites in Hancock County, Mississippi, are recently active

commercial sites that might be available for use subject to a Project Partnership Agreement (PPA) and normal USACE Real Estate acquisition processes. The proposed borrow locations avoid impacts to wetlands and are not expected to require compensatory mitigation.

FISH AND WILDLIFE RESOURCES

See Appendix 2 for a list of scientific names.

St. Tammany Parish is the fastest-growing parish in Louisiana and pressure to natural vegetative habitats from development and other land use changes is high due to the abundance of well-drained soils. As part of a planning initiative, the LDWF, Wildlife Diversity Program, analyzed the status of those habitats in St. Tammany Parish's natural vegetative types. Of the 22 vegetative habitat types identified, 15 are classified at wetlands, of which all are in a state of decline (Table 7).

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 Savannah	Rare	Declining

Table 7. Status and Trend of Vegetative Types in St. Tammany Parish

The coastal zone of Lake Pontchartrain and its Basin has opportunities for fishing, swimming, boating, crabbing, and other recreational activities. The Basin's commercial fishery and garden farms have supplied an array of seafood and produce to local dealers, as well as area restaurants. Over the last several decades, however, the Basin's water quality has declined. The basin is experiencing shoreline erosion, wetland loss, and mining for shells, oil, and gas. In addition, dead zones have developed, fisheries resources have diminished, and its substantial commercial and recreational values have been damaged.

Human activities are largely responsible for these adverse impacts on the environmental quality of the Lake Pontchartrain Basin. Since the late 1940s, growth and development has increased runoff that changed and destroyed many habitats. Stormwater discharges, inadequate wastewater treatment, and agricultural activities have significantly degraded water quality. Natural processes, combined with human activities, have caused the loss of thousands of acres of wetlands. By the mid-1980s, almost every river, bayou, or lake in the Lake Pontchartrain Basin was polluted. According to EPA data, the water quality of the rivers and streams of the Florida Parishes is seriously impaired. None of the sub-basins in this part of the Lake Pontchartrain Basin fully meets EPA's designated use standards for fish and wildlife propagation and primary contact recreation. In addition, Bayou Liberty has a fish-consumption advisory for mercury which can be found in the Louisiana Department of Environmental Quality's 2022 Integrated Report

Description of Habitats

Existing Conditions

Dominant habitat types in the project area include fresh and intermediate marsh, degraded pine savannah, and riparian habitats. Intermediate 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 are capable of withstanding spikes of salinity that are associated with tropical storm surge events. Intermediate marsh typically lies inland from brackish marsh and water salinity averages 3.3 ppt. It is commonly a narrow band of vegetation when compared with other marsh types due to the large differences between freshwater and brackish salinities. This marsh type is characterized by a diversity of plant species, many of which are found in freshwater marsh and some of which are found in brackish marsh. Plant diversity and soil organic matter content is higher than in brackish marsh. This marsh type is typically dominated by saltmeadow cordgrass and other common plants including common reed, bulltongue arrowhead and coastal waterhyssop. Submerged aquatics such as pondweeds and southern waternymph are also abundant in intermediate marshes.

Fresh marsh typically lies between the intermediate marsh and either uplands or forested wetlands. Normally, the tidal range is less in inland marshes, with fresh marsh generally less influenced by tides than more brackish marsh. Water salinity in fresh marsh averages 1.0 ppt. Fresh marsh supports the greatest diversity of plants and is often dominated by Maidencane, spikerush, bulltongue arrowhead, cattail, and alligatorweed. Many submerged and floating-leafed plants are present in this marsh type.

Submerged aquatic vegetation (SAV) is found in ponds and bayous throughout the project area and is generally more abundant in fresher habitats. SAV supports a diverse biota, exports organic matter and nutrients into the water column, oxygenates the water column, and stabilizes bottom sediments by reducing current velocity and wave energy. SAV species distributions and biomass are influenced by salinity, water depth, turbidity, as well as other variables.

The proposed project area is located within the historic range of longleaf pine. Pine savannahs are floristically rich, herb-dominated forests, that are naturally sparsely stocked with longleaf pine. This community is most often dominated by numerous grasses and sedges in the understory, and is noted for very high plant diversity, including insectivorous plants and showy

orchids and lilies. Pine savannahs historically dominated the regions of southeast and southwest Louisiana (LDWF 2009). Common woody species include longleaf pine (usually predominant tree species), slash pine, sweet bay magnolia, black gum, live oak, blackjack oak, laurel oak, wax myrtle, and St. John's wort. Herbaceous vegetation of pine savannahs is very diverse and includes broomsedge, little bluestem, slender bluestem, panic grasses, three-awn grasses, toothache grass, hairawn muhly, plume-grasses, jointgrasses, beak-rushes, yellow-eyed grasses, umbrella grasses, nut-rushes, giant white top sedge, pipeworts, bog buttons, and fimbry-sedge. Common forbes include pitcher plants, gerardias, lobelias, meadow beauties, bog thistle, narrow-leaved hog-fennel, milkworts, blazing-stars, rose-gentians, sundews, butterworts, bladderworts, and fringed-orchids. Fire frequency is a major factor controlling species occurrence and community structure and is considered the critical element in their maintenance (LDWF 2009). All the species indigenous to pine savannahs have evolved over millennia within a regime of frequent (once every 1 to 4 years) surface fires, and most depend on fire for perpetuation. Fire stimulates flowering and fruit/seed production of savannah herbs and shrubs, deters invasion by fire-intolerant woody vegetation, and exposes mineral soil for herb and longleaf pine seedlings to become established. Fire suppression has occurred within a significant portion of the project area and without frequent fire (preferably growing season burns which mimic historic fire regimes), shrubs and hardwoods are encroaching the overstory, dominating the midstory, and eliminating the herbaceous understory. Today, pine savannah remnants are limited in size compared to the broad expanses that once existed. Historically, the eastern Florida Parishes of Louisiana were dominated by extensive stands of this habitat. Now barely 1% of the original estimated 100,000 to 500,000 acres of pine savannah remains (LDWF 2015).

Habitat loss principally resulted from conversion of longleaf pine forests to other uses (i.e., agriculture, industrial pine plantations, and urban development), landscape fragmentation, and interruption of natural fire regimes (Landers et al. 1995, Wear and Greis 2002). The construction of pulpmills during the 1950s created an increased demand for smaller trees. These developments accelerated conversion of naturally regenerated longleaf pine forests into plantations of species that grow more rapidly in the short term. For these reasons the project area is now dominated with loblolly and slash pine trees.

Riparian forests are relatively narrow wetland forests occurring along small rivers and large creeks in central, western, southeastern, and northern Louisiana. They are seasonally flooded for brief periods. Vegetation in riparian zones stabilize streambanks and reduce floodwater velocity. Common tree species occurring within the Mile Branch riparian zone include southern magnolia, cottonwood, black gum, water oak, sweetgum, red maple, and loblolly pine. Primary midstory and understory occurring within the riparian zone include yaupon, greenbriers, Japanese climbing fern, and Chinese privet. Starbush, Sebastian bush, fetter bush and winterberry are also common riparian species in the Florida Parishes.

No Action Alternative

Under the No Action Alternative (NAA), vegetative resources would not be impacted from construction. Forested wetlands and uplands, however, would continue to be impacted by ongoing residential and commercial development. The greatest wetland losses are anticipated near the end of the analysis period between 2067 and 2082, when impacts from sea-level rise and subsidence would likely be greatest.

Fishery/Aquatic Resources

Existing Conditions

Estuaries are among the most productive habitats in the world because they support high primary and fisheries production (Whittaker and Likens 1973, Walme 1972). The impacted marsh in the project area consists of fresh and estuarine habitat. Most of the economically important saltwater fishes and crustaceans harvested in Louisiana spawn offshore and then use estuarine areas for nursery habitat (Herke 1995). Some of these fish and shellfish may penetrate inland to fresher habitats, while freshwater species are sometimes found in intermediate or brackish environments. In addition, the lower reaches of freshwater streams may serve as nursery areas for the young of some marine species.

The study area supports fresh, estuarine, and marine fishes and shellfishes. The fresh water of the study area supports many commercially and recreationally important fishes such as largemouth bass, black crappie, sunfishes, catfishes, freshwater drum, buffalos, and gars. Decaying plant material (detritus) is carried by surface runoff and tidal action from the study area wetlands into the adjacent estuarine waters, substantially contributing to the detritus- based food web that supports a high level of finfish and shellfish productivity. Estuarine and marine fishes include sheepshead, anchovies, scaled sardine, Gulf menhaden, striped mullet, white mullet, black drum, red drum, spot, spotted seatrout, sand seatrout, Atlantic croaker, gaff-topsail catfish, southern flounder, Gulf killifish, longnose killifish, sheepshead minnow, fat sleeper, gobies, alligator gar, and rough silverside. The dominant crustaceans expected to occur in the project area include grass shrimp, white shrimp, brown shrimp, and blue crab.

No Action Alternative

The major factors that will strongly influence future fish and riverine resources include stormwater discharges, inadequate wastewater treatment, agricultural activities, runoff, and development. 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 marsh loss due to sea level rise and subsidence, stormwater management, increased development, and nutrient runoff that negatively impact aquatic resources.

Essential Fish Habitat

The project may be located within an area identified as Essential Fish Habitat (EFH) by the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA, Magnuson-Stevens Act; P.L. 104-297). USACE should consult with the NMFS regarding EFH.

Wildlife Resources

Existing Conditions

The project area provides important habitat for numerous species of wildlife, including waterfowl, wading birds, shorebirds, neotropical migratory birds, mammals, reptiles, and amphibians.

Longleaf pine savannahs are home to a tremendous diversity of amphibian, reptile, bird, and mammal species. Amphibians endemic to longleaf pine savannah include the flatwoods salamander, Mabee's salamander, tiger salamander, striped newt, dwarf salamander, bog salamander, oak toad, pinewoods treefrog, barking treefrog, squirrel treefrog, Brimley's chorus frog, Southern chorus frog, little grass frog, ornate chorus frog, crawfish frog, gopher frog, and Eastern spadefoot. Reptiles endemic to longleaf pine savannah include the scarlet snake, Eastern indigo snake, Southern hognose snake, pine snake, pine woods snake, short-tailed snake, Florida crowned snake, Eastern coral snake, Eastern diamondback rattlesnake, mimic glass lizard, mole skink, and gopher tortoise. Bird species endemic to longleaf pine savannah include the Northern bobwhite, red-cockaded woodpecker, white-breasted nuthatch, brown-headed nuthatch, and Bachman's sparrow. Mammals endemic to longleaf pine savannah include the fox squirrel, Southeastern pocket gopher, and Florida mouse (Means 2006).

Riparian areas supply food, cover, and water for a large diversity of animals and serve as migration routes and stopping points between habitats for a variety of fish and wildlife. For fish species this habitat provides food, water, cover from predators, and spawning and rearing areas. In addition, riparian zones lower water temperatures. For wildlife species riparian habitat provides food, water, cover from heat and cold, cover from predators, and breeding and rearing areas.

The coastal marshes, forested wetlands, riparian zones, and pine savannah habitats of the Lake Pontchartrain Basin have been identified by the North American Waterfowl Management Plan (NAWMP), Gulf Coast Joint Venture (GCJV): Mississippi River Coastal Wetlands Initiative as a key waterfowl wintering area. The Gulf Coast is the terminus of the Central and Mississippi Flyways and is therefore one of the most important waterfowl areas in North America, providing both wintering and migration habitat for significant numbers of the continental duck and goose populations that use both flyways. The Mississippi River Coastal Wetlands Initiative area is dominated by coastal marsh, forested swamps, and seasonally flooded bottomland hardwoods that provide habitat for several species of wintering waterfowl. Wood ducks are the primary waterfowl species in forested wetlands, while other ducks (e.g., mallard, American widgeon, gadwall, and lesser scaup) use those forested habitats to a lesser degree. One strategy to achieving the goals and objectives of the GCJV is to maintain the existing functions and values of those habitats and prevent additional losses and degradation of those wetlands (Wilson 2002). Numerous other game birds are present in or adjacent to the study area, including American coot, rails, gallinules, common snipe, and American woodcock. Non-game bird species also utilize the study area marshes, including least bittern, pied-billed grebe, black-necked stilt, American avocet, killdeer, black-bellied plover, willet, and various species of sandpipers and gulls. The study area supports many resident and transient hawks and owls including red-shouldered hawk, barn owl, common screech owl, great horned owl, and barred owl. Winter residents include red-tailed hawk, northern harrier, and American kestrel, while the Mississippi kite, swallow-tailed kite and broad-winged hawk are common summer residents. Also, present are cuckoos, swifts, hummingbirds, nighthawks, woodpeckers, and the belted kingfisher.

Louisiana coastal forested wetlands provide neotropical migratory birds essential stopover habitat where they can forage and rest, and these coastal habitats provide nesting habitat for hundreds of thousands of birds each year. Some neo-tropical migrants that are currently

experiencing a population decline (e.g., white-eyed vireo, Northern parula) are dependent on large, forested acreage to successfully reproduce.

Wading birds (herons and egrets) typically inhabit fresh to saline marsh, swamps, and shrub habitat and will form nesting colonies in stands of trees and where shrubs are available throughout these habitats. With 17 species of wading birds that regularly occur, Louisiana is thought to have more wading birds than any other state. The importance of Louisiana's coast to many species of both breeding and nonbreeding birds is significant and hosts up to two-thirds of the regional and global abundance of some species (Remsen et al. 2019).

Important game mammals occurring in the project area include white-tailed deer, Eastern cottontail, swamp rabbit, gray squirrel, and fox squirrel. Commercially important furbearers include muskrat, nutria, river otter, raccoon, and mink. Other mammals expected to occur in the area include various species of insectivores, bats, rodents, and the nine-banded armadillo.

Amphibians such as the southern dusky salamander, dwarf salamander, Eastern newt, three-toed amphiuma, lesser siren, Gulf coast toad, Northern cricket frog, green tree frog, squirrel tree frog, spring peeper, Eastern narrow-mouthed toad, bullfrog, green frog, pig frog, and Southern leopard frog are expected to occur in freshwater project-area wetlands. Reptiles such as the American alligator, Eastern mud turtle, red-eared slider, snapping turtles, green anole, broadhead skink, little brown skink, mud snake, Eastern black kingsnake, rat snake, Gulf Coast ribbon snake, cottonmouth, common garter snake, and water snakes are also expected to occur in the project-area wetlands.

Louisiana supports the largest area of coastal marsh in North America (Coleman and Huh 2004, Couvillion et al. 2017). As observed by Remsen et al. (2019), the richness and abundance of birds of Louisiana's coastal marshes is matched nowhere in the U.S. Louisiana supports large populations of many obligate marsh bird species as well as marine bird species that require islands for breeding sites (Remsen et al. 2019). The coastal wetlands of Louisiana serve as wintering habitat for about 3 million ducks and 400,000 geese annually and thus is one of the most important wintering waterfowl areas on the continent. The area supports 19 percent of the U.S. wintering population of 14 species of ducks and geese, including more than 60 percent of the U.S. population for three species (mottled duck, gadwall, and blue-winged teal) and more than 20 percent for nine species (Michot 1996). Remsen et al. (2019) estimates that 73 percent of the U.S. population of sandwich tern breeds in Louisiana, and comparable estimates range from 24 to 55 percent for mottled duck, clapper rail, tricolored heron, Wilson's plover, royal tern, black skimmer, and seaside sparrow.

No Action Alternative

Under the No Action alternative, the project area would continue to provide habitat for a multitude of species including migratory waterfowl, wading birds, shorebirds, mammals, reptiles, and amphibians. Riparian habitat along Mile Branch would be maintained and would continue to provide benefits to fish and wildlife species. Pine savannah habitat would continue to transition to pine/hardwood due to lack of management (i.e., prescribed fire). The continued loss of emergent wetlands would negatively impact those species. In addition, conversion of shallow isolated ponds and associated SAV to large, unvegetated open-water areas would diminish habitat value for all wildlife species. Sea level rise will reduce habitat acres in the

project area and consequently is expected to reduce wildlife populations. The continued loss of wetlands via conversion to open water would decrease the habitat available for species that use both wetland and upland habitats for breeding, foraging, and migration. Further, the continued loss of wetlands would also decrease protection of upland habitats; as wetlands are lost or degraded, these inshore habitats would be subjected to higher pressures from storm surges and over-wash.

Threatened and Endangered Species

Within the project area, four threatened or endangered species are known to occur or believed to occur (Table 8). Information regarding those species and their preferred habitats are provided below.

Species	Species Group	Status
Manatee, West Indian	Mammal	Threatened
Sturgeon, Gulf	Fish	Threatened, Critical Habitat
Tortoise, Gopher	Reptile	Threatened
Woodpecker, Red-cockaded	Bird	Endangered

Table 8. List of threatened and endangered species believed to occur within the project area

West Indian Manatee

The threatened 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 Louisiana Wildlife Diversity Program, approximately 84 percent of reported manatee sightings (1990-2019) in Louisiana have occurred from the months of June through December. Manatee occurrences in Louisiana are increasing, and they have been regularly reported in the Amite, Blind, Tchefuncte, and Tickfaw rivers and in canals and bayous within the adjacent coastal marshes of southeastern Louisiana including Bayou Lafourche. Manatees may also infrequently be observed in the Mississippi River and coastal areas of southwestern Louisiana. Threats to this species include collisions with boats and barges, entrapment in flood control structures, poaching, habitat loss, and pollution. Cold weather and outbreaks of red tide may also adversely affect these animals. Should a proposed action directly or indirectly affect the West Indian manatee, further consultation with this office will be necessary.

The following are conditions that should be implemented to avoid impacts to manatee. All contract personnel associated with the project should be informed of the potential presence of manatees and the need to avoid collisions with manatees, which are protected under the Marine Mammal Protection Act of 1972, the Endangered Species Act of 1973 and State laws. All construction personnel are responsible for observing water-related activities for the presence of manatees. Temporary signs should 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., work area), and at least one sign should be

placed where it is visible to the vessel operator. Siltation barriers, if used, should be made of material in which manatees could not become entangled and should be properly secured and monitored. If a manatee is sighted within 100 yards of the active work zone, special operating conditions should be implemented, including, but not limited to: no operation of moving equipment within 50 feet of a manatee; all vessels should operate at no wake/idle speeds within 100 yards of the work area; and siltation barriers, if used, should be re-secured and monitored. Once the manatee has left the 100-yard buffer zone around the work area on its own accord, special operating conditions are no longer necessary, but careful observations should be resumed. Any manatee sighting should be immediately reported to the Service (337/291-3100) and the LDWF Wildlife Diversity Program (337/735-8676).

Gulf Sturgeon

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

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

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

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

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

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

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

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

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

Gopher Tortoise

In Louisiana, the threatened gopher tortoise (*Gopherus polyphemus*) occurs in Washington, Tangipahoa, and St Tammany Parishes. The gopher tortoise is the only native tortoise found in the southeastern U.S. This species is associated with areas that have well-drained, sandy soils appropriate for burrow establishment, ample sunlight for nesting, and understory vegetation suitable for foraging (i.e., grasses and forbs). The burrow opening is semicircular or "half-moon" in shape and a low mound of bare soil will be immediately in front of the mouth of an active burrow. Suitable soil types for gopher tortoises include Latonia and Bassfield (highly suitable), Cahaba, Ruston, and Smithdale (less suitable), and Abita, Malbis, Angie, and Prentiss (marginal).

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 (ROWs) 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.

Red-cockaded Woodpecker

The project area is located in a parish known to be inhabited by the endangered red-cockaded woodpecker (RCW, *Picoides borealis*). 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).

At-Risk Species

The Service's Southeast Region has defined "at-risk species" as those that are: 1) proposed for listing under the ESA by the Service; 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 Service add them to the list of protected species. Petitioned species include those for which the Service has made a substantial 90-day finding as well as those that are under review for a 90-day finding. As the Service develops proactive conservation strategies with partners for at-risk species, the states' Species of Greatest Conservation Need (defined as species with low or declining populations) will also be considered.

The Service's goal is to work with private and public entities on proactive conservation to conserve these species, thereby precluding the need to federally list as many at-risk species as possible. While not all species identified as at-risk will become ESA listed species, their potentially reduced populations warrant their identification and attention in mitigation planning.

Discussed below are species currently designated as "at-risk" that may occur within St. Tammany Parish. Within the study area, 11 at-risk species are known to occur or believed to occur (Table 9).

Species	Species Group
Golden Winged Warbler	Bird
Frecklebelly Madtom	Fish
Saltmarsh Topminnow	Fish
Monarch Butterfly	Insect
Southern Snaketail Dragonfly	Insect
Eastern Beard Grass Skipper	Insect
Tri-colored Bat	Mammal
Alabama Hickory Nut	Mollusk
Correll's False Dragon-head	Plant
Alligator Snapping Turtle	Reptile
Eastern Diamondback Rattlesnake	Reptile
Pearl River Map Turtle	Reptile

Table 9. At-risk Species

Golden-Winged Warbler

The golden-winged warbler relies on early successional forests with sparse trees and shrubs with an herbaceous understory of grasses and forbs in either wetland or upland settings. In Louisiana, it uses forested habitats during spring and fall migrations. It depends on these forested habitats along the Gulf Coast to provide food and water resources before and after trans-Gulf and circum-Gulf migration. Population declines are associated with both loss of habitat owing to succession and reforestation and the expansion of the blue-winged warbler, with which it hybridizes, into the range of the golden-winged warbler. The loss of wintering habitat in Central and South America, along with migratory stopover habitat, may also contribute to its decline.

Frecklebelly Madtom

The frecklebelly madtom is a small freshwater catfish restricted to the Mobile and Pearl River basins of the southeastern U.S. The fish is about 3-4 inches long and is yellow to dark brown with dark mottling and speckling usually extending to the belly. Frecklebelly madtoms are nocturnal fish that primarily feed on aquatic insect larvae.

This species inhabits medium to large rivers with little sedimentation. They usually occur over firm gravel substrates in swiftly flowing waters. The primary habitat is rocky riffles, rapids, and runs, often near aquatic vegetation. In Louisiana, this species occurs in the Pearl River drainage, including the Bogue Chitto River and lower Pearl River tributaries. In addition to the Pearl River of Mississippi and Louisiana, this fish is also found in the Mobile Basin, which includes Alabama, eastern Mississppi, northern Georgia, and a small portion of southern Tennessee. The frecklebelly madtom occurs in the Tombigbee, Alabama, Cahaba, Etowah, and Conasauga Rivers of the Mobile Basin.

Threats to the success of the frecklebelly madtom include damming, impoundments, channelization, gravel removal operations, dredging, bridge construction, and altered flow regimes. These practices restrict the movement of the fish and increase siltation from habitat modifications, which is considered a significant threat to the species. Other threats include pollution from activities such as agriculture and construction.

Saltmarsh Topminnow

The saltmarsh topminnow is a small, approximately 2 inch coastal fish. It is considered a resident species of coastal marsh and closely related to other killifish species such as the Gulf killifish.

Most studies indicate the species is most abundant in low-salinity saltmarsh ecosystems, with the most abundance in salinities less than 12 ppt, although they have been found in salinities from 0 parts per thousand (ppt) to 31.4 ppt. Studies have found that the species primarily use the marsh interior, readily using intermediate to high marsh where channels and rivulets exist for access to marsh interior. This species is found in the northern Gulf of Mexico from Galveston Bay, Texas to Escambia Bay, Florida. Numerous studies have documented this species throughout its entire range and several studies suggest it may be more widespread and numerous than previously thought.

Monarch Butterfly

The monarch butterfly is reddish orange with black vein-like markings. The wings have a black border with white spots. Monarchs go through a complete metamorphosis with four distinct life cycles: egg, caterpillar, chrysalis, and adult. It takes approximately one month for them to become adult butterflies. During the caterpillar stage, monarchs will only eat milkweed plants. Monarchs are known for their yearly migrations over great distances between their breeding grounds and overwintering locations.

Milkweed is the essential habitat component for monarch caterpillars, as it is their sole food source. There are about 100 species of milkweed native to North America. Milkweed grows in open fields, meadows, and other early successional habitat. Diverse native flowering plants that bloom during the growing season are essential habitat components during their migration.

Loss and degradation of both breeding and over-wintering habitat are large threats to the monarch. Both timing of migration and migration patterns are expected to be influenced by climate change. Anthropogenic practices such as mowing too frequently and the spread of invasive species threaten the monarch. Predation, the use of pesticides, and disease are also threats to the species.

On June 20, 2014, President Obama signed a Presidential Memorandum, "Creating a Federal Strategy to Promote the Health of Honey Bees and Other Pollinators," outlining an expedited agenda to address the devastating declines in honey bees and native pollinators, including the monarch butterfly. Recent research has shown dramatic declines in monarchs and their habitats leading conservation groups to petition the Service to list the species under the Endangered Species Act (ESA). Ensuring adequate and sustainable habitats, meeting all the life history needs of these species is of paramount importance. The Service and its partners are taking immediate actions to replace and restore monarch and pollinator habitat on both public and private lands across the U.S. landscape. Therefore, disturbed areas should be revegetated with native plant species, including species of nectar-producing plants and milkweed endemic to the area, we recommend consultation with state botanists to determine appropriate species where possible.

Southern Snaketail Dragonfly

The Southern snaketail is a dragonfly (order Odonata) with a green thorax which bears two lateral black stripes. Its head has segments of yellow, white, brown, and green. The abdomen is brown with yellow and white markings. Total length is 1.7 – 1.8 inches, depending on sex. The compound eyes in males are blue above and gray below. Adults are characterized by the most extensive dark markings of the subgenus Ophionurus and may be easily distinguished from most of its related species by the brown band along the interpleural interface on the thorax. It may be a subspecies of the Appalachian snaketail. The Southern snaketail has been considered among the rarest of the Odonata. The extreme rarity of the Southern snaketail may be related to the substrate requirements of the larval stage, which is two years. Larvae were most often collected from pea-sized gravel in 4 – 8 inches of water, with areas at the tail of riffles being the most productive. The species is known to make significant seasonal migrations.

The Southern snaketail typically inhabits medium-sized freshwater streams with gravel substrate. For example, the type locality (Tangipahoa River) averaged less than 32 feet wide with a few pools reaching a depth of 6.6 feet. The substrate was primarily a mixture of sand and pea-gravel eroded from local deposits. Good water quality and a stable stream flow is required. Threats may include gravel mining, siltation, pesticides, flood scour, clear cutting/deforestation, perturbation of stream flow, and a naturally occurring limited range of the species.

Eastern Beard Grass Skipper

The Eastern beard grass skipper, also called the Eastern arogos skipper, is a small yellow butterfly in the family of skippers, Hesperiidae. The upper side of the wing is yellow-orange lined with a black border. They can be differentiated from closely related species by their deep orange coloration and white fringe on the underside of their wings. Flight usually takes place in the southern states from April to September, and in the northern states from June to July due to temperature constraints. They are a subspecies of the arogos skipper which extends into the western U.S.

The historical range of this subspecies includes Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, Nebraska, New Jersey, New York, Pennsylvania, South Carolina, and Virginia. This subspecies is now so reduced that the few isolated remnant colonies, with some possibly no longer existing, occur in Louisiana, Mississippi, Florida, and New Jersey. It is believed to be extirpated from North Carolina since 2009.

They inhabit areas of grasslands and prairies, with specific habitat requirements varying regionally and among different subspecies. In eastern states habitats include serpentine barrens, savannahs, and flatwoods, while arogos skippers in western states are typically found in dry grasslands. Arogos skippers rely on host plants including big bluestem, little bluestem, reed grass, and lopsided Indiangrass for reproduction and larval feeding. Some of these host plants rely on ephemeral conditions brought by fire or grazing regimes. Adult skippers feed on the nectar of knapweeds, milkweeds, thistles, and blazing-stars. These sources of food vary regionally.

Habitat loss and fragmentation due to development, silviculture, agriculture, shrub, and invasive species encroachment, and altered fire regimes have been the primary cause of the decline of this skipper in most of its range. While fire is necessary for host plants, fires do cause mortality in the species which is a threat to the sparse populations. Therefore, conservative fire regimes, other methods for prairie maintenance such as grazing and mowing, and more research on management for this species is needed. In the Southeast, predation by fire ants might be a threat. Another cause of mortality is the bacteria septicemia, which is almost always fatal. Arogos skippers can also be hindered by parasites that negatively affect host plants. Fungus harms plants used as host plants during reproduction and as nectar sources for adults, directly affecting the skipper by decreasing sites for reproduction and sources of nutrients.

Tri-colored Bat

The tricolored bat, also known as the eastern pipistrelle, is a small bat that gets its name from their individual hairs being ‘tri-colored’: brown at tip, yellow in the middle, and dark at the base.

Overall, the fur appears yellow brown, with reddish forearm skin. This small bat flies slowly with an erratic pattern while foraging, causing it to sometimes be mistaken for a moth.

The tricolored bat is distributed from southern Canada through most of the eastern U.S. (38 states total), and along eastern Mexico to Honduras. This species is thought to be expanding its distribution westward based on several documented westerly range expansions. In Louisiana, this species is distributed statewide except for the extreme southern portions of the state and is encountered more frequently in the northern portion of Louisiana than the southern.

Tricolored bats appear to inhabit landscapes that are partly open, with large trees and plentiful woodland edges. They are found in a variety of terrestrial habitats, including grasslands, old fields, suburban areas, orchards, urban areas, and woodlands, especially hardwood woodlands. Little is known about daytime summer or maternity roosts. These bats are among the first bats to emerge at dusk each night, and their appearance at tree-top level indicates that they may roost in foliage or in high tree cavities and crevices. They are not often found in buildings or in deep woods, seeming to prefer edge habitats near areas of mixed agricultural use. Hibernation sites are found deep within caves or mines in areas of relatively warm, stable temperatures. However, research is ongoing determining small bat hibernation habitats other than caves and mines.

The main threat to this species is White Nose Syndrome (*Pseudogymnoascus destructans*), with affected hibernation sites resulting in more than a 75 percent decline of bats, with some sites declining by 90 percent. Other threats include habitat modification and destruction including forest and grassland conversion to urban/suburban land use, and mortality during migration from winter hibernaculum to summer roosting habitat due to wind energy development. The tricolored bat is listed as a species of least concern by the International Union for Conservation of Nature and is apparently secure in Louisiana with many occurrences. Stevens et al. (2017) suggests this species is common throughout the state and heightened conservation consideration is not warranted at this time. However, range wide declines in this species have occurred in response to threats and create a need for continued population monitoring.

Alabama Hickorynut

The Alabama hickorynut is a 1.2 to 2-inch-long freshwater mussel with round or elliptical shape. The outer shell (periostracum) is smooth and brown to yellow brown, with rays. This species is a long-term brooder that is gravid from June through August of the following year. Like other freshwater mussels, the Alabama hickorynut releases its larvae (glochidia) into the water column, where they parasitize a fish (glochial host), in order to transform into a juvenile mussel. Once the glochidia are ready, they release from the host to find a suitable substrate. Suitable glochidial host fishes for this species include the naked sand darter, southern sand darter, Johnny darter, Gulf darter, blackbanded darter, dusky darter, and redspot darter.

The range of this species is unclear, as it is endemic to the Mobile River basin. It is believed to be distributed across eastern Gulf drainages in Alabama, Louisiana, Mississippi, and Oklahoma. It occurs in the Pearl and Amite River Systems of Louisiana. This species has been extirpated from much of its range by impoundment of large stream habitat and water quality degradation.

The Alabama hickorynut inhabits sand and gravel substrates in moderate currents in large streams. However, the presence of moderate gradient pool and riffle habitats in a variety of

stream and river sizes may contain this species. Habitat modification and destruction due to siltation and impoundment threaten this species. It is also negatively affected by the pollution of streams and rivers.

Correll's False Dragonhead

Correll's false dragonhead is a robust, somewhat succulent plant that grows up to 3.3 feet tall. Its stems are often unbranched, with mid-stem leaves opposite and usually widest in the middle with large sharp teeth. The leaves decrease in size from mid to upper stem. This plant is a hardy perennial with elongate rhizomes. The plant flowers from May to September with pink and tubular flowers with two lips. This plant requires full sun.

The wetland indicator status of this species is obligate, meaning it occurs almost always in wetlands. Occurrences in Louisiana are all in roadside ditches. Elsewhere it occurs along riverbanks, often growing in flowing water. Vigorous growth of rhizomes allows Correll's false dragonhead to be competitive in disturbed areas. Potential habitat includes non-natural habitats such as drainage and irrigation ditches and wet utility ROWs. This species is known from Texas, southern Louisiana, and northern Mexico (Nuevo Leon, Sonora, and Coahuila).

This species is threatened by ditch dredging and scraping for maintenance and installation of water lines and other utilities. Use of herbicides along roadsides is also an issue. Exotic invasive species may be a threat, though Correll's false dragonhead does appear to be competitive against many plants, with one Louisiana population competing with the exotic torpedo grass (*Panicum repens*) and being monitored closely. Correll's false dragonhead is possibly naturally rare, and there is a need to increase survey efforts to detect previously unknown populations.

Alligator Snapping Turtle

The alligator snapping turtle is the largest species of freshwater turtle in North America and is highly aquatic and somewhat secretive. They are primitive in appearance and are characterized by a large head, long tail, and an upper jaw with a strongly hooked beak. Hatchlings look very similar to adults. Sexual maturity is achieved in 11 to 21 years for males and 13 to 21 years for females. No more than one clutch per year per female has been observed in the wild.

Alligator snapping turtles are opportunistic scavengers and consume a variety of foods. Fish comprise a significant portion of their diet; however, they also eat crayfish, mollusks, smaller turtles, insects, nutria, snakes, birds and vegetation (including acorns). The alligator snapping turtle is the only turtle species that has a predatory lure (a small, worm-like appendage on the tongue). Both adults and juveniles use this lure to attract fish into striking range. The lure is white or pale pink in juveniles and mottled or gray in adults.

The alligator snapping turtle is confined to river systems that flow into the Gulf of Mexico, extending from the Suwannee River in Florida to the San Antonio River in Texas. They are found in large rivers, major tributaries, bayous, canals, swamps, lakes, ponds and oxbows. It is most common in freshwater lakes and bayous, but also found in coastal marshes and sometimes in brackish waters near river mouths. The alligator snapping turtle is highly associated with in-stream structure (e.g., tree root masses, stumps, submerged trees, etc.).

Extensive commercial and recreational harvesting in the last century resulted in significant declines to many alligator snapping turtle populations. Commercial harvesting is now prohibited in all states within its range and recreational harvest is prohibited in every state except for Mississippi and Louisiana. Currently, the primary threats to the species are legal and illegal intentional harvest, bycatch associated with commercial fishing of catfish and buffalo, nest predation and habitat alteration.

Eastern Diamondback Rattlesnake

The eastern diamondback rattlesnake is recognized by it large size, dorsal pattern of diamonds, yellowish unpatterned belly, black tail, and rattle at the tip of the tail. The dorsal pattern has 18 to 20 diamonds aligned apex to apex down the midline of the back. They reach sexual maturity at 2 to 6 years and have a gestation period of approximately one year. Females reproduce at 2-to-4-year intervals and may live for 10 years, with a few snakes living 15 to 20 years.

Eastern diamondback historically occupied a very similar range to long leaf pine forests. This species prefers open canopy long-leaf pine savannahs with herbaceous ground cover. This snake may occur where remnants of its native habitat remain, or where open canopy forests with interspersed grassland support vegetation similar to that which is found in mature open canopy long-leaf pine forest. This species requires large tracts of habitat, and home ranges average 116 and 208 acres, for females and males, respectively.

The historic range consists of the coastal plain of the southeastern U.S. including North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, and Louisiana. It is currently believed to be extirpated in Louisiana.

Threats to this species include killing by humans out of fear, intentional hunting, vehicle strikes, and conversion of suitable habitat to other land uses. Another issue faced by the snake is a lack of any legal protections, except in North Carolina where it is a state endangered species, and Alabama where it is illegal to sell or possess this species without a permit.

Pearl River Map Turtle

The Pearl River map turtle is a freshwater turtle with a pronounced keel with knobs, and an olive brown carapace with a diagnostic continuous black stripe on the mid-line. The usual size of this species ranges from 2.5 to 4.2 inches in males, and 7.3 to 9.3 inches in females. This species was previously classified with the Pascagoula map turtle but was determined to be a distinct species in 2010. They can be differentiated by the continuous black stripe on the dorsal mid-line of the Peral River map turtle versus the discontinuous black stripe of the Pascagoula map turtle.

This map turtle occurs in small to medium sized permanent streams with a sand and mud substrate. It also occurs in large to medium-sized rivers, especially those with an abundance of mollusks, sandy banks, sandbars, deep pools, and logs or other suitable basking sites. It may venture into shallow water or onto sandy beaches at night, but usually clings to submerged objects just below the surface of the water. Nests are in sandy banks or sand bars. Adult females depend largely on mollusks, especially clams and snails, while males and juveniles feed mostly on insects and other arthropods.

This species is highly vulnerable to the negative effects of water pollution and sedimentation on its freshwater mollusk prey. In the Columbia reach of the Pearl River drainage, downstream of the Monticello pulp mill, the Pearl River map turtle has declined relative to that of the ringed map turtle over the past seventeen years, perhaps, because of a decline in the mussel population associated with diminished water quality. Exploitation for the pet trade, particularly in the Lower Pearl River drainage in Louisiana, may also be a significant threat. Raccoons and crows also predate the nests of this species.

The range of this species is confined to the Pearl River system in Mississippi and eastern Louisiana. Pearl River drainage populations occur in the Ross Barnett Reservoir, the main stem Pearl River, Bogue Chitto River, Yockanookany River and Strong River.

Migratory Birds and Other Trust Resources

Bald Eagle

The proposed project area may provide nesting habitat for the bald eagle, which was officially removed from the List of Endangered and Threatened Species as of August 8, 2007. However, the bald eagle remains protected under the Migratory Bird Treaty Act (MBTA) and Bald and Golden Eagle Protection Act (BGEPA). Because the project area includes suitable habitat for nesting and foraging bald eagles and because eagles may build new nests each nesting season, we recommend contractors be mindful of nesting eagles during project construction.

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, willow, 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.

During project construction, on-site personnel should be informed of the possible presence of nesting bald eagles near the project boundary, and should identify, avoid, and immediately report any such nests to this office. If an active or inactive eagle nest is discovered within 2 miles of the project footprint, the applicant should follow the bald and golden eagle guidelines found on-line at https://www.fws.gov/library/collections/bald-and-golden-eagle-management to determine whether disturbance will occur and/or an incidental take permit is needed.

Coastal Forest and Neotropical Migrating Songbirds

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 will have upon breeding migratory birds of conservation concern within the West Gulf Coast Plain Bird

Conservation Region. Many migratory birds of conservation concern require large blocks of contiguous habitat to successfully reproduce and survive.

In Louisiana, the primary nesting period for forest-breeding migratory birds occurs between April 15 and August 1. Some species or individuals may begin nesting prior to April 15 or complete their nesting cycle after August 1, but the vast majority nest during this period. The proposed project may directly impact migratory birds of conservation concern because habitat clearing that occurs during the 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, the Service recognizes that some birds may be taken during project construction/operation even if all reasonable measures to avoid take are implemented.

In addition to the direct loss of grassland and forested habitat, the proposed project may indirectly impact migratory birds of conservation concern because construction of large-scale projects within forested habitats typically results in habitat fragmentation. Forest fragmentation may contribute to population declines in some avian species because fragmentation reduces avian reproductive success (Robinson et al. 1995). Fragmentation can alter the species composition in a given community because biophysical conditions near the forest edge can significantly differ from those found in the center or core of the forest. As a result, edge species could recruit to the fragmented area and species that occupy interior habitats could be displaced. The fragmentation of intact forests could have long-term adverse impacts on some forest interior bird species.

The primary impact to forest habitat conditions from the proposed project would result from the conversion of forest habitat to levees and staging areas. We recommend avoiding impacts to forested areas to the maximum extent practicable.

Wading Bird Colonies

In accordance with the Migratory Bird Treaty Act of 1918 (as amended) and FWCA, please be advised that the project area includes habitats which are commonly inhabited by colonial nesting waterbirds and/or seabirds.

Colonies may be present that are not currently listed in the database maintained by LDWFes. That database is updated primarily by: (1) monitoring previously known colony sites and (2) augmenting point-to-point surveys with flyovers of adjacent suitable habitat. Although several comprehensive coast-wide surveys have been recently conducted to determine the location of newly established nesting colonies, we recommend that a qualified biologist inspect the proposed work site for the presence of undocumented nesting colonies during the nesting season because some waterbird colonies may change locations year-to-year.

For colonies containing nesting wading birds (i.e., herons, egrets, night-herons, ibis, and roseate spoonbills), anhingas, and/or cormorants, all activity occurring within 1,000 feet of a rookery should be restricted to the non-nesting period, depending on the species present. Below is the list of colonial nesting birds that may be found and the corresponding activity window during which

the project may occur without affecting nesting wading bird colonies (Table 10). The Service recommends that the project be constructed outside of those windows to the maximum extent practicable.

Species	Project Activity Window/Non-nesting Period
Anhinga	July1-March 1
Double-crested Cormorant	July 1-March 1
Great Blue Heron	August 1-February 15
Great Egret	August 1-February 15
Little Blue Heron	August 1-March 1
Tricolored Heron	August 1-March 1
Reddish Egret	August 1-March 1
Cattle Egret	September 1-April 1
Green Heron	September 1-March 15
Black-crowned Night Heron	September 1-March 1
Yellow-crowned Night Heron	September 1-March 15
Ibis	September 1-April 1
Roseate Spoonbill	August 1-April 1

Table 10. Colonial nesting birds and their corresponding non-nesting period

In addition, we recommend that on-site contract personnel including project-designated inspectors be trained to identify colonial nesting birds and their nests and avoid affecting them during the breeding season (i.e., the period outside the activity window). Should on-site contractors and inspectors observe potential nesting activity, coordination with the LDWF and the Service should occur.

Managed Areas

Big Branch Marsh National Wildlife Refuge

The BBMNWR is located within the project area. All project related activities on the refuge must be coordinated with Refuge Project Leader Neil Lalonde (985-882-2000). Portions of the proposed levee alignment traverse BBMNWR. The Service recommends that the levee alignment be moved off the refuge. 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. This project would also have indirect impacts to pine savannah habitat on the refuge and those impacts would require mitigation on refuge lands. Close coordination by both the USACE and its contractors must be maintained with the Project Leader.

Louisiana Natural and Scenic Rivers

The proposed channelization and clearing and snagging of Mile Branch as proposed are prohibited by the Louisiana Scenic Rivers Act (LSRA), La. R.S. 56:1840. LDWF administers the Scenic Rivers Program and close coordination must be maintained with that agency (Chris Davis rcdavis@wlf.la.gov) to ensure compliance with that Act. The following Louisiana Designated Natural and Scenic Rivers occur within the parish: 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, Tchefuncte River (excluding any tributaries), West Pearl River, and Wilson Slough.

EVALUATION METHODOLOGY

The Service defines impacts as effects relative to the affected fish and wildlife resources. Impacts may be direct or indirect. Direct impacts are all project-related direct (construction) impacts. Indirect impacts are impacts from an action that occur later in time or farther removed in distance and they may have landscape-scale implications.

Within the project area, all impacts to marsh were classified as direct (direct levee and staging areas). Based on hydraulic and hydrology modeling, indirect impacts associated with the proposed project to marsh habitats are not anticipated (Figure 11). Impacts to pine savannah were classified as either direct (direct levee) or indirect (protected and unprotected areas adjacent to the levee) (Figures 11 and 12).

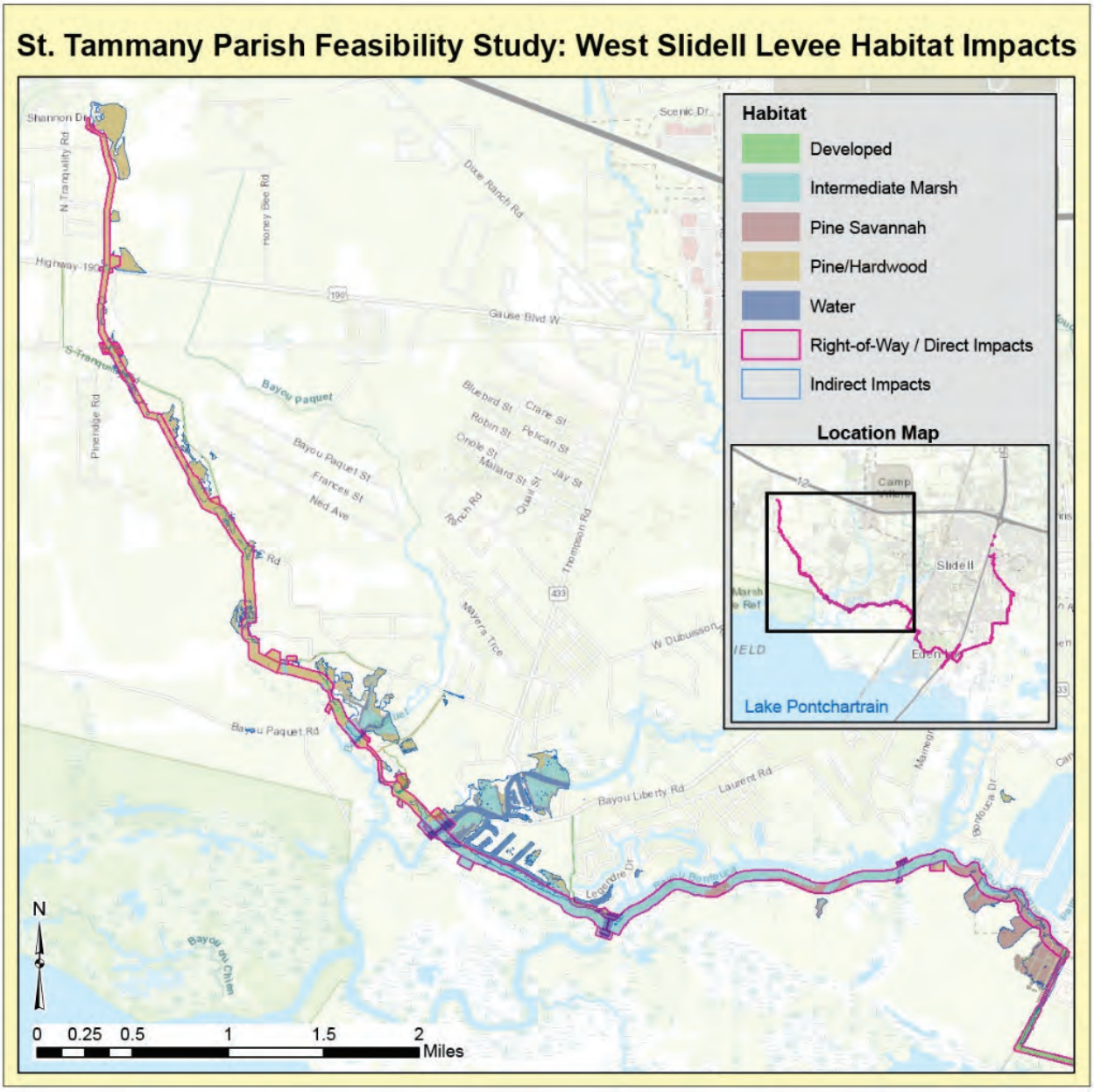

Figure 11. Direct and Indirect Impact Areas West Levee

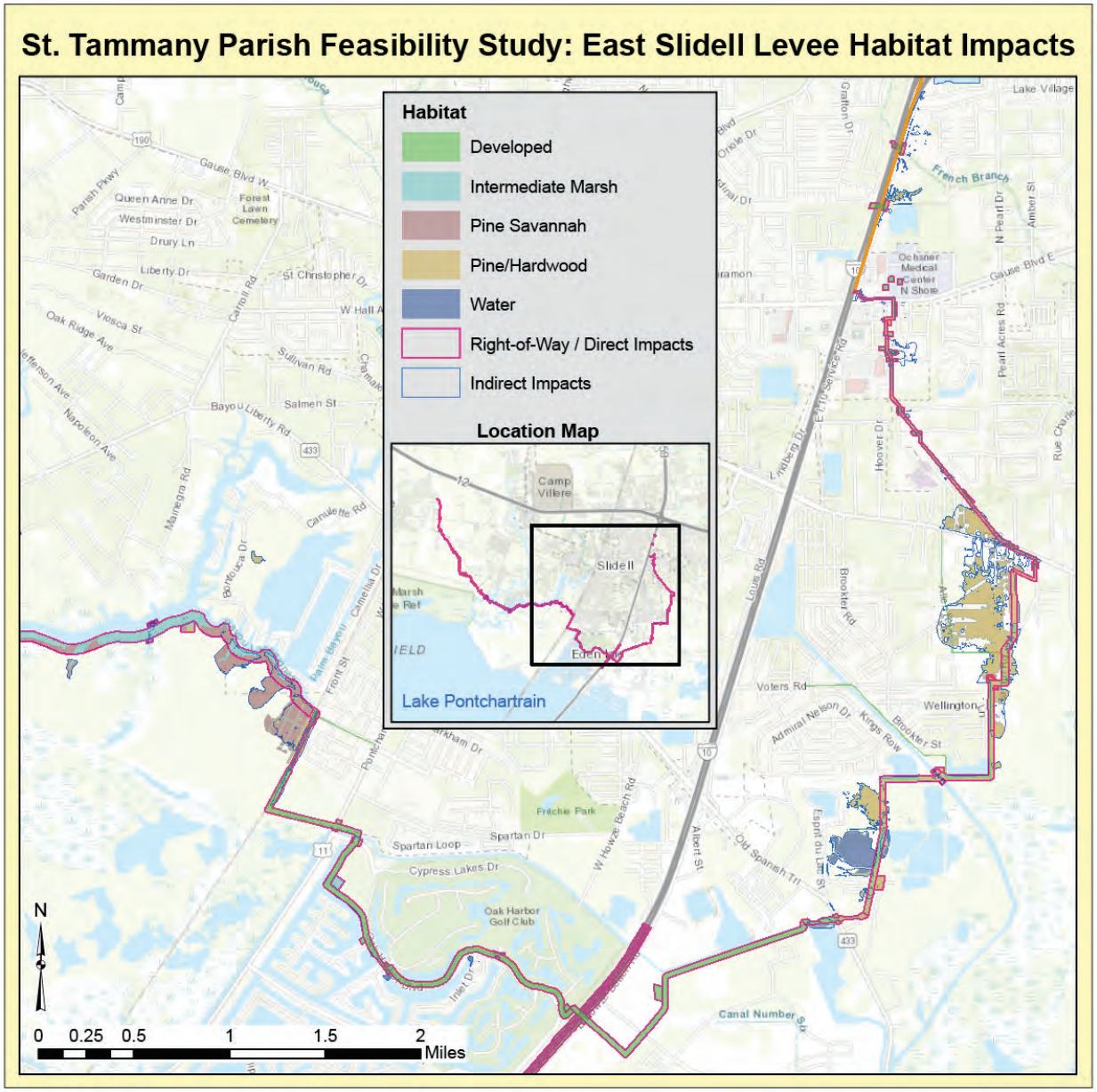

Figure 12. Direct and Indirect Impact Areas East Levee

A Habitat Evaluation Team (HET) was formed to assist with and concur on the methodology and quantification of environment impacts. The HET included representatives from the USACE, the Service, NMFS, LDWF, and NFS.

Fresh and Intermediate Marsh

To quantify anticipated indirect project impacts to fish and wildlife resources, the Service used the 2017 (version 2) USACE Approved Wetland Value Assessment (WVA) fresh/intermediate coastal marsh models. The WVA model was developed to evaluate restoration projects proposed for funding under Section 303 of the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) and was modified through the USACE approval process for use in the USACE planning process. These models are approved for regional use on USACE Civil Works projects. Further information on this model may be obtained from the USACE's New Orleans District,

Regional Planning and Environmental Division South at https://ecolibrary.planusace.us/ (use the search term "WVA").

The WVA models operate under the assumption that optimal conditions for fish and wildlife habitat within a given coastal wetland type can be characterized, and that existing or predicted conditions can be compared to that optimum to provide an index of habitat quality. Habitat quality is estimated and expressed using mathematical models developed specifically for each wetland type. Each model consists of 1) a list of variables that are considered important in characterizing fish and wildlife habitat; 2) a Suitability Index graph for each variable, which defines the assumed relationship between habitat quality (Suitability Index) and different variable values; and 3) a mathematical formula that combines the Suitability Indices for each variable into a single value for wetland habitat quality, termed the Habitat Suitability Index (HSI). The WVA models assess the suitability of each habitat type for providing resting, foraging, breeding, and nursery habitat to a diverse assemblage of fish and wildlife species. This standardized, multi-species, habitat-based methodology facilitates the assessment of project-induced impacts on fish and wildlife resources.

HSI values are determined for each target year (TY). Target years, determined by the model user, represent significant changes in habitat quality or quantity that are expected during the 50-year period of analysis, under future with-project and future without-project conditions. Because of the time constraints associated with this project HSI values were only calculated for the TSP and the NAA. In this project, target years of 0, 1, 40 and 50 are evaluated.

The product of an HSI value and the acreage of available habitat for a given target year is known as the Habitat Unit (HU). The HU is the basic unit for measuring project effects on fish and wildlife habitat. Future HUs change according to changes in habitat quality and/or quantity. Results are annualized over the period of analysis to determine the Average Annual Habitat Units (AAHUs) available for each habitat type.

The change (increase or decrease) in AAHUs between future projections of the TSP and the NAA provided a measure of anticipated impacts. A net gain in AAHUs indicates that the project is beneficial to the habitat being evaluated; a net loss of AAHUs indicates that the project is damaging to that habitat type. In determining future with TSP conditions, all project-related direct (construction) impacts were assumed to occur in Target Year 1.

Fresh/Intermediate Marsh Impacts WVA

The Fresh/Intermediate WVA consists of six variables:
Variable V1 – Percent of wetland area covered by emergent vegetation
Variable V2 – Percent of open water area covered by aquatic vegetation (SAV)
Variable V3 – Marsh edge and interspersion
Variable V4 – Percent of open water area ≤ 1.5 feet deep in relation to marsh surface
Variable V5 – Salinity
Variable V6 – Aquatic organism access

Changes in each variable are predicted for existing and future projections of the NAA and TSP over a 50-year period of analysis. For details on marsh habitat evaluation see assumptions and assessment documents (https://ecos.fws.gov/ServCat/Reference/Edit/154305).

Habitat Evaluation Procedures (HEPs)

To quantify impacts to pine savannah fish and wildlife resources the Service was limited to using species specific Habitat Evaluation Procedures (HEPs) because there is not a pine savannah community model. The HEP models are similar to the Service's WVAs, in that habitat quality and quantity are measured for baseline conditions and predicted future conditions for the NAA and in this case the TSP. The WVA model utilizes an assemblage of variables considered important to the suitability of that habitat type for supporting a diversity of fish and wildlife species. The Service's concern with the HEP approach is that these 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. In addition, there are a limited number of species with published HEP models that are good indicators of pine savannah 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. After a thorough review of available HSIs, the Service chose the red-cockaded woodpecker (RCW) (Tirpak et al. 2009) and pine warbler (Service 1982) to measure impacts to pine savannah habitats in the project area.

Pine savannah habitat in the project area typically occurs above the 5-foot contour line and will be both directly and indirectly impacted by the proposed project. Hydrologic and Hydraulic modeling revealed that a slight increase in inundation occurred in some locations near the levee alignment (Figures 10 and 11). Increased inundation could also result in project area pine savannah habitats transitioning to bottomland hardwood stands.

Pine Warbler HEP

The pine warbler HEP consists of three variables :
Variable 1 – Percent canopy tree closure of overstory pines
Variable 2 – Successional stage of stand
Variable 3 – Percent of dominant canopy pines with deciduous understory in the upper $^{1}/_{3}$ layer.

Changes in each variable are predicted for existing and future projections of the NAA and TSP over a 50-year period of analysis. For details on the Pine Warbler evaluation see assumptions and assessment documents (https://ecos.fws.gov/ServCat/Reference/Profile/154305).

Red-cockaded Woodpecker HEP

The HSI model for the RCW includes six variables:
Variable 1 – landform, landcover and successional age class
Variable 2 – forest patch size
Variable 3 – pine basal area
Variable 4 – hardwood basal area
Variable 5 – connectivity
Variable 6 – large pine (> 14 inch diameter at breast height [dbh]) density

Changes in each variable are predicted for existing and future projections of the NAA and TSP over a 50-year period of analysis. For details on the RCW evaluation see assumptions and assessment documents (https://ecos.fws.gov/ServCat/Reference/Profile/154305).

Riparian Habitat Impacts WVA

Habitat within the Mile Branch riparian zone is composed of mixed pine/hardwood stands (Figure 13). A WVA does not exist for this type of habitat; however, because bottomland hardwoods are an integral component of the overstory the HET agreed to use the bottomland hardwood WVA. That WVA, however, is not designed to quantify impacts to pine/hardwood habitat. Consequently, the Service is concerned that the habitat quality of pine/hardwood habitats are being inappropriately undervalued.

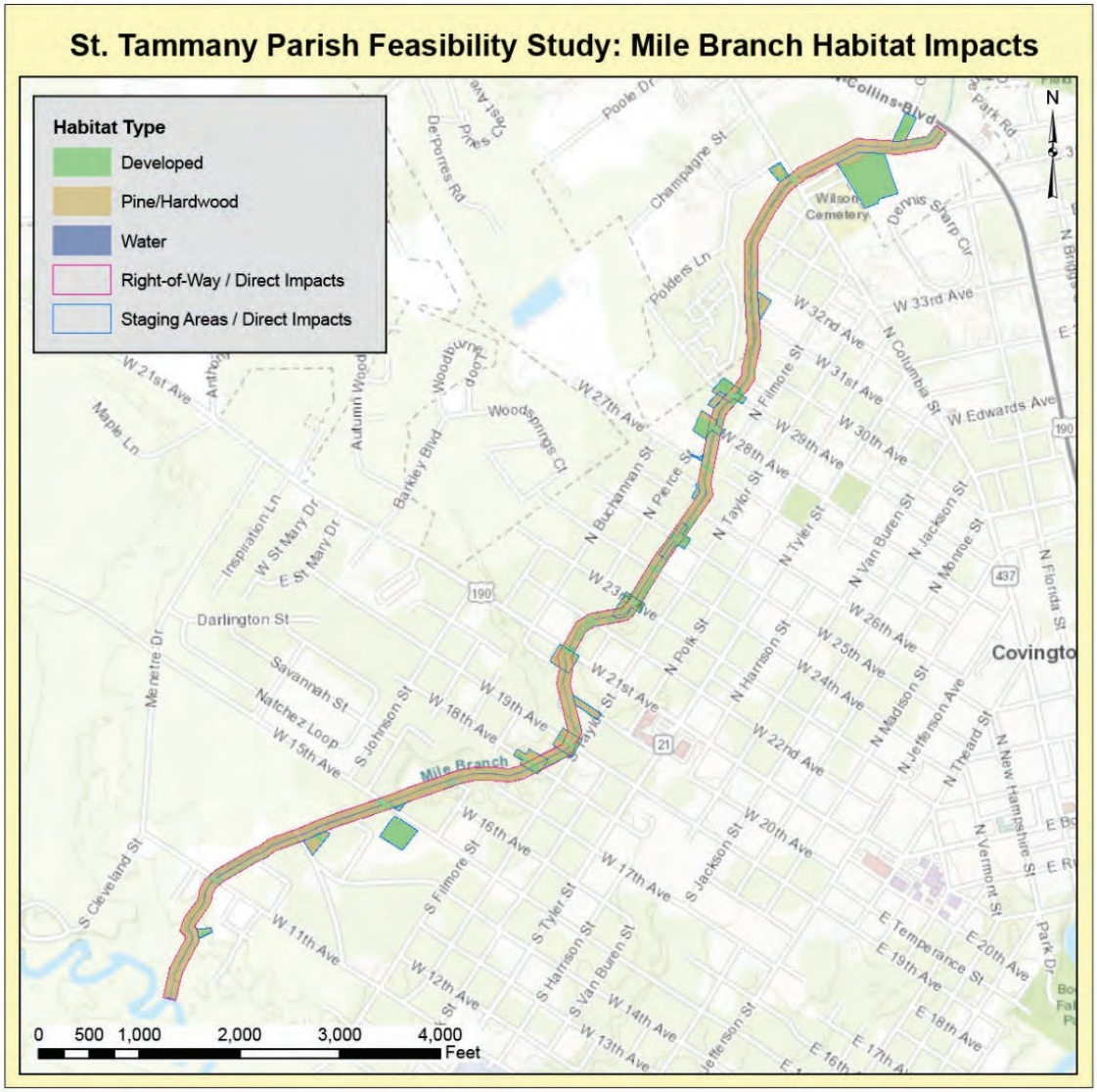

Figure 13. Mile Branch Impact Areas

Riparian corridors (i.e., rivers, streams, and adjacent lands) are particularly valuable habitats for wildlife. Vegetation plays a key role in the function of riparian areas as suitable wildlife habitat. Streamside vegetation provides food and shelter for many species. The shade, detritus and woody debris provided by streamside forests are important for healthy fisheries. Leaves, branches, and trees uprooted by rivers, streams, bayous, etc. become food and shelter for aquatic organisms and many forms of terrestrial wildlife inhabiting riparian areas. The high value of riparian areas as wildlife habitat is also due to the proximity to water combined with the convergence of many species along the edges and ecological transition zones between aquatic/wetland, aquatic/upland, wetland/upland, and river channel/backwaters habitats. Loss of these riparian corridors results in habitat fragmentation, which is a major cause of wildlife decline. It is, therefore, important to maintain undeveloped and naturally vegetated corridors between habitats of a sufficient width to enable animals to travel from one habitat to another.

The Bottomland Hardwood WVA consists of seven variables:
Variable 1 – Tree Species Composition
Variable 2 – Stand Maturity
Variable 3 – Understory/Midstory
Variable 4 – Hydrology
Variable 5 – Size of Contiguous Forested Area
Variable 6 – Suitability and Traversability of Surrounding Land Uses
Variable 7 – Disturbance

Changes in each variable are predicted for existing and future projections of the NAA and TSP over a 50-year period of analysis. For details on the Riparian habitat evaluation see assumptions and assessment documents (https://ecos.fws.gov/ServCat/Reference/Profile/154305).

PROJECT IMPACTS

The Service's Mitigation Policy (Federal Register, Volume 46, No. 15, January 23, 1981) identifies four resource categories that are used to ensure that the level of mitigation recommended by Service biologists will be consistent with the fish and wildlife resource values involved.

Resource Category 2 are habitats of high value for evaluation species and are relatively scarce or becoming scarce on a national basis or in the ecoregion section. The mitigation goal for habitat in this category is that there should be no net loss of in-kind habitat value.

Direct and Indirect Impacts

The STP FS project would provide flood damage reduction through the construction (and operation) of a total of approximately 16.3 miles of a hurricane and storm damage risk reduction levee and floodwall from west Slidell to south Slidell, five pump stations, five floodgates, ramps, channel improvements to Mile Branch in Covington, and nonstructural home elevations and floodproofing for eligible structures in the Parish. In addition to direct impacts in the project area as a result of construction, modeling indicated there were minor project-induced hydrology changes near the alignment (Figures 10 and 11). Based on the WVA of all direct and indirect areas the STP FS project will have unavoidable impacts to 440.5 acres of pine savannah, 113.0

acres of fresh/intermediate marsh and 34.9 acres of riparian habitat. Of these impacts, 67.8 acres of pine savannah and 76.9 acres of fresh/intermediate marsh on BBMNWR and 372.6 acres of pine savannah and 36.1 acres of fresh/intermediate marsh on private lands will be impacted (Tables 11 and 12).

SOUTH AND WEST SLIDELL COMBINED LEVEE HABITAT OPTIMIZED DIRECT							
Private Lands			BBMNWR			Totals	
Habitat	SubTotal Acres	SubTotal Hectares	Habitat	SubTotal Acres	SubTotal Hectares	Acres	Hectares
Developed	176.330498	71.358422	Developed	4.392105999	1.777422	180.7226037	73.135844
Intermediate Marsh	36.121811	14.617979	Intermediate Marsh	76.87841221	31.111591	113.0002232	45.72957
Pine Savannah	170.678647	69.071213	Pine Savannah	31.92191642	12.918342	202.600564	100.9931294
Water	20.405850	8.257954	Water	1.124155946	0.45493	21.53000549	8.712884
	403.536805	163.305568		114.3165906	46.262285	517.853396	228.5714274

Table 11. Direct (construction footprint) impacts in initial acres and hectares for the STPFS

SOUTH AND WEST SLIDELL COMBINED LEVEE HABITAT OPTIMIZED INDIRECT MERGE							
Private Lands			BBMNWR			Totals	
Habitat	SubTotal Acres	SubTotal Hectares	Habitat	SubTotal Acres	SubTotal Hectares	Acres	Hectares
Developed	0.000000	0	Developed	0	0	0	0
Intermediate Marsh	0.000000	0	Intermediate Marsh	0	0	0	0
Pine Savannah - Protected Side	175.552015	71.04492732	Pine Savannah - Protected Side	0	0	175.55202	71.044927
Pine Savannah - Unprotected Side	26.26838931	10.63067151	Pine Savannah - Unprotected Side	35.92586391	14.53899794	62.194253	25.169669
Water	0.000000	0	Water	0	0	0	0

Table 12. Indirect impacts in initial acres and hectares for the STPFS

By the end of the 50-year period of analysis, on BBMNWR there would be a net loss of -1.44 acres of pine savannah (-1.19 directly impacted, -0.25 indirectly impacted) (Table 13) and -28.8 net acres of marsh (directly impacted) (Table 14). There will be an associated loss of -33.13 marsh AAHUs; -9.74 RCW AAHUs and -2.53 pine warbler AAHUs in the direct impact area; and -6.62 RCW AAHUs and -1.71 pine warbler AAHUs in the indirect impact area.

Note: Net acres are the difference between FWP (year 50 with the project) and FWOP (year 50 without the project) or FWP-FWOP at the end of the project life. AAHUs represent changes in habitat quality and/or quantity which are annualized over the 50-year period of analysis.

Pine Savannah - BBMNWR	Intermediate SLR		
Impact Type	Species	Net Acres	AAHUS
BBMNWR Direct		-1.19	
	RCW		-9.74
		-1.19	
	Pine Warbler		-2.53
BBMNWR Indirect - Protected Side		N/A	
	RCW		N/A
		N/A	
	Pine Warbler		N/A
BBMNWR Indirect - Unprotected Side		-0.25	
	RCW		-6.62
		-0.25	
	Pine Warbler		-1.71
RCW			**-16.36**
Pine Warbler			**-4.24**

Table 13. Results of the Red-cockaded woodpecker and Pine Warbler HEPs for pine savannah impacts on Big Branch Marsh National Wildlife Refuge for the STPFS

INTERMEDIATE RSLR		
WVA FRESH/INTERMEDIATE MARSH	Net Acres	AAHUS
Private Direct Permanent	-11.1	-14.4
BBMNWR Direct Permanent	-28.8	-33.13
Total	-40	-48

Table 14. Results of the Fresh and Intermediate Marsh WVA project impacts for the STPFS

By the end of the 50-year period of analysis, on private lands there would be a net loss of -148.4 acres of pine savannah (-145.3 directly impacted, -3.09 indirectly impacted) (Table 15) and -11.1 net acres of marsh (directly impacted) (Table 16). The FWP scenario resulted in the loss of -14.4 marsh AAHUs; 0 RCW AAHUs and -42.45 pine warbler AAHUs in the direct impact area; 0 RCW AAHUs and -10.52 pine warbler AAHUs in the indirect interior impact area; and 0 RCW AAHUs and -1.55 pine warbler AAHUs in the indirect exterior impact area.

Pine Savannah - Private Lands	Intermediate SLR		
Impact Type	**Species**	**Net Acres**	**AAHUS**
Private Land Direct		-145.31	
	RCW		0.00
		-145.31	
	Pine Warbler		-42.45
Private Land Indirect - Protected Side		-3.09	
	RCW		0.00
		-3.09	
	Pine Warbler		-10.52
Private Land Indirect - Unprotected Side		0.00	
	RCW		0.00
		0.00	
	Pine Warbler		-1.55
Subtotal Private Direct and Indirect			
RCW			**0.00**
Pine Warbler			**-54.52**

Table 15. Results of the Red-cockaded woodpecker and Pine Warbler HSIs for pine savannah impacts on Private Lands for the STPFS

By the end of the 50-year period of analysis, there would be a net loss of -34.9 acres of riparian habitat adjacent to Mile Branch. The FWP scenario resulted in the loss of -0.65 bottomland hardwood (BLH) AAHUs (Table 16).

	Initial Acres	Net Acres	AAHUs	AAHUs/acre
Mile Branch Riparian Zone	34.93	-34.93	-22.87	-0.65

Table 16. Results of the Bottomland Hardwood Wetland Value Assessment (WVA) for riparian impacts at Mile Branch for the STPFS

Riparian Impacts

The Mile Branch portion of the proposed project involves deepening and widening the existing channel and replacing seven bridges or culverts. The proposed deepening and widening would require the removal of riparian habitat along Mile Branch. Riparian habitats are unique habitats known to provide cover, food, and water for a large variety of wildlife, and they serve as important migration corridors and stopover points. In addition, vegetation in riparian zones stabilize streambanks and reduce floodwater velocity.

To minimize impacts to Mile Branch, the Service recommends that the USACE assess whether the existing culverts are of sufficient size to allow for adequate drainage or if larger size culverts are needed. If larger culverts are being installed, we recommend the USACE assess whether these larger structures would preclude the need to widen and deepen the channel. In addition, the Service recommends that the USACE assess whether debris build-up at bridges and/or culverts is blocking/limiting conveyance of floodwaters. If obstructions in the waterway are present and removal would allow for adequate flow during flood events, the Service recommends that the less damaging snagging and clearing be conducted in place of widening and deepening the canal. Should snagging and clearing be included as a feature of the project, those activities should follow the techniques described within the Stream Obstruction Removal Guidelines (see attached) to accomplish the work in the least damaging manner possible.

Operations and Maintenance Impacts

In addition to the potential impact to water exchange from project structures, the Service is concerned about reduced future water exchange due to Relative Sea Level Rise (RSLR) potentially requiring increased structure closures. If the proposed levee and/or operation of structures increases flood frequency and water depth the pine savannah in the project area will become increasingly stressed. Over time, a stressed pine savannah could convert to bottomland hardwoods and/or marsh. Reduced water exchange in the enclosed wetlands would lead to further water quality deterioration in the Lake Pontchartrain Basin by eliminating or reducing the filtering capacity of those wetlands. The potential wetland habitat impact would result in the reduction of resident fish and wildlife, reduced important wintering habitat for waterfowl and other migratory birds that use the Central and Mississippi Flyways, and reduced nursery habitat and detritus input important to the maintenance of estuarine-dependent fish and shellfish production.

Fisheries impacts

The ability of estuarine dependent marine fishery organisms to migrate to and from coastal habitats decreases as structural restrictions increase, thereby reducing fishery production. The physical ability (i.e., swimming speed) to navigate through a structure is not the only factor influencing fish passage. Both behavioral and physical responses govern migration and affect passage of fishery organisms through structures. These responses may vary by species and life stage. In addition, 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.

It should not be assumed that structures that have been determined to provide sufficient drainage capacity also optimize or provide adequate fishery passage. Generally, bigger, and more numerous openings are better for maintaining estuarine dependent fishery migration. Flood protection water control structures in any watercourse should maintain pre-project cross section in width and depth to the maximum extent practicable, especially structures located in tidal passes. 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. More investigation is warranted to refine and adaptively manage water control structure design and operations to minimize adverse impacts to fishery passage.

Developmental pressures

Developmental pressures on enclosed forested wetlands would likely increase with levee construction due to the reduced threat of flooding in the area but that would also be dependent on the proposed operation of pumps. According to the Corps Civil Works Program Five-Year Development Plan for Fiscal Year 2011 to Fiscal Year 2015, national flood damages are increasing and that is attributed to population migration to the coasts and development of floodplains, thus creating apparent contradiction between flood damage reduction investments and national flood damages (Corps of Engineers, 2011). Another apparent inconsistency between programs is the planning of restoration projects while at the same time levees are being proposed to enclose floodplain habitat and permits are issued for development in these floodplains. More consistency between these programs needs to address the conflicting approaches between restoration and future development. Therefore, the Corps and local sponsor should acquire adequate protection of the enclosed wetlands to ensure and maintain preservation of those areas in perpetuity via the purchase of non-development easements and local flood zoning ordinances.

THE SERVICE POSITION AND RECOMMENDATIONS

We define impacts as effects to fish and wildlife resources. Impacts may be direct or indirect. Direct impacts include all project-related construction impacts. Indirect impacts are impacts from an action that occur later in time or are farther removed in distance and may have landscape-scale implications. Indirect protected side levee and indirect unprotected levee impacts are located adjacent to levee alignment.

Construction and related activities for the proposed project will result in the direct loss of approximately 146.5 acres (-9.7 RCW AAHUs, -45.0 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. Indirect impacts are anticipated to be 3.3 acres (-6.6 RCW AAHUs; -13.8 pine warbler AAHUs) of pine savannah. Said another way, there will be 221.3 acres (-70.9 AAHUs; -9.7 RCW AAHUs; and -45.0 pine warbler AAHUs) of unavoidable adverse direct (levee and structure footprints) construction impacts. Indirect (interior and exterior wetlands) impacts that would reduce the habitat quality of 3.3 acres (-6.6 RCW AAHUs; -13.8 pine warbler AAHUs) of pine savannah habitat associated with levee construction, resulting in a total (direct and indirect impacts) of 224.6 acres and -70.9 AAHUs, -16.3 RCW AAHUs and -58.8 pine warbler AAHUs of project area habitats.

Of the total losses, there are direct losses on BBMNWR of approximately 1.2 acres (-9.7 RCW AAHUs; -2.5 pine warbler AAHUs) of pine savannah and 28.8 acres (-33.1 AAHUs) of fresh/intermediate marsh and indirect impacts to 0.25 acre (-6.6 RCW AAHUs; -1.7 pine warbler AAHUs) of pine savannah. Total direct loss to BBMNWR is 30.0 acres (-33.1 AAHUs; -9.7 RCW AAHUs; -2.5 pine warbler AAHUs) of pine savannah and fresh/intermediate marsh habitats and the indirect impacts to 0.25 acre (-6.6 RCW AAHUs; -1.7 pine warbler AAHUs) of pine savannah habitat. The total direct and indirect impacts for pine savannah and fresh/intermediate marsh on BBMNWR is 30.3 acres and -33.1 AAHUs, -16.3 RCW AAHUs and -4.2 pine warbler AAHUs.

The Service does not oppose construction of the proposed project provided that the fish and wildlife conservation recommendations are included and adequately addressed in the feasibility report and related authorizing documents.

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.
2. Indirect impacts to pine savannah habitat (-6.62 AAHUs) on the BBMNWR are required to be mitigated for on refuge lands.
3. Species of vegetation, planted and maintained on levees or levee slopes, should be closely coordinated with the Service.
4. All project related activities on the refuge must be coordinated with Refuge Project Leader Neil Lalonde (985-882-2000).
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.
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.
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 to enhance organism passage. Various ramp designs should be considered. Please coordinate with the National Marine Fisheries Service (NMFS), Alexis Rixner (alexis.rixner@noaa.gov) on this issue.

8. To offset fish and wildlife impacts to the Mile Branch stream bottom, the Service recommends the USACE develop a backwater area project feature to account for stream bottom impacts as proposed during the planning phase of the STP FS.
9. To minimize impacts to Mile Branch, the USACE should assess whether the existing culverts are of sufficient size to allow for adequate drainage or if larger size culverts are needed. If larger culverts are being installed, the USACE should assess whether these larger structures would preclude the need to widen and deepen the channel. In addition, the USACE should assess whether debris build-up at bridges and/or culverts is blocking/limiting conveyance of floodwaters. If obstructions in the waterway are present and removal would allow for adequate flow during flood events, then the less damaging snagging and clearing should be conducted in place of widening and deepening the canal. Should snagging and clearing be included as a feature of the project, those activities should follow the techniques described within the Stream Obstruction Removal Guidelines (Appendix 1) or nature-based engineering techniques should be used to accomplish the work in the least damaging manner possible.
10. Mile Branch and Bayou Liberty are each a Louisiana designated Natural and Scenic River. LDWF should review the projects affecting each stream and determine if a Scenic River Permit will be required. The USACE shall initiate consultation with the LDWF Scenic Rivers Program prior to conducting any activities within or adjacent to the banks of either stream. Scenic Rivers Coordinator Chris Davis can be contacted at (225)765-2642.
11. 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.

12. The Service recommends the development of a Pine Savannah Community Model and a Stream/Riparian Community Model, including Ecosystem Restoration Planning Center of Expertise (ECO-PCX) approval. These tools will be used for evaluating mitigation credits and refining project impacts during later project phases. The Service is currently using FWS Habitat Evaluation Procedures (HEP) for pine savannah habitat evaluations and bottomland hardwood WVAs because there are no user-friendly ECO-PCX approved evaluation tools for pine savannah and stream/riparian habitats. These more appropriate tools would be community models based on the habitat's ecology and important indicator species. Without these models, the analysis of impacts and mitigation may be inaccurately estimated.
13. 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 will 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.
14. 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 (March 1 to July 31).
15. 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.
16. If it becomes necessary to use borrow sources other than the previously proposed environmentally cleared sites, the Service recommends the 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.
17. 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.
18. 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., September 1 through

February 15).

19. West Indian manatees occasionally enter Lakes Pontchartrain and Maurepas and associated coastal waters and streams during the summer months (i.e., June 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.
20. 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 dragonhead, alligator snapping turtle, Eastern diamondback rattlesnake, and Pearl River map turtle.
21. A Biological Assessment should be prepared to identify potential direct and indirect impacts to federally listed threatened and endangered species that occur within the project impact area. Those species include the West Indian manatee, Gulf sturgeon, gopher tortoise, and red-cockaded woodpecker. The USACE should determine if the potential impacts identified would "likely (or not likely) adversely affect" those species.
22. 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.

We appreciate the cooperation of your staff on this study. We look forward to our continued coordination with you to further protect fish and wildlife resources. If you need additional assistance or have questions regarding this letter, please contact Karen Soileau (337/291-3132) of this office.

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APPENDIX 1

Stream Obstruction Removal Guidelines

prepared by

Stream Renovation Guidelines Committee,
The Wildlife Society and American Fisheries Society

in cooperation with

INTERNATIONAL ASSOCIATION OF FISH AND WILDLIFE AGENCIES

1983

These guidelines were prepared by the Stream Renovation Guidelines Committee, a joint committee of The Wildlife Society and the American Fisheries Society. They were prepared at the request of the International Association of Fish and Wildlife Agencies. Committee members who participated in the effort were:

Chester McConnell, Chairman, TWS and AFS, Tennessee
Allen Binns, AFS, Wyoming
Errol Claire, AFS, Oregon
Donald Duff, AFS, Utah
James Karr, TWS, Illinois
Gerald Montgomery, TWS, Tennessee
David Parsons, TWS, Tennessee
James Sedell, AFS, Oregon
Monte Seehorn, AFS, Georgia

The guidelines were patterned after similar versions that have been used successfully on projects in several states. The Stream Renovation Guidelines Committee revised, reorganized and expanded earlier versions to make them applicable on an international basis.

The International Association of Fish and Wildlife Agencies hopes that these "Stream Obstruction Removal Guidelines" will be appropriately used as guidance by agencies, organizations and landowners in the management and protection of our valuable stream ecosystems.

James A. Timmerman, Jr., PhD, President
International Association of Fish and Wildlife Agencies

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Introduction

The intent of these guidelines is to aid in correcting stream flow problems, caused by obstructions, in an environmentally sound manner and to maintain natural stream characteristics. They are a positive alternative, designed to protect natural resources, to be used when a government agency or other interests are considering channelization, clearing and snagging, or other severe stream modifications. The purpose is not to generate projects but to provide a sound alternative that will lessen adverse impacts when a decision has been made to correct stream flow problems.

Many important, interrelated factors that influence streams are not addressed in these guidelines. For example, they do not provide management suggestions for watershed, floodplain or riparian areas, nor do they provide instructions for development of specific instream fish habitat features. Information concerning these aspects is readily available in various publications.

Debris, sediment and channel structure play an important role in maintaining the integrity of aquatic ecosystems but sometimes excessive amounts cause problems that man seeks to correct. In cases where excessive debris and/or fine sediment have no significant impact on societal values, no work need be done. Persons interested in wild natural resources oppose destructive, structural stream modification practices and favor nonstructural measures in most instances. It is recognized, however, that unwise land use and abusive stream use practices often diminish the flow capacities of streams to the extent that corrective action is demanded. Development interests and flood-damaged communities often successfully promote drastic stream modifications to achieve some desired level of water conveyance or flood relief. When planners seek solutions to stream flow problems, nonstructural measures should always be used to correct the problems when practical. In cases where it is inappropriate or infeasible to address flow problems with no action or nonstructural alternatives, the obstruction removal alternative in accordance with these guidelines is recommended as the preferred alternative.

The guidelines shall be applied and monitored by an interdisciplinary team of experts knowledgeable about local conditions. This is essential to successful implementation. The team shall be responsible for classifying the various stream reaches and monitoring ongoing and completed work for compliance.

These guidelines are only applicable to situations where channel blockages result in unacceptable flow problems and where restoration of the natural or former flow capacity of the channel is desired. The combination of obstruction removal and various nonstructural alternatives should be thoroughly examined before it is determined that more drastic channel modification is the only feasible solution. In either case, natural resource agencies may seek mitigation of unavoidable ecological damages.

These guidelines have been designed for broad application and, by necessity, are quite general. Users are encouraged to adapt these concepts to specific local situations.

Application of these guidelines requires the following sequential actions:

1. establish interdisciplinary team of experts,
2. classify stream reaches according to degree of flow problems and biological sensitivity,
3. specify extent and methods of removal for each flow condition,
4. monitor ongoing work to insure compliance, and
5. establish maintenance provisions.

Anyone considering work in streams should be aware that federal and/or state legal requirements may be applicable. In addition, use of guidelines, such as the Channel Modification Guidelines developed jointly by the U.S. Soil Conservation Service and the U.S. Fish and Wildlife Service and some state agency guidelines, may be required.

Definition of Stream Obstruction Conditions

Condition One

These stream segments have acceptable flow and no work would be required. They may contain various amounts of instream debris and fine sediment, such as silt, sand, gravel, rubble, boulders, logs and brush. In certain situations flow may be impeded, but due to stream and land classification or adjacent land-use, this is not a problem.

Condition Two

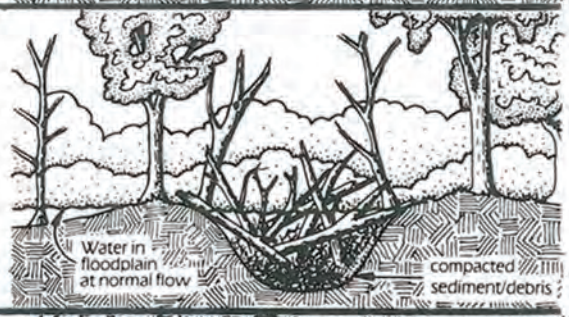
These stream segments currently have no major flow impediments, but existing conditions are such that obstructions are likely to form in the near future, causing unacceptable problems. This condition is generally characterized by small accumulations of logs and/or other debris which occasionally span the entire stream width. Accumulations are isolated, not massive and do not presently cause upstream ponding damages.

Condition Three

These stream segments have unacceptable flow problems. Obstructions are generally characterized by large accumulations of lodged trees, root wads, and/or other debris that frequently span the entire stream width. Although impeded, some flow moves through the obstruction. Large amounts of fine sediment have not covered or lodged in the obstruction.

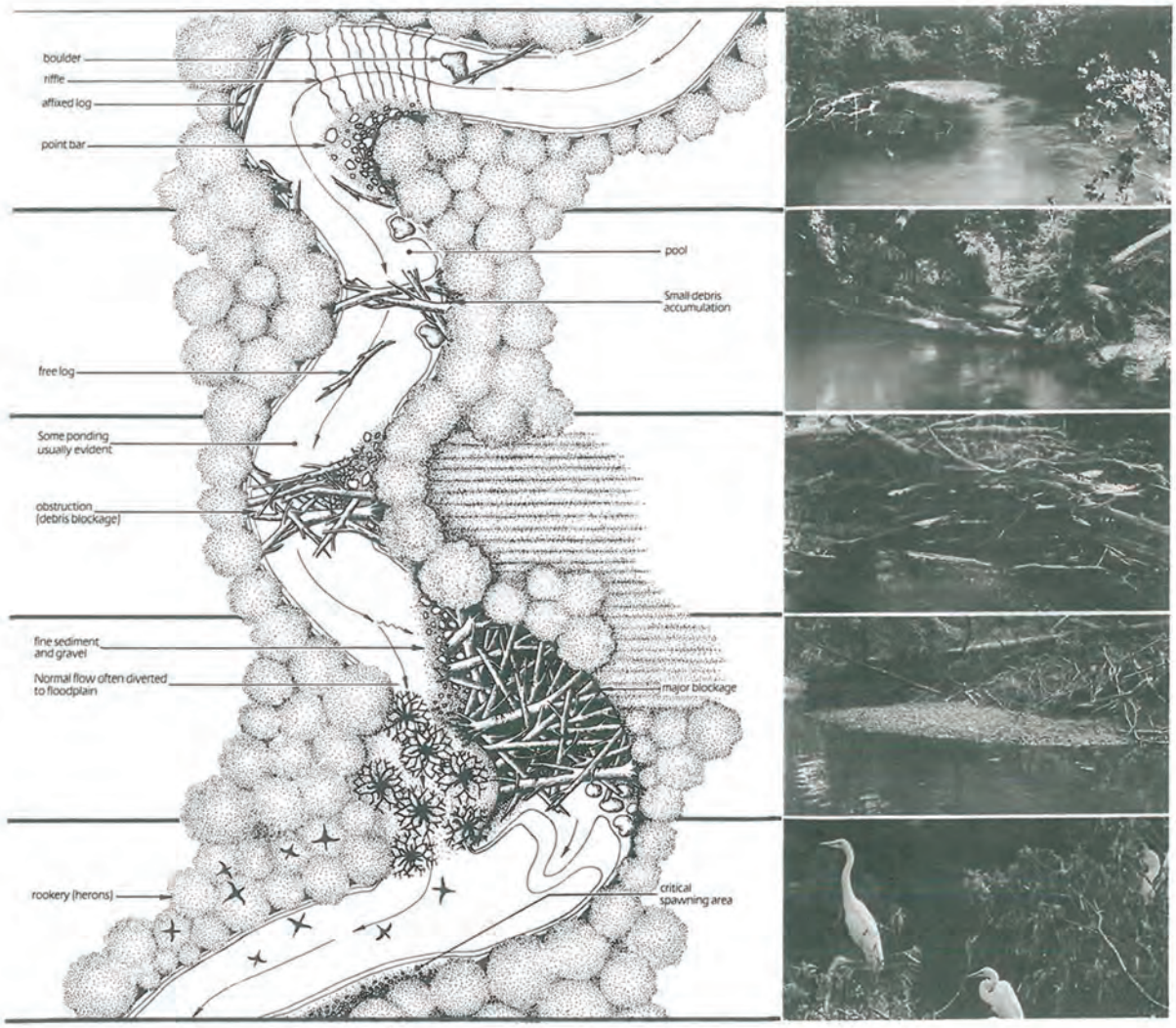
Condition Four

These stream segments are characterized by major blockages causing unacceptable flow problems. Obstructions consist of compacted debris and/or sediment that severely restricts flow.



Condition Five

These stream segments possess unique, sensitive, or especially valuable biotic resources and should be dealt with on a case-by-case basis. Examples include, but are not limited to: Areas harboring rare or endangered species, shellfish beds, fish spawning and rearing areas, and rookeries.


boulder
riffle
affixed log
point bar
pool
Small debris accumulation
free log
Some ponding usually evident
obstruction (debris blockage)
fine sediment and gravel
Normal flow often diverted to floodplain
major blockage
rookery (herons)
critical spawning area

3

Materials That May Be Removed

Fine Sediment

Only those fine sediment accumulations that are obstructing flows to a degree that results in unacceptable flow problems may be removed (Figure 1). Small accumulations of fine sediment generally do not cause problems and should be left undisturbed (Figure 2).

Debris Blockages

Only those debris accumulations that are obstructing flows to a degree that results in unacceptable flow problems, or are likely to cause problems in the near future, may be removed (Figure 3). Small accumulations of debris generally do not cause problems and should be left undisturbed (Figure 4).

Affixed logs that are crossways in the channel that are causing problems or are likely to cause problems in the near future should be moved to a more parallel orientation or may be removed (Figure 5). Isolated or single logs shall not be disturbed if they are embedded, lodged, or rooted in the channel and are not causing flow problems (Figure 6). Generally, embedded logs that do not span the channel are not considered to cause problems and should not be removed.

Free logs that are not rooted, embedded, or lodged should be left, repositioned, affixed, or may be removed (Figure 7).

Gravel, rubble, and boulders in isolated accumulations normally do not cause flow problems and should not be removed (Figure 8). Accumulations that are causing flow problems should be repositioned or may be removed.

Rooted Trees

Rooted trees (alive or dead) may be cut and repositioned or removed if they are likely to cause problems in the near future or if their removal is required to secure access and provide for practical operation of equipment (Figures 9, 10). Tree stumps with roots should be left in place to prevent bank erosion (Figure 11).

Figure 1. **Fine sediments (silt and sand) have completely filled this stream segment. About 98 percent of the stream water now flows across the floodplain on both sides of the stream and cannot be seen in this photograph. Such accumulations may be removed.**

Figure 2. **Small accumulation of silt, sand and gravel should be left undisturbed. It is not obstructing flow and it provides beneficial habitat for fish and other aquatic life.**

Figure 3. **Debris accumulation obstructing flow and is likely to cause additional problems. Such accumulations may be removed.**

Figure 4. **Small accumulation of debris on the inside of the stream channel bend is causing no flow problems. Such material is beneficial to fish and other aquatic life and should be left undisturbed. As a preventative measure, some of the debris could be cut above the water to keep other debris from becoming lodged.**

Figure 5. Log crossways of stream channel, trapping additional debris and restricting flow. Flow problems are likely to increase in the near future. Such accumulations may be removed.

Figure 7. Free log in stream channel currently causing no flow problems. Such logs should be left, repositioned, affixed, or may be removed.

Figure 6. Single log with one end lodged on stream bank and the other embedded in the stream bottom. If no flow problems are associated with such logs they should be left in place.

Figure 8. Isolated accumulation of gravel and rubble causing no flow problems. Such accumulations should be left in place. These areas are essential for some forms of aquatic life.

Figure 9. Dead tree leaning across stream is likely to fall in the near future and may be cut.

Figure 10. Cut tree repositioned along stream bank to aid in preventing bank erosion and to provide fish habitat.

Figure 11. Tree stump with roots left in place to prevent bank erosion. Valuable fish habitat was also salvaged.

Material Removal

General Criteria

No stream work, including bank clearing, repositioning, or removal of material, should be allowed except at specific locations where unacceptable flow problems occur or may occur in the near future. Where stream work is needed, access routes for equipment should be selected to minimize disturbance to the floodplain and riparian areas (Figure 12). Channel excavation and debris removal also should be accomplished in a manner that minimizes clearing of vegetation. The smallest equipment feasible should be used. If tributaries or distributaries must be disturbed by the project, they shall be restored when the work is completed. All disturbed areas shall be reseeded or replanted with plant species which will stabilize soils and benefit fish and wildlife.

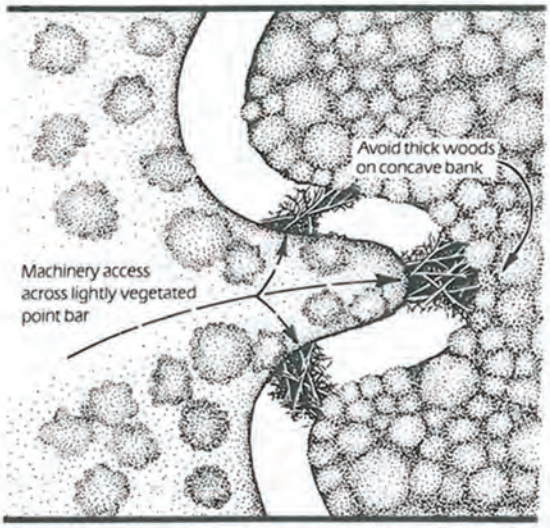


Figure 12. **Schematic plan for machinery access to selected debris blockages designed to protect stream bank vegetation.**

Specific Criteria

Condition One Segments. No work shall be conducted in Condition One Segments.

Condition Two Segments. Equipment that will cause the least damage to the environment shall be selected for performing the work. First consideration will be given to the use of hand operated equipment such as axes, chain saws, and winches to remove accumulations (Figure 13). Boats with motors may be used where needed (Figure 14). When the use of hand operated equipment is not feasible, heavier equipment may be used. Examples include: small tractors, backhoes, bulldozers, log skidders, and low PSI equipment (Figure 15). Equipment shall be operated in a manner that results in the least damage to vegetation and soils of the project area. In some cases explosives may be used resulting in less damage. Debris designated for removal from the stream or floodway should be removed or secured in such a manner as to restrict its re-entry into the channel. Generally, it should be positioned so as to reduce flood flow impediment.

Condition Three Segments. Equipment limitations will be the same as for condition two segments. Work shall be accomplished within the channel or from one side of the channel where possible (Figure 16). Selective tree clearing shall be limited to the minimum clearing necessary for equipment access and efficient operation of equipment on the worked side of the channel. Disposal of material may be accomplished by removing it from the floodplain or by burning, burying, or piling, as appropriate, with the minimum amount of disturbance to vegetation. Piled debris shall be gapped at frequent intervals and at all tributaries and distributaries.

Condition Four Segments. Blockage removal may employ any equipment necessary to accomplish the work in the least damaging manner (Figure 17). Work should be accomplished from one side of the channel, where practical. Material shall be disposed in accordance with guidelines presented above for condition three segments (Figure 18). Spoil piles should be constructed as high as sediment properties allow. The placement of spoil around the bases of mature trees should be avoided.

Condition Five Segments. Special provisions for protecting unique, sensitive, or productive biotic resources shall be developed by appropriate professionals on a case by case basis.

Subsequent Maintenance

Stream conditions shall be monitored on a regular basis and maintenance work shall be conducted in accordance with the guidance contained herein.

Figure 13. **Chainsaw being used to cut log so that it can be pulled with small hand winch and repositioned along stream bank.**

Figure 14. Hand labor crew in boat hooking cable to log. The small crawler tractor with winch will pull the log from the stream. Small equipment can be carefully maneuvered through the floodplain forest causing little damage.

Figure 17. Dragline being used to remove compacted debris and sediment at major blockage (Condition Four).

Figure 15. Hand labor crew hooking cable to log to be pulled from stream by small crawler tractor with winch. Only a narrow work zone along the stream was disturbed because of the small equipment. Note stump left in place to stabilize bank.

Figure 18. Large dead tree removed from stream, pulled onto the floodplain and positioned to prevent its re-entry into the channel.

Figure 16. Debris and sediment removal was accomplished by working from one side of the stream. Selected trees were cleared to allow equipment access and operation. Trees have now grown back on the cleared side.

Glossary

blockage Organic and inorganic materials which completely span or fill the channel causing water to pond or to be diverted onto the floodplain.

debris Includes gravel, cobble, rubble, and boulder-sized sediments as well as trees and other organic material.

distributary Any channel or outlet that conveys water away from a stream.

fine sediment Silt and sand-sized materials.

floodplain A plain along a stream that is covered by water when the stream overflows its bank.

flow impediment Any material in a channel which reduces the velocity of and retards flow, i.e. an obstruction.

interdisciplinary team A group of persons having expert knowledge in various disciplines including fish, wildlife, engineering, hydrology, and geomorphology.

low PSI equipment Equipment with wide tracks or large inflatable tires that lower the ratio of equipment weight to track surface. (PSI = pounds per square inch)

nonstructural measures Measures that reduce flood damages without altering the stream or its overflow characteristics. Nonstructural measures may include, but are not limited to:Land-use regulation, land acquisition, providing for the maintenance of aquatic areas, floodplain zoning, flood-proofing existing buildings, flood forecasting, flood warning, providing flood hazard information, flood insurance, tax adjustments, emergency assistance, and relocation of properties and people.

obstruction Any material which hinders the progress of stream flow, i.e. a flow impediment.

ponding An increase in water surface elevation upstream of a blockage or an obstruction.

riparian Relating to or living on or near the bank of a watercourse. These zones range in width from narrow bands in desert or mountainous areas to wide bands which occur in the piedmont and gulf states.

structural measures Artificial measures designed to reduce flood damages by altering the stream and/or its overflow characteristics. Examples include: channelization, reservoirs, floodways, dikes, levees, floodwalls, pumping plants, and diversions.

tributary Any channel or inlet that conveys water into a stream.

APPENDIX 2

SCIENTIFIC NAMES FOR SPECIES DISCUSSED IN REPORT

Threatened and Endangered Species

gopher tortoise	*Gopherus polyphemus*
Gulf sturgeon	*Acipenser oxyrhynchus desotoi*
red-cockaded woodpecker	*Picoides borealis*
ringed map turtle	*Graptemys oculifera*
West Indian manatee	*Trichechus manatus*

Amphibians

barking treefrog	*Hyla gratiosa*
bog salamander	*Eurycea* spp.
Brimley's chorus frog	*Pseudacris brimleyi*
bullfrog	*Lithobates catesbeianus*
crawfish frog	*Rana areolate*
dwarf salamander	*Eurycea quadridigitata*
E. narrow-mouthed toad	*Gastrophryne carolinensis*
Eastern newt	*Notophthalmus viridescens*
Eastern spadefoot	*Scaphiopus holbrookii*
flatwoods salamander	*Ambystoma cingulatum*
gopher frog	*Rana capito*
green frog	*Rana clamitans*
green tree frog	*Hyla cinerea*
Gulf coast toad	*Incilius valliceps*
lesser siren	*Siren intermedia*
little grass frog	*Pseudacris ocularis*
Mabee's salamander	*Ambystoma mabeei*
Northern cricket frog	*Acris crepitans*
oak toad	*Bufo quercicus*
ornate chorus frog	*Pseudacris ornate*
pig frog	*Rana grylio*
pinewoods treefrog	*Hyla femoralis*
Southern chorus frog	*Pseudacris nigrita*
Southern dusky salamander	*Desmognathus auriculatus*
southern leopard frog	*Lithobates sphenocephalus*
spring peeper	*Pseudacris crucifer*
squirrel treefrog	*Hyla squirella*
striped newt	*Notophthalmus perstriatus*
three-toed amphiuma	*Amphiuma tridactylum*
tiger salamander	*Ambystoma tigrinum*

Reptiles

alligator snapping turtle	*Macrochelys temminckii*

American alligator	*Alligator mississippiensis*
broadhead skink	*Plestiodon laticeps*
common garter snake	*Thamnophis sirtalis*
cottonmouth	*Agkistrodon piscivorus*
Eastern black kingsnake	*Lampropeltis getula*
Eastern coral snake	*Micrurus fulvius*
E. diamondback rattlesnake	*Crotalus adamanteus*
Eastern indigo snake	*Drymarchon corais*
Eastern mud turtle	*Kinosternon subrubrum*
Florida crowned snake	*Tantilla relicta*
green anole	*Anolis carolinensis*
Gulf Coast ribbon snake	*Thamnophis proximus*
little brown skink	*Scincella lateralis*
mimic glass lizard	*Ophisaurus mimicus*
mole skink	*Eumeces egregious*
mud snake	*Farancia abacura*
Pascagoula map turtle	*Graptemys gibbonsi*
Pearl River map turtle	*Graptemys pearlensis*
pine snake	*Pituophis melanoleucus*
pine woods snake	*Rhadinaea flavilata*
rat snake	Colubridae
red-eared slider	*Trachemys scripta elegans*
scarlet snake	*Cemophora coccinea*
short-tailed snake	*Stilosoma extenuatum*
snapping turtles	Chelydridae
Southern hognose snake	*Heterodon simus*
water snakes	Colubridae

Birds

American avocet	*Recurvirostra americana*
American coot	*Fulica americana*
American kestrel	*Falco sparverius*
American widgeon	*Mareca americana*
American woodcock	*Scolopax minor*
anhinga	*Anhinga anhinga*
Bachman's sparrow	*Aimophila aestivalis*
bald eagle	*Haliaeetus leucocephalus*
barn owl	*Tyto alba*
barred owl	*Strix varia*
belted kingfisher	*Megaceryle alcyon*
black-bellied plover	*Pluvialis squatarola*
black-crowned night-heron	*Nycticorax nycticorax*
black-necked stilt	*Himantopus mexicanus*
black skimmer	*Rynchops niger*
blue-winged teal	*Anas discors*
broad-winged hawk	*Buteo platypterus*
brown-headed nuthatch	*Sitta pusilla*

cattle egret	*Bubulcus ibis*
clapper rail	*Rallus crepitans*
common gallinule	*Gallinula galeata*
common screech owl	*Megascops asio*
common snipe	*Gallinago gallinago*
cuckoos	*Cuculus* spp.
double-crested cormorant	*Phalacrocorax auritus*
egrets	Ardeidae
gadwall	*Mareca strepera*
golden-winged warbler	*Vermivora chrysoptera*
great blue heron	*Ardea herodias*
great egret	*Ardea alba*
great horned owl	*Bubo virginianus*
green heron	*Butorides virescens*
gulls	Laridae
herons	Ardeidae
hummingbirds	Trochilidae
ibis	Threskiornithidae
killdeer	*Charadrius vociferus*
least bittern	*Ixobrychus exilis*
lesser scaup	*Aythya affinis*
little blue heron	*Egretta caerulea*
mallard	*Anas platyrhynchos*
Mississippi kite	*Ictinia mississippiensis*
mottled duck	*Anas fulvigula*
nighthawks	Caprimulgidae
Northern bobwhite	*Colinus virginianus*
Northern harrier	*Circus hudsonius*
Northern parula	*Setophaga americana*
pied-billed grebe	*Podilymbus podiceps*
pine warbler	*Setophaga pinus*
rails	*Rallidae* spp.
red-shouldered hawk	*Buteo lineatus*
red-tailed hawk	*Buteo jamaicensis*
reddish egret	*Egretta rufescens*
roseate spoonbill	*Platalea ajaja*
royal tern	*Thalasseus maximus*
sandpipers	Scolopacidae
seaside sparrow	*Ammodramus maritimus*
swallow-tailed kite	*Elanoides forficatus*
swifts	Apodidae
tricolored heron	*Egretta tricolor*
white-breasted nuthatch	*Sitta carolinensis*
white-eyed vireo	*Vireo griseus*
willet	*Tringa semipalmata*
Wilson’s plover	*Charadrius wilsonia*
wood duck	*Aix sponsa*
woodpeckers	Picidae

yellow-crowned night-heron	*Nycticorax nycticorax*

Mammals

Bats	Chiroptera
Eastern cottontail	*Sylvilagus floridanus*
Florida mouse	*Podomys floridanus*
fox squirrel	*Sciurus niger*
gray squirrel	*Sciurus carolinensis*
mink	*Neogale vison*
muskrat	*Ondatra zibethicus*
nine-banded armadillo	*Dasypus novemcinctus*
nutria	*Myocastor coypus*
raccoon	*Procyon lotor*
river otter	*Lontra canadensis*
Southeastern pocket gopher	*Geomys pinetus*
swamp rabbit	*Sylvilagus aquaticus*
tricolored bat	*Perimyotis subflavus*
white-tailed deer	*Odocoileus virginianus*

Fish

alligator gar	*Atractosteus spatula*
anchovies	*Engraulidae* spp.
Atlantic croaker	*Micropogonias undulatus*
blackbanded darter	*Percina nigrofasciata*
black drum	*Pogonias cromis*
blue crab	*Callinectes sapidus*
brown shrimp	*Farfantepenaeus aztecus*
common grass shrimp	*Palaemonetes vulgaris*
dusky darter	*Percina sciera*
fat sleeper	*Dormitator maculatus*
frecklebelly madtom	*Noturus munitus*
gaff-topsail catfish	*Bagre marinus*
gobies	*Gobiidae* spp.
Gulf darter	*Etheostoma swaini*
Gulf killifish	*Fundulus grandis*
Gulf menhaden	*Brevoortia patronus*
Johnny darter	*Etheostoma nigrum*
longnose killifish	*Fundulus similis*
naked sand darter	*Ammocrypta beani*
red drum	*Sciaenops ocellatus*
redspot darter	*Etheostoma artesiae*
rough silverside	*Membras martinica*
saltmarsh topminnow	*Fundulus jenkinsi*
sand seatrout	*Cynoscion arenarius*
scaled sardine	*Harengula jaguana*
sheepshead minnow	*Cyprinodon variegatus variegatus*

sheepshead	*Archosargus probatocephalus*
southern flounder	*Paralichthys lethostigma*
southern sand darter	*Ammocrypta meridiana*
spot	*Leiostomus xanthurus*
spotted seatrout	*Cynoscion nebulosus*
striped mullet	*Mugil cephalus*
white mullet	*Mugil curema*
white shrimp	*Litopenaeus setiferus*

Mollusks

Alabama hickorynut	*Obovaria unicolor*

Insects

Appalachian snaketail	*Ophiogomphus incurvatus*
arogos skipper	*Atrytone arogos*
Eastern beard grass skipper	*Atrytone arogos arogos*
fire ants	*Solenopsis invicta*
monarch butterfly	*Danaus plexippus plexippus*
Southern snaketail	*Ophiogomphus australis*

Plants

alligatorweed	*Alternanthera philoxeroides*
beak-rushes	*Rhynchospora* spp.
big bluestem	*Andropogon gerardii*
black gum	*Nyssa sylvatica*
blackjack oak	*Quercus marilandica*
bladderworts	*Utricularia* spp.
blazing-stars	*Liatris* spp.
bog buttons	*Lachnocaulon* spp.
bog thistle	*Eryngium integrifolium*
broomsedge	*Andropogon virginicus*
bulltongue arrowhead	*Sagittaria lancifolia*
butterworts	*Pinguicula* spp.
cattail	*Typha latifolia*
Chinese privet	*Ligustrum sinen*se
coastal waterhyssop	*Bacopa monnieri*
common reed	*Phragmites australis*
Correll's false dragon-head	*Physostegia correllii*
cottonwood	*Populus deltoides*
fetter bush	*Lyonia lucida*
fimbry-sedge	*Fimbristylis* spp.
fringed-orchids	*Platanthera* spp.
gerardias	*Agalinis* spp.
giant white top sedge	*Dichromena latifolia*
hairawn muhly	*Muhlenbergia capillaris*

Japanese climbing fern	*Lygodium japonicum*
jointgrasses	*Coelorachis* spp.
knapweeds	*Centaurea* spp.
laurel oak	*Quercus laurifolia*
little bluestem	*Schizachyrium scoparium*
live oak	*Quercus virginiana*
lobelias	*Lobelia* spp.
loblolly pine	*Pinus taeda*
longleaf pine	*Pinus palustris*
lopsided Indiangrass	*Sorghastrum secundum*
maidencane	*Panicum hemitomon*
meadow beauties	*Rhexia* spp.
milkweeds	*Asclepias* spp.
milkworts	*Polygala* spp.
narrow-leaved hog-fennel	*Oxypolis filiformis*
nut-rushes	*Scleria* spp.
panic grasses	*Panicum* spp.
pipeworts	*Eriocaulon* spp.
pitcher plants	*Sarracenia* spp.
plume-grasses	*Erianthus* spp.
pondweeds	*Potamogeton* spp.
red maple	*Acer rubrum*
reed grass	*Calamovilfa brevipilis*
rose-gentians	*Sabatia* spp.
saltmeadow cordgrass	*Spartina patens*
slash pine	*Pinus elliottii*
slender bluestem	*Schizachyrium tenerum*
greenbriers	*Smilax* spp.
Sebastian bush	*Sebastiana fruticose*
southern magnolia	*Magnolia grandiflora*
southern waternymph	*Najas guadalupensis*
spikerush	*Eleocharis palustris*
St. John’s wort	*Hypericum perforatum*
starbush	*Illicium floridanum*
sundews	*Drosera* spp.
sweet bay magnolia	*Magnolia virginiana*
sweetgum	*Liquidambar styraciflua*
thistles	*Cirsium* spp.
three-awn grasses	*Aristida* spp.
toothache grass	*Ctenium aromaticum*
umbrella grasses	*Fuirena* spp.
water oak	*Quercus nigra*
wax myrtle	*Myrica cerifera*
winterberry	*Ilex verticillate*
yaupon	*Ilex vomitoria*
yellow-eyed grasses	*Xyris* spp.