ST. TAMMANY PARISH, LOUISIANA FEASIBILITY STUDY REVISED DRAFT INTEGRATED FEASIBILITY REPORT WITH DRAFT ENVIRONMENTAL IMPACT STATEMENT

THREATENED AND ENDANGERED SPECIES BIOLOGICAL ASSESSMENT

June 22, 2023

The Fish and Wildlife Service (Service) has reviewed the information provided and offers the following comments in accordance with provisions of the Endangered Species Act (ESA) of 1973 (87 Stat. 884 as amended, 16 U.S.C. 1531 et seq.). Based on the justification given by the U.S. Army Corps of Engineers (USACE), we concur with the USACE's determination that the proposed action is not likely to adversely affect the federally listed and/or proposed species and their critical habitats as described herein.

We recommend 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 because of any of the above conditions or for changes not covered in this consultation should occur before changes are made and or finalized.

BRIGETTE FIRMIN Digitally signed by BRIGETTE FIRMIN Date: 2023.09.20 15:06:44 -05'00'

Brigette D. Firmin DATE
Field Supervisor
Louisiana Ecological Services Office

The purpose of this Biological Assessment (BA) is to assess the effects of the proposed project and determine whether the project may affect any Federally threatened, endangered, proposed or candidate species. This BA is prepared in accordance with legal requirements set forth under Section 7 of the Endangered Species Act (16 U.S.C. 1536 (c)).

Table of Contents

1 Description of the Action 5
1.1 Project Name 5
1.2 Introduction 5
1.3 Project Description 6
1.3.1 Location 7
1.3.2 Description of the Project Habitat 7
1.3.3 Project Proponent Information 9
1.3.4 Project Purpose 9
1.3.5 Project Type and Deconstruction 10
1.3.6 Anticipated Environmental Stressors 25
1.4 Action Area 28
1.5 Conservation Measures 29
1.5.1. Gulf Sturgeon 29
1.5.2 West Indian Manatee 29
1.5.3 Alligator Snapping Turtle 29
2 Species Affects Analysis 30
2.1 Gopher Tortoise (*Gopherus polyphemus*) 30
2.1.1 Status of the Species 30
2.1.2 Environmental Baseline 31
2.1.3 Effects of the Action 35
2.1.4 Cumulative Effects 36
2.1.5 Discussion and Conclusion 36
2.2 Gulf Sturgeon (*Acipenser oxyrinchus desotoi*) 37
2.2.1 Status of the Species 37
2.2.2 Environmental Baseline 38
2.2.3 Effects of the Action 40
2.2.4 Cumulative Effects 41
2.2.5 Discussion and Conclusion 41
2.3 Louisiana Quillwort (*Isoetes louisianensis*) 43
2.3.1 Status of the Species 43
2.3.2 Environmental Baseline 44
2.3.3 Effects of the Action 46

2.3.4 Cumulative Effects 46
2.3.5 Discussion and Conclusion 46
2.4 Red-Cockaded Woodpecker (*Picoides borealis*) 47
2.4.1 Status of the Species 47
2.4.2 Environmental Baseline 48
2.4.3 Effects of the Action 50
2.4.4 Cumulative Effects 51
2.4.5 Discussion and Conclusion 51
2.5 West Indian Manatee (*Trichechus manatus*) 52
2.5.1 Status of the Species 52
2.5.2 Environmental Baseline 53
2.5.3 Effects of the Action 55
2.5.4 Cumulative Effects 55
2.5.5 Discussion and Conclusion 55
3 Critical Habitat Effects Analysis 57
4 Summary Discussion, Conclusion, and Effect Determinations 59
4.1 Effect Determination Summary 59
4.2 Summary Discussion 59
4.3 Conclusion 60
5 References 61

Appendices

Appendix A Detailed Project Description

Appendix B IPaC report and USFWS email confirmation

Appendix C Species Recovery Plans and Status Assessment Reports

Appendix C-1: Gopher Tortoise Recovery Plan and Species Status Assessment Report

Appendix C-2 Gulf Sturgeon Recovery/Management Plan

Appendix C-3: Louisiana Quillwort Recovery Plan

Appendix C-4: Red-cockaded Woodpecker Recovery Plan

Appendix C-5: West Indian Manatee Recovery Plan

Appendix D Conservation Measures

Appendix D-1: Protected Species Construction Conditions

Appendix D-2: Vessel Strike Avoidance Measures

Appendix D-3: Standard Manatee Conditions for In-Water Activities

Appendix D-4: Alligator Snapping Turtle Conservation Measures

Appendix E Species Habitat Analysis

Appendix E-1: Gopher Tortoise Survey

Appendix E-2: Red-cockaded woodpeckers habitat foraging analysis

1 Description of the Action

1.1 Project Name

St. Tammany Parish, Louisiana Feasibility Study - Revised Draft Integrated Feasibility Report with Draft Environmental Impact Statement

1.2 Introduction

Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended, requires that “Each Federal agency shall in consultation with and with the assistance of the secretary, insure that any action authorized, funded or carried out by such agency…is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species…”

The U.S. Army Corp of Engineers (USACE), New Orleans District (MVN), has prepared this Biological Assessment (BA) to evaluate the potential impacts associated with the proposed flood risk reduction project, St. Tammany Parish, Louisiana Feasibility Study. This BA provides the information required pursuant to the ESA and implementing regulation (50 CFR 402.13), to comply with the ESA. Additional legal authorities include the National Environmental Policy Act (NEPA) of 1969, 42 U.S.C. section 4321, et seq.; the Fish and Wildlife Conservation Act of 1958 (PL 85-624; 16 U.S.C. 661 et seq.); the Marine Mammal Protection Act of 1972 (MMPA); and the Migratory Bird Treaty Act of 1918 (MBTA). A BA has been submitted to the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) by the USACE, MVN to initiate informal consultation regarding potential impacts to threatened and endangered species from construction related to St. Tammany Parish, Louisiana Feasibility Study. This BA addresses impacts from the proposed action to species within USFWS jurisdiction. A separate BA was submitted to the NMFS to address species and critical habitat within NMFS jurisdiction.

A search on the USFWS’ Information for Planning and Consulting (IPaC) site, conducted on February 23, 2023, resulted in a list of ESA-listed species that should be considered when assessing the impacts of this project. That list includes the alligator snapping turtle, eastern black rail, West Indian manatee, red-cockaded woodpecker, gopher tortoise, ringed map turtle, Gulf sturgeon, Louisiana quillwort, monarch butterfly, and Gulf sturgeon Critical Habitat. Only impacts to the West Indian manatee, Louisiana quillwort, Gulf sturgeon, Gulf sturgeon critical habitat, Gopher tortoise, and red-cockaded woodpecker are discussed in this BA.

Email correspondence with USFWS determined that the black rail is known to occur in the Gulf Coast Chenier Plain of Louisiana (specifically Cameron and Vermilion Parishes); Since the proposed action would not impact this area, "no effect"

determination can be made for this species. Additionally, a “no effect” determination can be made for the ringed map turtle as it’s known range in Louisiana, the Pearl and Bogue Chitto Rivers, would not be impacted by the proposed project.

The monarch butterfly is listed in the ESA as a “candidate” species. Candidate species receive no protections under the ESA. Should a listing decision be made prior to completion of the proposed action, CEMVN will reinitiate consultation with the USFWS.

The alligator snapping turtle is listed in the ESA as “proposed threatened”. Proposed species are not protected by the take prohibitions of Section 9 of the ESA until the rule to list is finalized. Under section 7(a)(4) of the ESA, Federal agencies must confer with the Service if their action will jeopardize the continued existence of a proposed species. Correspondence between the USFWS and USACE determined a conference is not necessary because of the scale of the project relative to the range of this species and the availability of suitable habitat (Appendix B). Measures to minimize impacts to the alligator snapping turtle provided by the USFWS is included in Section 1.5.3.

Marine Mammal Protection Act prohibits the take (i.e., harass, hunt, capture, or kill) of all marine mammals. The responsibilities for the protection, conservation, and management of marine mammals are shared by the U.S. Fish and Wildlife Service and NOAA Fisheries. Within the Action Area, the West Indian manatee is protected under the MMPA and ESA. Impacts to the manatee are discussed in this BA.

The Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703, et seq.) is the primary legislation in the United States established to conserve migratory birds. 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. An IPaC search indicated there are 40 species of MTBA-listed birds within the Action Area. While the MBTA has no provision for allowing incidental take, USFWS recognizes that some birds may be taken during project construction/operation, even if all reasonable measures to avoid take are implemented.

1.3 Project Description

The proposed action consists of the construction of a levee and floodwall system along an alignment in South and West Slidell, Louisiana, channelization of a portion of the Mile Branch in Covington, Louisiana (Figure 1), and the creation of new habitat mitigation areas to offset losses within the project’s construction footprint areas.

Channel improvements would occur on the lower 2.15 miles (11,341 ft channel) of Mile Branch in Covington, Louisiana. The proposed work would consist of approximately 20 acres of channel that would be cleared and grubbed prior to mechanical dredging.

The levee and floodwall system consists of construction of a total of approximately 18.4 miles (96,950 feet) of earthen levee and floodwall which includes approximately 15 miles (79,100 feet) of levees constructed in separate (non-continuous) segments, and

3.4 miles (17,850 feet) of separate (non-continuous) segments of a floodwall (Figure 3). Features included in the system design consist of eight pump stations, thirteen sluice gates/lift gates, sixteen vehicular floodgates, one pedestrian floodgate, one railroad gate, and eleven road ramps (Table 3). See Appendix A for details of the project features.

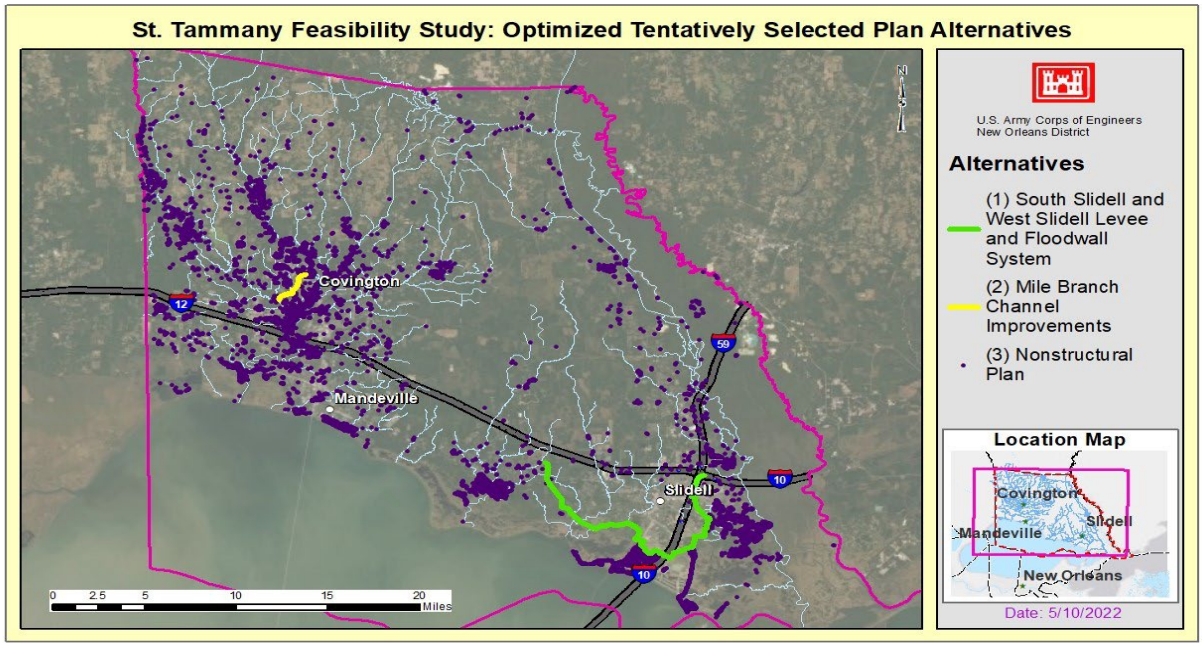

Figure 1. Proposed levee alignment and channel improvements in St. Tammany Parish, Louisiana.3.

1.3.1 Location

The channel improvement project is located in St. Tammany Parish, Louisiana within the City of Covington. The levee and floodwall system would be constructed in southeast St. Tammany Parish near Slidell, Louisiana. The M2 mitigation site is located along the northeast shore of Lake Pontchartrain near Big Branch Marsh National Wildlife Refuge.

1.3.2 Description of the Project Habitat

The Louisiana Department of Wildlife and Fisheries, Wildlife Diversity Program, identified 22 habitat types occurring within St. Tammany Parish. Of the 22 vegetative habitat types identified, 15 are classified as wetlands, of which all are in a state of decline. Habitat identified within the Action Area include fresh marsh, intermediate marsh, longleaf pine flatwood savannas, fresh floating/submerged vegetation, mixed hardwood-loblolly forest, longleaf pine flatwoods, upland longleaf pine forests, and open water (Table 1).

Table 1. Status of vegetative types in St. Tammany Parish (source: Louisiana Department of Wildlife and Fisheries, 1999 and St. Tammany New Directions 2025 web site).

Vegetative Type	Abundance/Status	Trend
Fresh Marsh	Rare	Stable/Very Slowly Declining
Intermediate Marsh	Common	Stable/Very Slowly Declining
Longleaf Pine Flatwood Savannah	Rare	Declining
Fresh Floating/Submersed Vegetation	Common	Stable
Mixed Hardwood-Loblolly Forest	Uncommon	Declining
Longleaf Pine Flatwoods	Critically Imperiled	Rapidly Declining
Upland Longleaf Pine Forest	Critically Imperiled	Rapidly Declining

Freshwater marsh is found surrounding bodies of open water and is located along the shoreline of Lake Pontchartrain and along the mouth of the Pearl River. It forms in accreting, sediment rich, high-energy environments typical for this region and is dominated by rush and reed plant species like cattails and arrowhead. These marshes can form detached mats of vegetation, known as flotant, which encourage colonization by other plant species. Fresh marshes provide nursery habitat for estuarine-dependent species important to recreational and commercial fisheries such as blue crab, white shrimp, Gulf menhaden, Atlantic croaker, red drum, southern flounder, bay anchovy, striped mullet, and others. Fresh marshes also provide habitat for largemouth bass, warmouth, black crappie, blue catfish, bowfin, and gar.

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

Pine savannas are scattered within the Action Area and are a managed habitat type within the Bayou Bonfouca NWR. They are found naturally on broad "flats" in an

interdigitated mosaic with mesic to dry-mesic (non-wetland) longleaf pine flatwoods, savannas occupying the poorly drained and seasonally saturated/flooded depressional areas and low flats, while the non-wetland flatwoods occupy the better drained slight rises and low ridges. They are subject to a highly fluctuating water table, from surface saturation/shallow flooding in late fall/winter/early spring to growing-season droughtiness.

Uplands scattered throughout the parish are dry and generally consist of a mixed hardwoods and loblolly pine forest as well as dry-mesic pine flatwoods. Mixed hardwood-loblolly pine forests are distributed in a variety of ecological settings statewide on broad ridgetops and gentle side slopes in terrace uplands; on middle and lower slopes between uplands and stream bottoms; and at the heads of drainages along small, intermittent streams.

Open water habitats within Lake Pontchartrain are characterized by sandy bottoms and relatively shallow depths extending to 15 feet (NOAA Chart 11639). Desktop review of National Oceanic and Atmospheric Administration Bathymetric Data of Lake Pontchartrain (ESD-PHB-21, W00561) indicate water depth between approximately 3 ft to 11 ft in the vicinity of the M2 borrow site.

1.3.3 Project Proponent Information

Requesting Agency

Department of Defense (DOD)
Army Corp of Engineers (COE)
Kristin Gunning
7400 Leake Avenue
New Orleans, LA 70118
504-862-1514
Kristin.t.gunning@usace.army.mil

Lead Agency

Same as Requesting Agency

1.3.4 Project Purpose

St. Tammany Parish has experienced repeated, widespread flooding from rainfall and riverine bank overtopping, and storm surge, including historic impacts during Hurricane Katrina in August of 2005 and recently with the flood of August 2016. The purpose of the proposed project is to construct a flood risk reduction system to reduce the severity of flood damages and risk to public health and safety, caused by heavy rainfall, riverine flooding, tropical storms, and hurricanes.

1.3.5 Project Type and Deconstruction

Mile Branch Channel Improvements

Construction

This feature consists of channel improvements on the lower 2.15 miles (11,341 ft channel) of Mile Branch in Covington, Louisiana. The proposed work would consist of approximately 20 acres of channel that would be cleared and grubbed prior to mechanical dredging (Figure 2). Table 2 lists the Mile Branch attributes of the tentatively selected plan (TSP) for the 50-year period of analysis.

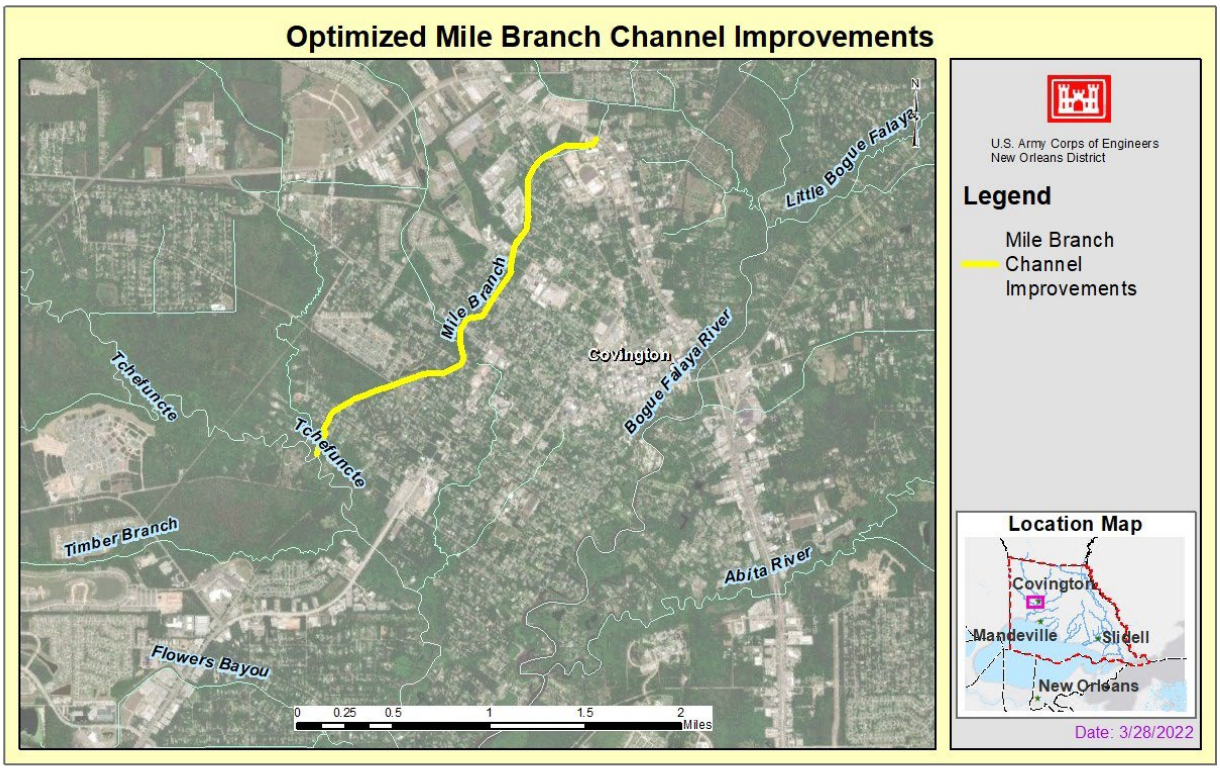

Figure 2. Mile Branch Channel Improvements

Table 2. Summary Table of TSP for Mile Branch

Attribute	Mile Branch Channel Improvements
Total Length of improvements	2.15 miles (11,341 feet)
Material to be Mechanically Dredged	130,000 cubic yards
Access Roads for both clearing and for bridge replacement	0 acres
Number of staging areas for clearing and grubbing and mechanical dredging and for culvert/bridge replacement	19 (7 for culvert/bridge replacements, 11 for clear and grubbing and mechanical dredging and one that becomes a backwater area)
Number of Bridge Replacements of Culverts	7
Temporary ROW	7.3 acres (2.2 acres for culvert/bridge replacements and 5.1 acres for clear and grubbing and mechanical dredging)
Permanent ROW	38.5 acres (34 acres for clear and grubbing and mechanical dredging and 4.5 acres for one staging area that becomes a backwater area)

The Mile Branch channel improvements would 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. Assumptions for channel improvements included a 65-ft from the centerline of each side of the channel for right of way (ROW) as a general guideline (total width of 130 ft).

The improvements would include clearing and grubbing and mechanical dredging of the channel. The channel would be widened as well as deepened. The channel bottom would be lowered by 5 ft. Work would be done by excavators or small skid steers and all work would be performed from the bank. The trees located close to the bank would be removed and the banks would be stabilized, seeded, and fertilized to have a grass cover. Material removed may include sediment, trees, debris, or other obstructions within the waterway. Removed material would be trucked off-site and disposed at a facility licensed to handle the material.

For the channel improvements, approximately 34 acres of permanent ROW would be needed. This area would include 25 ft on each side of the Mile Branch channel. Within

the 34 acres, approximately 20 acres of channel would be cleared and grubbed prior to mechanical dredging. Up to 130,000 cubic yards of material may be mechanically dredged from the channel and would be removed by truck or sidecast along the bank. Sidecast material would temporarily increase water turbidity and decrease water quality, and naturally revegetate or move through the water channel to be deposited downstream. Removed material would be trucked off-site and disposed at a facility licensed to handle the material.

Mile Branch improvements may include bridge replacements or culverts. Approximately 2.2 acres would be required for staging along the various areas of the bridge/culvert replacements.

Riparian Zone bioengineering techniques and nature-based-solutions (NBS) would be considered as appropriate for Mile Branch FRM during PED in coordination with the NFS and resource agencies. A backwater area would be created off of mile branch that provides 3 acres of mud bottom as a project feature. Ideally, a free exchange of water between mile branch and the backwater area would be preferred, however, if access to Mile Branch must be provided along the full length of Mile Branch, then culverts would be required to allow inflow and outflow between the two areas. Culverts would be placed at an elevation that allows frequent water exchange between Mile Branch and the backwater area to avoid stagnation. The site would be excavated 3-5-ft below the average stage of Mile Branch to achieve both deep-water and shallow water habitat. A 40-ft buffer would be planted with bottomland hardwoods around the east, south, and west perimeter of the site. The 40-ft buffer should not be higher than the existing elevation to allow run-off from adjacent areas to flow into the backwater area. The deep-water area would be excavated at a 3:1 slope away from the buffer to achieve the required depth of the site. Finger islands would be created within the site and planted with BLH. Excavated material from within the site would be hauled off-site. The internal tree "fingers" would be at a lower elevation than the perimeter forested buffer. The fingers should be at the former natural ground elevation or a foot or two lower but would be sufficient to support BLH species. Deep water "channels" would extend through the southern end of the tract to encourage circulation throughout the site. Some shallow areas should be provided for marsh or swamp vegetation growth.

Staging and Access

Site access to Mile Branch would be via public roads and public rights of way.

Staging areas are assumed to be dry. Any trees would be removed and hauled away to an approved facility. If necessary, crushed stone would be placed in the staging area prior to construction. After construction, the crushed stone would be removed, and the disturbed areas would be fertilized and seeded.

For the culvert and bridge replacement work, all staging areas were assumed to be located within the individual structure construction areas. Staging areas are to be tree and vegetation free and covered with crushed stone.

South and West Slidell Levee and Floodwall Alignment

Construction

The levee and floodwall system would consist of a total of approximately 18.4 miles (96,950 feet) of earthen levee and floodwall which includes approximately 15 miles (79,100 feet) of levees constructed in separate (non-continuous) segments, and 3.4 miles (17,850 feet) of separate (non-continuous) segments of a floodwall (Figure 3). Construction of the levee alignment would impact approximately 520.7 acres of permanent ROW and it would require approximately 7,069,000 cubic yards of fill, including fill material required for future levee lifts (estimates include a 30 percent contingency). Table 3 provides a summary of the attributes of the South and West Slidell Levee and Floodwall System. Table 4 is a summary of the levee quantities required for the initial construction.

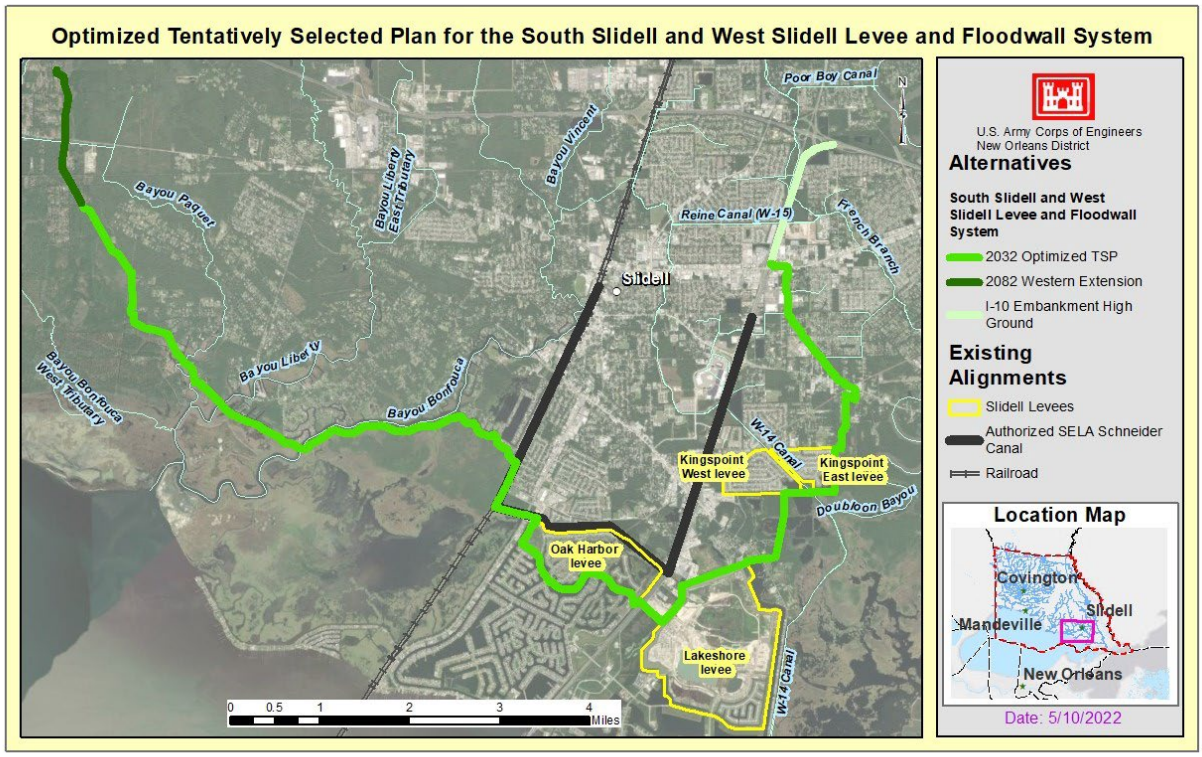

Figure 3. South and West Slidell Levee and Floodwall alignment in St. Tammany Parish, Louisiana

Table 3. Summary Table of South Slidell and West Slidell Levee and Floodwall System

Attribute	South Slidell and West Slidell Levee and Floodwall System
Total Length of alignment	18.4 miles (96,950 feet)
Length of Floodwall	3.4 miles (17,850 feet)
Length of earthen Levee	15 miles (79,100 feet)
Temporary Acres of Construction for Levee and Floodwall system	109 acres
Permanent Acres for Levee and Floodwall system	521 acres
Hydraulic Design Elevation Range (Dependent on location)	13.5 to 16 (year 2032) 17.5 to 20 (year 2082)
Pump Stations	8
Sluice Gates/Lift Gates	13
Number of Vehicular Floodgates	16
Number of Pedestrian Floodgates	1
Number of Railroad Gates	1
Number of Road Ramps	11
Fill (Borrow Material) Required	7,069,000 cubic yards

Table 4. Initial levee alignment ROW and fill quantities

Levee Alignment ROW and Levee Quantities Initial Construction (Year 2032)	
WEST SLIDELL	
Permanent ROW	240 acres
Fill Material (includes 30% contingency)	2,007,000 cubic yards
SOUTH SLIDELL	
Permanent ROW	120 acres
Fill Material (includes 30 %contingency)	825,000 cubic yards**
TOTAL	
Permanent ROW	360 acres
Fill Material (includes 30 % contingency)	2,832,000 cubic yards

**includes quantities for I-10 portion of the alignment.

Levee Lifts

Levee lifts would be required over the 50-yr period of analysis. The levee lift schedule would follow the hydraulic design elevation requirements and thus were divided into 3 geotechnical reaches: Oak Harbor South; I-10 Crossing; and Slidell East/Northeast as illustrated in Table 5. The fourth lift (final lift for the 50-year period of analysis), projected to occur in year 2076 would elevate the levee to a construction elevation of 19 ft.

Table 5. Future Levee Lifts

	Construction Lift (year)	**Construction Elevation (feet)**	**Permanent ROW (acres)**	**Fill Material (+30% contingency; cubic yards)**
WEST SLIDELL				
First lift	2033	16	N/A	771,000
Second lift	2038	17.5	N/A	901,000
Third lift	2051	19	N/A	685,000
Fourth lift	2076	19	30 *	709,000 *
SOUTH SLIDELL				
Oak Harbor South				
First Lift	2035	17	N/A	106,000
Second Lift	2048	18	N/A	120,000
Third Lift	2064	19	N/A	115,000
I-10 Crossing**				
Slidell East / Northeast				
First Lift	2034	19	N/A	271,000
Second Lift	2047	20.5	N/A	295,000
Third Lift	2064	21.5	N/A	264,000
Total For Future Lifts				
			30	4,237,000
Total for Life of the Project (initial construction + lifts)				
			390	**7,069,000**

***** Includes the levee quantities (192,000 cubic yards) for the Western High Ground Tie-in for Year 2082.

** I-10 Crossing features would be constructed to the 2082 elevation and therefore would not require additional lifts.

Western Extension

The Western High Ground Tie-in for Year 2082 is shown in dark green in Figure 3. Based on modeling, the western extension would not be necessary until the year 2076 when the risk reduction would be needed. It is anticipated that this levee segment would be constructed during the fourth levee lift of the West Slidell alignment.

The alignment would commence north of US 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 US 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 feet past the intersection with South Tranquility Road and tie with the existing year 2032 alignment for West Slidell.

West Slidell Alignment

Construction

Levee construction would commence on the south side of US 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 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 the Big Branch Marsh National Wildlife Refuge (NWR). It would cross Bayou Paquet and Bayou Liberty and would continue eastward on the northside of the Big Branch Marsh NWR. It would then 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. railroad tracks west of US Highway 11 in the vicinity of Dellwood Pump Station in Slidell. The West Slidell Alignment is shown in Figure 4. A typical levee cross-section for West Slidell is shown in Figure 5.

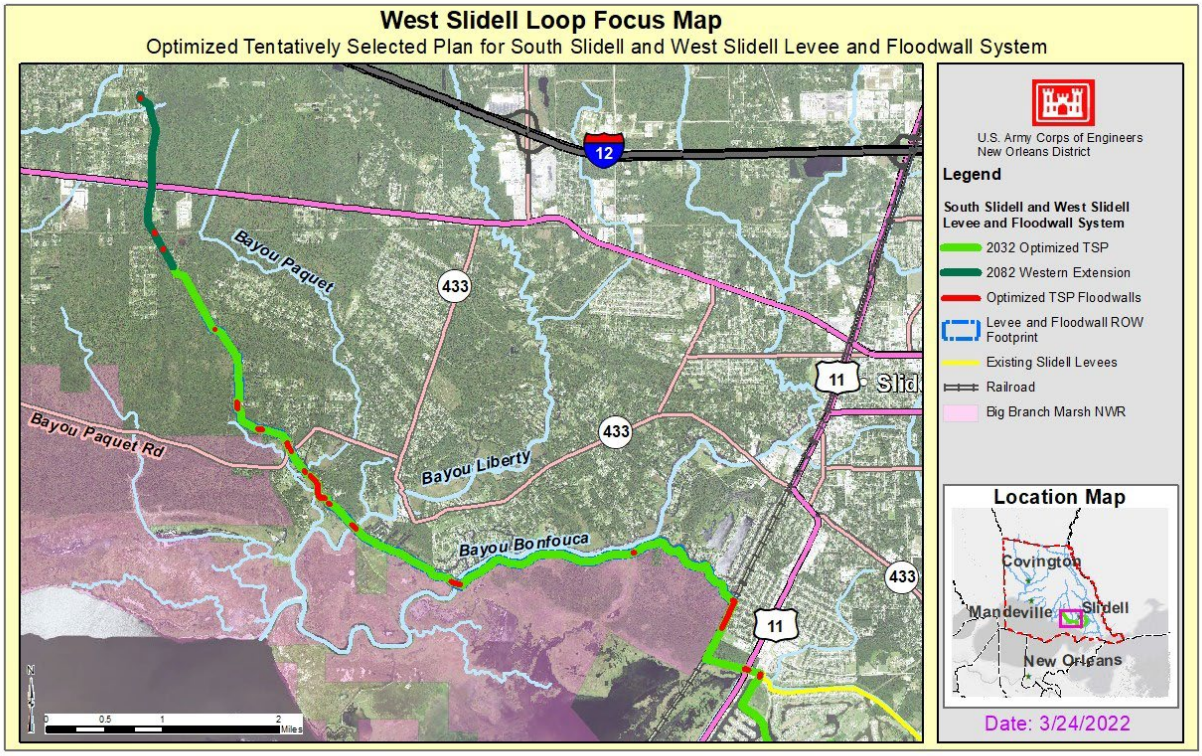

Figure 4. West Slidell and the South Slidell Levee and Floodwall System

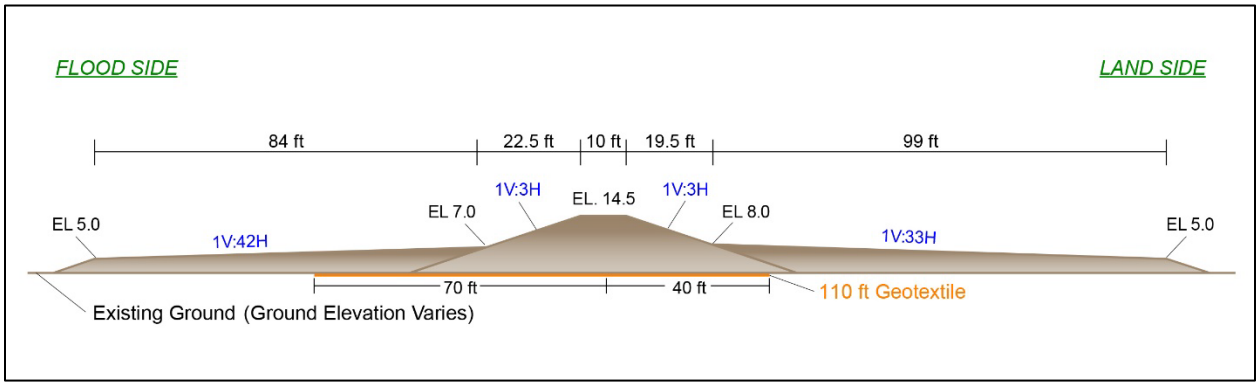

Figure 5. Typical Cross-Section with Berms for West Slidell

South Slidell Alignment

Construction

The levee and floodwall system alignment from West Slidell would continue to South Slidell. From the railroad gate connecting West Slidell with South Slidell, the alignment would transition to a floodwall 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 turns east toward Highway 11 where it would cross 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). It would then 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 the 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 the I-10. The I-10 would be raised to ramp over the new levee section (hydraulic design elevation of 18.5 ft for year 2082).

The alignment would continue southeast and would tie to an existing portion of the Lakeshore Estates ring levee. It then would turn north and then east and cross Old Spanish Trail/Highway 433, continue north and tie into 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 would tie 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 it 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 would cross Highway 190 Business and continue northwest on the west side of the existing CLECO Corporate Holdings, LLC utility corridor. It would cross South Holiday Drive and continue north. Itwould then turn east on Manzella Drive and turn north in the middle of the block between Yaupon Drive and Malbrough Drive.

The alignment would cross Gause Boulevard as a ramp crossing and would turn west and tie to high ground (hydraulic design elevation of 18.5 ft for year 2082) in the vicinity of the I-10. There would be additional road ramps for businesses on the north side of Gause Boulevard, the I-10 Service Road and the I-10 on-ramp for the I-10 eastbound at Gause Boulevard. The West Slidell Alignment is shown in Figure 6. A typical levee cross-section for West Slidell is shown in Figure 7.

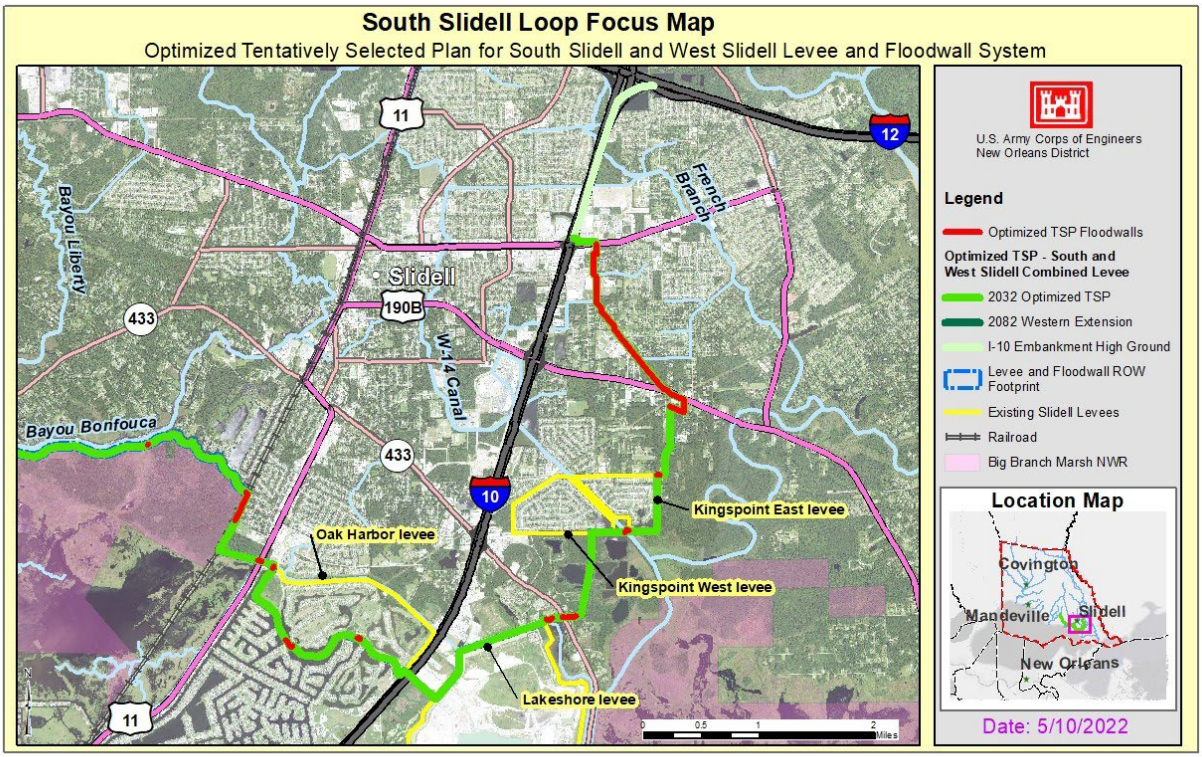

Figure 6. South Slidell Levee and Floodwall System

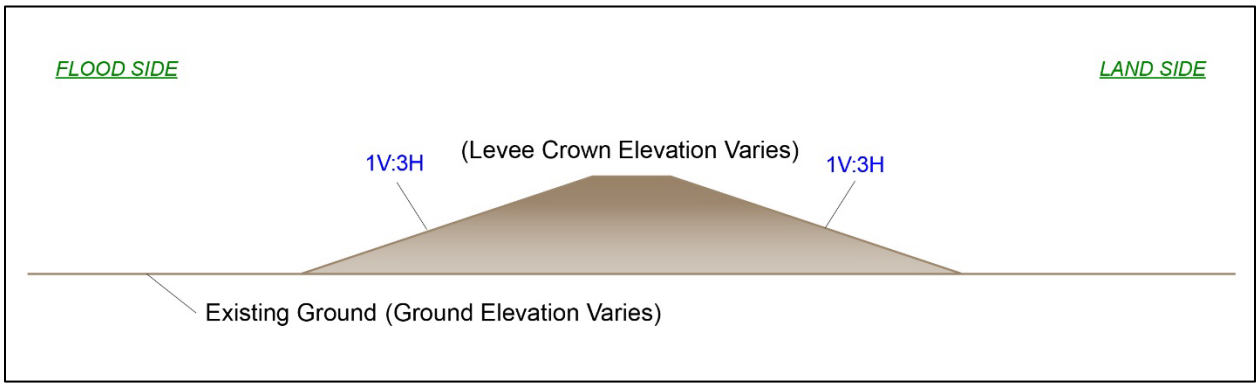

Figure 7. Typical Cross-section for South Slidell

Temporary Bypass Channel

Temporary bypass channels would be constructed at locations where a pump station or floodgate is proposed within the limits of a channel. The temporary bypass channels would route water around the structures in order for the construction to be done in dewatered conditions.

In order to maintain pre-construction flow conditions and minimize environmental impacts during construction, the temporary bypass channels would be similarly sized to the channels being impacted. After construction, the bypass channel is assumed to be included in the footprint of the structure site and the channel flow would be rerouted through the new structure feature. Navigation of common local vessels would be considered for the bypass channels, and design features of a navigable bypass channel would be developed during PED.

Temporary Retaining Structures (TRS)

Temporary Retaining Structures (cofferdams) are temporary features that facilitate the construction of major structures. Cofferdams allow water or other materials to be removed inside the TRS in order to work in an excavated and/or dewatered condition.

Cofferdams would be required during the construction of the pump stations and floodgates. Qualified designers employed or sub-contracted by the construction contractors would design the TRS for this project.

Pump Stations

The Optimized TSP would include a total of eight (8) pump stations. These pump stations are divided into large pumping capacity and small pumping capacity.

In West Slidell there would be two (2) pump stations with large pumping capacity and two (2) pump stations with small pumping capacity. In South Slidell there would be four (4) pump stations with small pumping capacity (Table 6). Large pump stations were assumed to have similar components and configuration as the USACE West Shore Lake Pontchartrain Reserve Relief Canal Pump Station. Small pump stations would have similar pumping capacities to the Prescott Road Pump Station for the Lake Pontchartrain Lakeshore study. These studies can be found at the following linkhttps://www.mvn.usace.army.mil/Missions/Environmental/NEPA-Compliance-Documents/Bipartisan-Budget-Act-2018-BBA-18/West-Shore-Lake-Pontchartrain/.

Table 6: Pump Stations

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

Access and Staging

Existing public roads would be utilized for access to the maximum extent possible. New roads would be constructed in locations where access cannot be achieved via existing roadways. Construction of new roads would require permanent ROW. New access roads would be a 40-ft wide footprint (consisting of a 25 ft right-of-way for the access road itself and a 7.5-ft width for vegetation free zones (VFZ) on both sides of the road. Access roads would be constructed using crushed stone for the road surface.

For construction of the levee on refuge land (from Bayou Bonfouca to the railroad tracks), the ingress and egress would be at the Norfolk Southern railroad tracks on the east side of Bayou Bonfouca and existing roads on the west side. A one-way flow of traffic would be maintained. The USACE would need to obtain permission from the railroad owner (Norfolk Southern Railway Corp.) prior to construction. A temporary access road would be constructed on the protected side of the ROW between the proposed crown of the levee and Bayou Bonfouca. Once construction is complete, the area would be cleared of vegetation within the right of way and graded to drain away from the levee. Access during future inspections would be done by driving on the crown of the levee.

There would be one temporary 2-acre staging area in the reach on refuge land but would be located off the refuge. This staging area would be used to process the material prior to building the levee. The area would be restored to pre-construction elevation that existed prior to impacting the site.

Table 7 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. Staging areas would be required to be continuously accessible. The staging areas required during initial construction of the levee alignment would be the same staging areas required for construction of future levee lifts. Staging areas are assumed to be dry. Any trees would be removed and hauled away to an approved facility. If necessary, crushed stone would be placed in the staging area prior to construction. After construction, the crushed stone would be removed and the disturbed areas would be fertilized and seeded.

For the culvert and bridge replacement work, all staging areas were assumed to be located within the individual structure construction areas. Staging areas are to be tree and vegetation free and covered with crushed stone.

Table 7. Summary of Staging Areas and 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	270
South Slidell (includes 23 acres for I-10)	29	120
Sub-Total for Levees	**39**	**420**
Floodwall Segments		
Western High Ground Tie In	NA	NA
West Slidell	0	3.7
South Slidell	0	22.7
Sub-Total for Floodwall Segments	**0 ***	**26.4**
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	1.25
West Slidell	1.25	0

South Slidell	9	0
Sub-Total for Vehicular, Pedestrian, and Railroad Gates	**11.75**	**1.25**
Road Ramps		
Western High Ground Tie In	0.5	0
West Slidell	0	0
South Slidell	5	0
Sub-Total for Road Ramps	**5.5**	**0**
Access Roads - New		
Western High Ground Tie In	0.1	0.1
West Slidell	0.45	0.45
South Slidell	2.75	2.75
Access Roads - Existing		
Western High Ground Tie In	0	0
West Slidell	15.8	0
South Slidell	9.9	0
Sub-Total for Access Roads	**29**	**3.3**
Mile Branch Channel Improvements	7.3	38.5
Sub-Total for Mile Branch Channel Improvements	**7.3**	**38.5**
Total Acres for 50-year Period of Analysis	**109**	**520**

*for floodwall segments, staging areas would be included in the 80 ft wide permanent ROW.

Mitigation

The proposed project was designed to avoid and minimize impacts to significant resources to the extent practicable. However, unavoidable impacts to local habitats would occur and would be offset through compensatory mitigation.

Mitigation credits would be purchased from approved mitigation banks for impacts to Riparian and Pine Savanna habitats. Impacts to Big Branch Marsh National Wildlife Refuge would be mitigated by managing pine savanna habitat (PSR-01) within the refuge via controlled burns. An existing gravel logging road would be improved and provide access to the site (Figure 8).

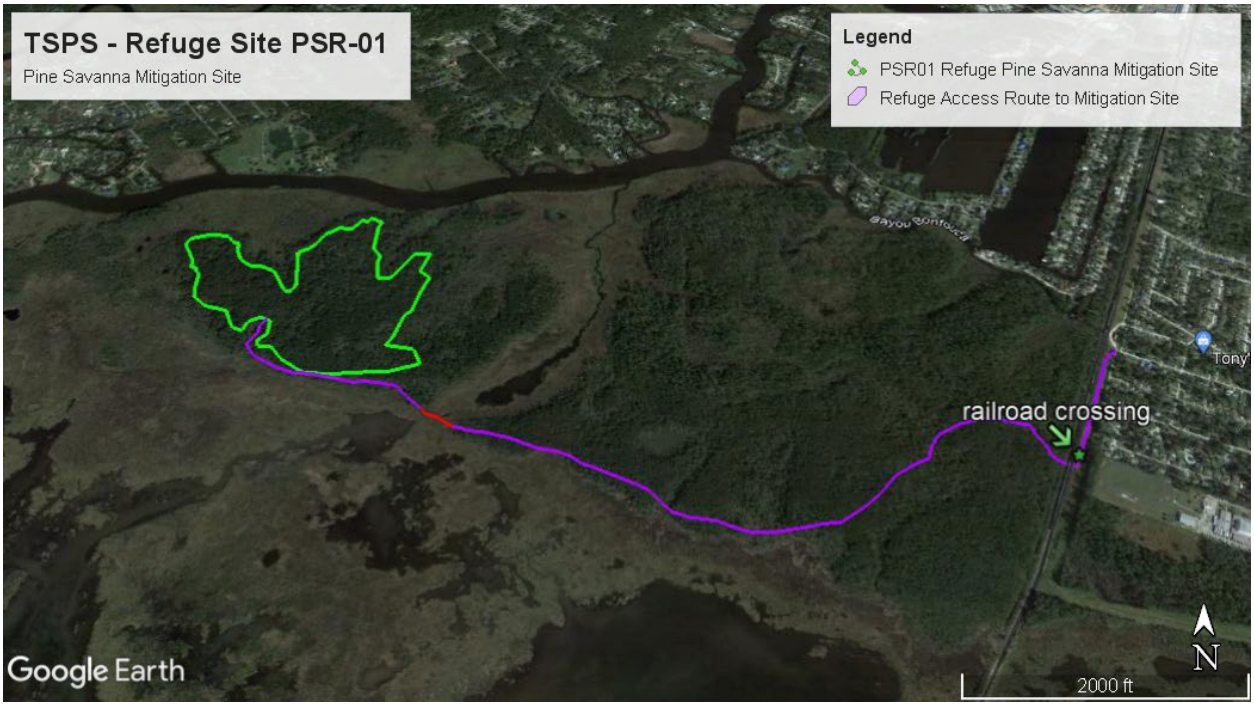

Figure 8. Pine Savanna Mitigation Site within Big Branch Marsh National Wildlife Refuge.

Proposed mitigation for marsh consists of 200 acres of marsh creation on the north shore of Lake Pontchartrain, east of the Causeway Bridge near Lacombe. The assumed existing elevation is -1.65' NAVD88. Initial target elevation for dredge fill would be to approximate elevation +2.5 NAVD88, to ultimately hit a target marsh elevation of +1.0 NAVD88. At this 35% design level, total perimeter retention would be required to retain dredge material and allow for vertical accretion. Approximately 14,718 linear ft of new retention dike would be required along the limit of the project footprint. The dike would be built with borrow from within the footprint. The dike would be built with a 5 ft crown width to elevation +4.8' NAVD88, to provide one ft of freeboard during pumping operation and allow for settlement. This dike would be degraded in year 1, upon settlement and dewatering of the created marsh platform. The degraded material can be disposed of in the original borrow canal if settlement allows or cast into the open water immediately outside of the project footprint. Spill boxes or weirs would be constructed at pre-determined locations within the retention dike to allow for effluent water release from within the marsh creation area. If deemed necessary by the construction contractor, low level interior weir or baffle dikes can be constructed to assist in vertical stacking of dredged material.

Marsh creation would require borrow of approximately 2,200,000 cubic yards of material. A borrow site of 134 acres would accommodate this requirement. The borrow plan is to obtain material from Lake Pontchartrain, requiring a buffer of 2,000 ft between the existing shoreline and the borrow area limit. Borrow would not be allowed greater than 10 ft below the existing lake bottom, except that a tolerance of 1-ft below this target

elevation would be provided the contractor to account for inaccuracies in the dredging process. To assure adequate borrow, the fill quantity was doubled account for unsuitable materials, unknown utilities, unidentified anomalies, and/or unsighted cultural finds. An access corridor of approximately 7,340 linear feet would be allowed from the lake to the proposed marsh creation site. The access corridor can be used to establish a pipeline corridor, offload equipment as necessary, and transport personnel to and from the worksite. The contractor would be instructed to minimize usage and damage within the access corridor, by using existing waterways for daily transportation of supplies and personnel where possible.

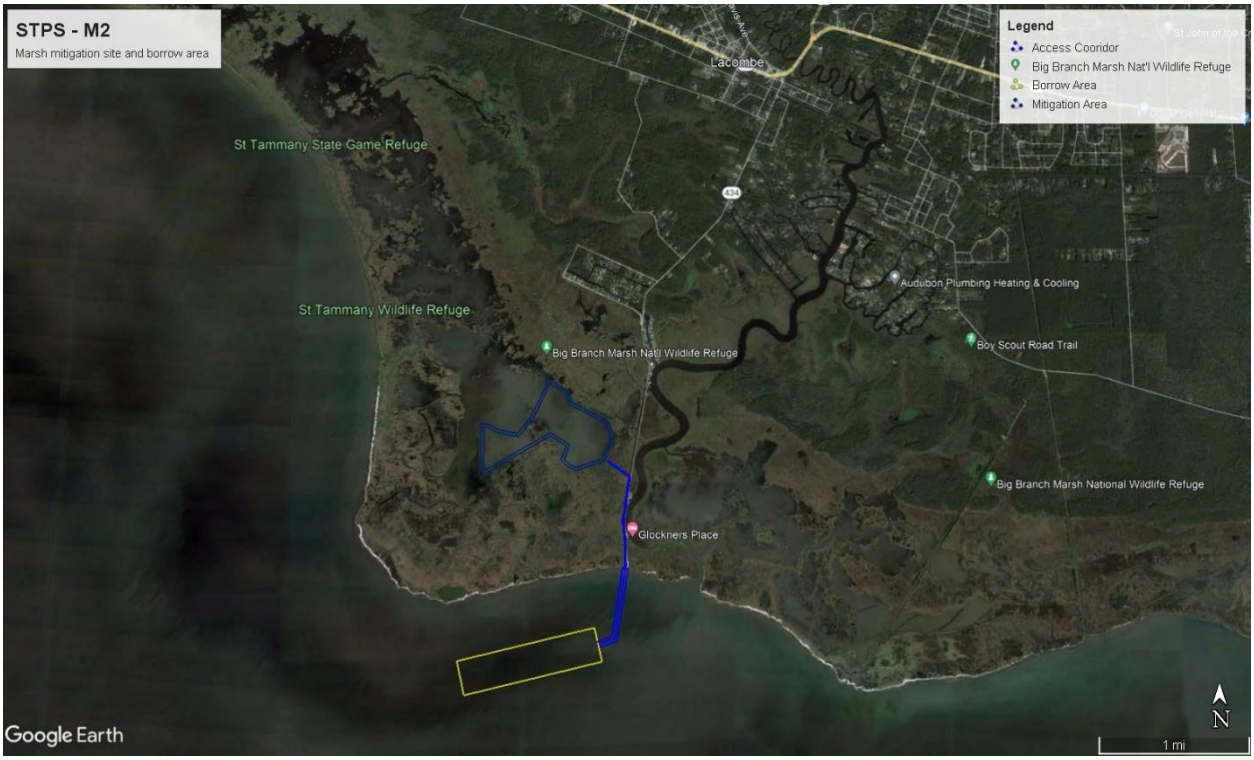

Figure 9. Marsh mitigation site and borrow area.

1.3.6 Anticipated Environmental Stressors

1.3.6.1 Animal Features

Existing terrestrial wildlife habitat and wildlife resources within the Project Area would be directly impacted by the removal of existing terrestrial habitat along the proposed 18.4-mile levee and floodwall system, as well as, lower 2.15 miles of Mile Branch. Though the existing terrestrial habitats would be removed, similar habitat is located adjacent to the project area that could be utilized by local wildlife during construction.

Disturbance from excavation and placement of material along the proposed levee and floodwall alignment, as well as, from within Lake Pontchartrain and Mile Branch could

result in death of individuals if they are unable to flee the construction work area. This is especially relevant to sessile species. Mitigation measures, including habitat restoration activities, would be implemented to offset the intensity of these impacts during and after the construction activities are completed.

1.3.6.2 Aquatic Features

Construction of the levee and floodwall system includes the removal of approximately 157 acres of marsh, swamp, and BLH habitat. Indirect impacts to approximately 1,707 acres of marsh, swamp, and BLH habitats would result from the alteration of drainage and flow on the protected side of the levee, and anticipated erosion of marsh on the floodside of the levee.

Approximately 20 acres of Mile Branch Channel would be cleared and grubbed prior to mechanical dredging. Indirect impacts are estimated to be approximately 23 acres of BLH and swamp habitat and include the potential shifting of vegetative communities as the result of changes in hydrology.

A 200-acre marsh site would be created on the north shore of Lake Pontchartrain to offset some impacts from the proposed action. This would increase the available aquatic features within the project area by converting open water habitat to marsh. This new marsh would provide additional habitat to nearby species and increase the ecological value of the system as a whole.

Impacts to aquatic and fisheries resources associated with sedimentation poses a risk. Best Management Practices would be implemented to reduce this risk. The potential for sedimentation during construction could adversely affect food sources for aquatic species. However, this impact would be temporary.

Changes to overall available aquatic and fisheries habitat would be negligible in Lake Pontchartrain and Mile Branch as a result of the proposed action. The M2 marsh creation project would create 200 acres of aquatic and fish habitat on the north shore of Lake Pontchartrain, post-construction.

1.3.6.3 Environmental Quality Features

There would be temporary impacts to local water quality within the Lake Pontchartrain borrow pit during dredging. Changes to temperature, dissolved oxygen (DO), ultimate carbonaceous biochemical oxygen demand (CBODU), total nitrogen (TN), ammonia-nitrogen (NH3-N), nitrate-nitrite (NOX), organic nitrogen (Org-N), total phosphorus (TP), orthophosphate (PO4), organic phosphorus (Org-P), phytoplankton chlorophyll-a, and total suspended solids (TSS) could occur. However, these changes are expected to be negligible due to the small size of the borrow pit compared to the overall size of the Lake Pontchartrain basin and high flushing rate of the lake. Overall, there would be

temporary short-term, adverse impacts to water quality both during and for a short time following construction.

Within Mile Branch, channelization and clearing of riparian corridors could increase runoff from nearby development which may increase input of CBODU, TN, NH-3N, NOX, Org-N, TP, PO4, Org-P, phytoplankton chlorophyll-a, and TSS. Additional nutrient input could increase growth of algae and macrophytes, which would in turn increase DO. In addition, reduced canopy cover exposes the channel to more direct sunlight which could alter temperature regimes. Increased water temperature and light may alter existing community structure. Implementation of BMPs could reduce long-term negative impacts from channel alterations.

Direct and indirect impacts to the air quality within the Project Area could occur as a result of construction activity (e.g., machinery/vehicle emissions, dust, etc.) However, impacts would be temporary, minor and limited to the construction period only.

1.3.6.4 Landform (topographic) Features

The current topographic features in the project area include the Mile Branch, Lake Pontchartrain and associated tributaries, natural ridges, Native American earthworks/mounds, existing levees, agricultural fields, and residential areas.

1.3.6.5 Soil and Sediment

On the lower 2.15 miles (11,341 ft) of Mile Branch, approximately 130,000 cubic yards of channel would be dredged and the material placed in the designated disposal areas. The levee and floodwall system would consist of a total of approximately 18.4 miles (96,950 feet) of earthen levee and floodwall which would impact approximately 520.7 acres of permanent ROW and would require approximately 7,069,000 cubic yards of fill. Fill would be obtained from CEMVN approved borrow sources. Creation of 200 acres of marsh to offset impacts from the levee and floodwall system construction would require borrow of approximately 2,200,000 cubic yards of material from a 134-acre borrow site within Lake Pontchartrain.

Indirect impacts to soils within the Project Area could be anticipated because of ongoing operations and associated maintenance through the life of the project. There is potential for increased sedimentation in Mile Branch and Lake Pontchartrain from dredging operations. Best Management Practices would be implemented to reduce temporary adverse impacts from sedimentation.

1.4 Action Area

Pursuant to 50 C.F.R. § 402.02, the term action area is defined as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action." Accordingly, the action area typically includes the affected jurisdictional waters and other areas affected by the authorized work or structures within a reasonable distance. The ESA regulations recognize that, in some circumstances, the action area may extend beyond the limits of the Corps' regulatory jurisdiction.

Figure 10. Approximate Action Area in St. Tammany Parish, Louisiana.

For the purposes of this consultation, CEMVN has defined the action area to include the following:

<u>Mile Branch</u>

This feature consists of channel improvements on the lower 2.15 miles (11,341 ft channel) of Mile Branch in Covington, Louisiana. The proposed work would consist of approximately 20 acres of channel that would be cleared and grubbed prior to mechanical dredging (Figure 2). The Mile Branch channel improvements would 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.

Levee and Floodwall System

The levee and floodwall system would consist of construction of approximately 18.4 miles of earthen levee and floodwall in St. Tammany Parish, Louisiana. Construction of the levee alignment would impact approximately 520.7 acres of permanent ROW and it would require approximately 7,069,000 cubic yards of fill, including fill material required for future levee lifts. Figures 3, 4, and 6 provide illustrations of the proposed levee and floodwall alignment.

PSR-01 Mitigation Site

Impacts to Big Branch Marsh National Wildlife Refuge would be mitigated by managing approximately 70 acres of pine savanna habitat (PSR-01) within the refuge via controlled burns. Figure 8 provides an illustration of PSR-01.

M2 Mitigation Site

Proposed mitigation for marsh consists of 200 acres of marsh creation on the north shore of Lake Pontchartrain, east of the Causeway Bridge near Lacombe. Borrow would be obtained from a 134-acre site within Lake Pontchartrain. Figure 9 provides an illustration of the M2 mitigation site.

1.5 Conservation Measures

1.5.1. Gulf Sturgeon

To reduce impacts to Gulf sturgeon*, Protected Species Construction Conditions* and *Vessel Strike Avoidance Measures*, developed by NMFS, would be implemented for the proposed project. See Appendix D for detailed information on these measures.

1.5.2 West Indian Manatee

To minimize the potential for construction activities to cause adverse impacts to manatees, the standard manatee protection measures developed by the USFWS, Lafayette, Louisiana Field Office and located in Appendix D-3, would be implemented when activities are proposed that would impact habitat where manatees could occur.

1.5.3 Alligator Snapping Turtle

To minimize the potential for construction activities to cause adverse impacts to alligator snapping turtles, the USFWS recommends the conservation measures located in Appendix D-4

2 Species Affects Analysis

2.1 Gopher Tortoise (*Gopherus polyphemus*)

2.1.1 Status of the Species

2.1.1.1. Legal Status

The gopher tortoise is listed as threatened under the Endangered Species Act (Federal Register Vol. 87, No. 196, October 12, 2022).

2.1.1.2 Recovery Plans

The most recent recovery plan available for the gopher tortoise is dated December 1990 (Appendix C-1). A SSA dated August 2021 is also available (Appendix C-1).

2.1.1.3 Life History Information

The gopher tortoise occurs in the Southeastern Atlantic and Gulf Coastal Plains from southern South Carolina west through Georgia, the Florida panhandle, Alabama, and Mississippi to eastern Louisiana, and south through peninsular Florida (Auffenberg and Franz 1982). The gopher tortoise is the only tortoise that is native to the southeastern United States and is known to live up to 60 years in the wild.

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

Gopher tortoises were found to mostly forage on foliage, seeds, and fruits of grasses and forbs, generally in an area of about 150 feet surrounding burrows (McRae et al. 1981). Although they feed primarily on broadleaf grasses, wiregrass (*Aristida stricta var. beyrichiana*), asters, legumes, and fruit, they are known to eat more than 300 species of plants (Garner and Landers 1981; Ashton and Ashton

2004; Richardson and Stiling 2019). The diet of adults resembles that of a generalist herbivore, with at least some preference for certain plants over others, and may also include insects and carrion (Macdonald and Mushinsky 1988; Birkhead et al. 2005; Richardson and Stiling 2019). Legumes are thought to be particularly important for re-conditioning females after egg laying, and it has been shown that clutch sizes and percent of gravid females were lowest in areas with low percent cover of legumes (White 2009).

Gopher tortoises mostly breed from May through October (Landers et al. 1980; McRae et al. 1981; Taylor 1982; Diemer 1992a; Ott-Eubanks et al. 2003). Female gopher tortoises usually lay eggs from mid-May through mid-July, and incubation lasts 80 - 110 days (Diemer 1986). Tortoises may nest in the soil at the entrance of a burrow (Butler and Hull 1996; Smith et al. 1997a), or in other open sandy areas, when available (Landers et al. 1980). Range wide, average clutch size varies from about four to eight eggs/clutch (Ashton et al. 2007).

2.1.1.4 Conservation Needs

The SSA dated August 2021 includes conservation measures for the gopher tortoise. Below are the conservation measures listed in the SSA. See Appendix C-1 for further details on each.

- Federal and State Protections and Conservation
- Florida Gopher Tortoise Management Plan and Permitting Guidelines
- Relocation, Translocation, Recipient Sites, and Headstarting
- Gopher Tortoise Conservation and Crediting Strategy
- Conservation Agreements
- Conservation Strategies, Best Management Practices, and Other Conservation Initiatives and Guidelines
- Conservation Lands

2.1.2 Environmental Baseline

2.1.2.1 Species Presence and Use

USFWS determined the eastern and western portions of the gopher tortoise's range meet the criteria of Distinct Population Segments (DPS) under the ESA.

The eastern DPS includes the states of Florida, Georgia, South Carolina, and most of Alabama. Although the eastern DPS is threatened by habitat loss and fragmentation due to urbanization, climate warming, sea-level rise and habitat management, many of these populations are in good condition. In addition, habitat restoration efforts, implementation of best management practices, and conservation

measures to benefit the gopher tortoise have contributed to the eastern DPS no longer meeting the criteria for ESA listing.

In terms of the estimated range wide number of gopher tortoises, the majority of gopher tortoise individuals and populations are found in the eastern DPS. Only 8 percent of the estimated range wide population occur in the western DPS and include many small, isolated populations. Populations in the western DPS are characterized by life-history differences including smaller clutch size, lower hatch rate, and larger home range, likely related to the clay soil and poorer quality habitat in the western portion of the range. Populations in the western DPS also exhibit lower resiliency and are more vulnerable to catastrophic events. The western DPS continues to meet the definition of a threatened species under the ESA.

Gopher tortoises occur in 3 parishes in Louisiana: Washington, Tangipahoa, and St. Tammany. The action area is listed under the western DPS.

2.1.2.2 Species Conservation Needs Within the Action Area

The SSA dated August 2021 includes conservation measures for the gopher tortoise. Below are the state conservation measures that might be applicable to the action area. See Appendix C-1 for further details.

- The gopher tortoise population in Louisiana is listed as threatened under the Endangered Species Act. Also ranked as S1 (critically imperiled) in Louisiana. The gopher tortoise is protected by regulation and prohibits the take, possession, export/sale, and killing of gopher tortoises.
- Translocation describes the intentional capture and transfer of individuals (or groups of individuals) from one location to another. Translocation is commonly used as a conservation strategy to mitigate the loss of tortoises from land slated for development. These displaced tortoises are often translocated to reestablish extirpated populations or augment existing populations (Griffith et al. 1989).
- The Range wide Conservation Strategy for the Gopher Tortoise was developed in 2013 by the USFWS to guide conservation of the gopher tortoise. Specifically, this Strategy is designed for partners, including the states within gopher tortoise range, USFWS, and other public and private entities to collect and share information on gopher tortoise threats, outline highest priority conservation actions, and identify organizations best suited to undertake those conservation actions.

2.1.2.3 Habitat Condition (General)

Gopher tortoise habitat comprises well-drained sandy soils (burrowing, sheltering, and breeding), with an open canopy, sparsely vegetated midstory, and abundant herbaceous groundcover (feeding). Generally, upland habitat within the action area

consists of densely forested areas and anthropogenic landscapes such as rights-of-way. Gopher tortoise surveys conducted by LA Department of Wildlife and Fisheries staff, along with USACE and USFWS personnel, determined that dense forested habitat within the action area was not suitable for gopher tortoises. Additionally, surveys of areas that were not heavily forested and appeared suitable for tortoises found no evidence of tortoises or their burrows.

2.1.2.4 Influences

Habitat loss and fragmentation, roads, climate conditions, disease human activities, predation, and non-native and invasive species all influence the persistence of the species.

Urbanization and major roads (Auffenberg and Franz 1982; Diemer 1986; Diemer 1987; Enge et al. 2006), incompatible and/or insufficient habitat management, and certain types of agriculture (Lohoefener and Lohmeier 1984; Auffenberg and Franz 1982; Hermann et al. 2002) can negatively impact gopher tortoises and gopher tortoise habitat. Invasive species can influence gopher tortoises either through direct impacts (e.g., predation; Mann 1995; Engeman et al. 2009; Engeman et al. 2011; Dziadzio et al. 2016b; Bartoszek et al. 2018) or alterations to habitat structure and/or function (Lippincott 1997; Bastios 2007).

Climate change has the potential to negatively impact habitat through the loss of habitat due to sea level rise (Hayhoe et al. 2018), limitations on number of suitable burn days due to changes in temperature (Kupfer et al. 2020), precipitation, increased flooding due to predicted increases in the severity of hurricanes (Castellon et al. 2018), and human migration from inundated coastal areas to inland areas, with subsequent impacts to gopher tortoises (Ruppert et al. 2008).

A number of diseases have been documented in gopher tortoises, including fungal keratitis (Myers et al. 2009); iridovirus; ranavirus (Johnson et al. 2008); herpesvirus; bacterial diseases related to Salmonella spp., Mycoplasma spp., Helicobacter sp. (Desiderio et al. 2021), and Dermatophilus; and numerous internal and external parasites (Ashton and Ashton 2008, pp. 39-41). Upper Respiratory Tract Disease (URTD) resulting from two Mycoplasma species (*M. agassizii and M. testudineum*) has received the most attention recently. URTD has been documented throughout much of the tortoise's range (Berish et al. 2010; McGuire et al. 2014a; Goessling et al. 2019), but the magnitude of threat URTD poses to gopher tortoise populations and tortoise demographics is uncertain (Karlin 2008).
Human harvest of gopher tortoises for consumption has historically influenced gopher tortoise populations, particularly in portions of the Florida panhandle. Tortoises were harvested in large numbers during the Great Depression, a practice

which continued for decades following the Depression (Tuma and Sanford 2014). Prior to the closure of tortoise harvest in the late 1980s, a community in Okaloosa County held an annual tortoise cookout (Enge et al. 2006). Low numbers of tortoises on sites with otherwise adequate habitat were speculated to reflect episodes of human predation in the 1980s and 1990s in Mississippi (Lohoefener and Lohmeier 1984; Mann 1995; Estes and Mann 1996). Though this practice is not as common as it was prior to the 1980's, localized harvest still occurs in some rural areas across the Southeast (Rostal et al. 2014) but is likely not a significant threat to current populations.

Rattlesnake roundups are locally organized events that offer prizes for the largest and most rattlesnakes caught. Historically, there were multiple roundups throughout the Southeast. With the recent conversion of two roundups to wildlife festivals (Claxton, GA in 2012; Whigham, GA in 2021), only one roundup remains in the Southeast, in Opp, Alabama.

The technique of blowing fumes of noxious liquids (otherwise known as “gassing”) down tortoise burrows was used primarily to collect snakes for these rattlesnake roundups (Means 2009). It is thought this practice of gassing burrows harms or harasses the resident tortoise, though research that quantifies negative direct impacts (i.e., mortality) is limited. For example, one study found that no tortoises died or showed ill-effects after being gassed in their burrows; however, this study did not examine potential long-term impacts or repeated gassing (Speake and Mount 1973). Tortoise burrows have also been excavated to retrieve snakes, sometimes in conjunction with burrow gassing (Means 2009), rendering the burrows unusable.

Gopher tortoise nest predation varies annually and across sites, ranging from approximately 45-90 percent in a given year (Landers et al. 1980; Wright 1982; Marshall 1987). Gopher tortoises are most susceptible to predation within their first year of life, though most predation appears to occur within 30 days of hatching (Pike and Seigel 2006; Smith et al. 2013). Overall annual hatchling survival has been estimated to be approximately 13% (Perez-Heydrich et al. 2012). In some instances, predation-related mortality may reach 100% within one-year post-hatching (Pike and Seigel 2006).

Raccoons are the most frequently reported predator of nests and juvenile gopher tortoises (Landers et al. 1980; Butler and Sowell 1996); other predators of nests and/or juvenile tortoises include gray fox (*Urocyon cinereoargenteus*), striped skunk (*Mephitis mephitis*), Virginia opossum, coyote (*Canis latrans*), nine-banded armadillo, several snake species (e.g. *Agkistrodon piscivorus, Drymarchon corais, Masticophis flagellum*), fire ants (*Conomyrma spp., Solenopsis invicta*)., and red-tailed hawks (*Buteo jamaicensis*) (Douglass and Winegarner 1977; Fitzpatrick and

Woolfenden 1978; Landers et al. 1980; Wilson 1991; Mann 1995; Butler and Sowell 1996; Wetterer and Moore 2005; Pike and Seigel 2006). Twenty-five species—12 mammals, 5 birds, 6 reptiles and 2 invertebrates—are known to be predators of eggs, emerging neonates, hatchlings, and older tortoises (Ashton and Ashton 2008). Adult gopher tortoises are less likely to experience predation except by canines (e.g., domestic dogs, coyotes, foxes) and humans (Causey and Cude 1978; Taylor 1982; Hawkins and Burke 1989; Mann 1995). Some predators are subsidized by human activities such as habitat fragmentation and edge effect (e.g., red imported fire ants) (Wetterer and Moore 2005), roads and infrastructure (e.g., red imported fire ants) (Stiles and Jones 1998), increased availability of food (e.g., raccoons), reduction or elimination of top carnivores (e.g., coyotes, red foxes) (Crooks and Soule 1999), ecological perturbations allowing range expansion (e.g., coyotes), and simply because some are domestic and associated with humans (e.g., cats and dogs).

2.1.2.5 Additional Baseline Information

On June 14, 2022, Louisiana Department of Wildlife and Fisheries staff, along with CEMVN and USFWS personnel, conducted gopher tortoise surveys within the project area. A total of six (6) areas, hereby referred to as Right of Entry (ROE), within the proposed levee right-of way were surveyed for the presence of gopher tortoises. Survey areas were selected by suitability of the soils in the area. 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). ROE 1, 2 and 3 were assessed from the public roads adjacent to these areas and appeared to be uninhabitable for gopher tortoises due to the dense forests completely covering these areas. No evidence of gopher tortoises or their burrows were observed.

Transects were performed on ROE 4, 5, and 6, which contained suitable soils that were not heavily forested. No evidence of gopher tortoises or their burrows were observed in these areas. Additional information regarding these surveys, including survey area and tortoise soil suitability maps, are located in Appendix E-1.

2.1.3 Effects of the Action

2.1.3.1 Indirect Interaction

Construction activities, such as clearing, fill placement, and heavy machinery use, could eliminate suitable gopher tortoise foraging habitat by physically removing or smothering herbaceous groundcover. Additionally, compaction of soil could limit the ability of tortoises to create burrows for sheltering and nesting.

2.1.3.2 Direct Interactions

In areas where tortoises may be present, noise and activity associated with construction would likely temporarily displace gopher tortoises from active construction zones to other nearby habitat. Displacement of tortoises is not likely to significantly impact the species where suitable habitat is available nearby.

Additionally, tortoises may be physically injured or killed if struck by equipment or materials during construction. This effect is discountable due to the ability of the species to move away from the project site if disturbed.

2.1.4 Cumulative Effects

For purposes of consultation under ESA Section 7, cumulative effects are those caused by future state, tribal, local, or private actions that are reasonably certain to occur in the Action Area. Future Federal actions that are unrelated to the proposed action are not considered, because they require separate consultation under Section 7 of the ESA. At this time the USACE is unaware of any future state, tribal, local, or private non-Federal unrelated to the proposed action that are reasonably certain to occur in the Action Area.

2.1.5 Discussion and Conclusion

The proposed project would not occur near or affect any known gopher tortoise burrows. In addition, field surveys conducted by the LDWF, CEMVN, and USFWS indicated that the majority of the project area does not contain suitable soils for gopher tortoise burrows. Therefore, CEMVN has determined that the proposed action will not likely adversely affect the gopher tortoise.

2.2 Gulf Sturgeon (*Acipenser oxyrinchus desotoi*)

2.2.1 Status of the Species

2.2.1.1. Legal Status

The Gulf Sturgeon is listed as Threatened under the Endangered Species Act (Federal Register Vol. 56, No. 189, September 30, 1991).

2.2.1.2 Recovery Plans

The most recent recovery plan available for the Gulf sturgeon is dated September 1995 (Appendix C-2).

2.2.1.3 Life History Information

The Gulf sturgeon is an anadromous fish (ascending rivers from the sea for breeding) that have historically inhabited coastal rivers from the Mississippi in Louisiana to the Tampa Bay in Florida. The Gulf sturgeon is one (1) of two (2) geographically dispersed subspecies of the Atlantic Sturgeon (*Acipenser oxyrhynchus*).

The Gulf sturgeon is characterized by a sub-cylindrical body that is imbedded with bony plates or “scutes”. The snout of the fish is greatly extended and bladelike and includes four (4) fleshy barbells in front of the mouth. The upper lobe of the tail is longer than the lower lobe. Adult specimens generally range in size from 1.8 to 2.4 meters (m) or six (6) to eight (8) feet in length. They are typically light brown to dark brown in color but are known to vary in color from grayish brown to bluish black on their back and sides, grading to white on their belly.

Age at sexual maturity ranges from 8 to 12 years for females and 7 to 9 years for males (Huff 1975). The Gulf sturgeon is a long-lived species, with some individuals reaching at least 42 years in age (Huff 1975).

The feeding habits of the Gulf sturgeon vary, depending upon the fish’s age (i.e., young-of-year, juvenile, sub-adult, adult) and is closely associated with migration and spawning habits. Throughout fall and winter, juveniles feed in the lower salinity areas in the river mouth and estuary while subadults and adults migrate and feed in the estuaries and nearshore Gulf of Mexico habitat (Foster 1993). Some Gulf sturgeon may also forage in the open Gulf of Mexico.

The Gulf sturgeon typically inhabits the coastal rivers of the Gulf of Mexico during the warmer months of the year and generally overwinters in estuaries and bay

environments within the Gulf of Mexico. The adults move into the tributary rivers for spawning in the spring and return to the Gulf waters in the fall. Spawning occurs in the upper reaches of rivers, at least 100 km (62 miles) upstream of the river mouth in habitats consisting of one or more of the following: limestone bluffs and outcroppings, cobble, limestone bedrock covered with gravel and small cobble, gravel, and sand. These hard bottom substrates are required for egg adherence and shelter for developing larvae. Documented spawning depths range from 1.4 to 7.9 m (4.6 to 26 ft).

2.2.1.4 Conservation Needs

There are currently no conservation plans for the Gulf sturgeon. However, there is a Recovery Plan dated 1995 that includes an outline for recovery actions addressing threats to the Gulf sturgeon. Below are the main objectives. See Appendix C-2 for further details.

- Determine essential ecosystems, identify essential habitats, assess population status, and refine life history investigations in management unit rivers.
- Protect individuals, populations, and their habitats.
- Coordinate and facilitate exchange of information on Gulf sturgeon conservation and recovery activities.

2.2.2 Environmental Baseline

2.2.2.1 Species Presence and Use

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

Prior to the listing of the species, Davis et al. (1970) reported the collection of Gulf sturgeon from Lake Pontchartrain during a Louisiana Department of Wildlife and Fisheries (LDWF) anadromous fish survey from 1966 to 1969. From 1988 to 1999, LDWF, through various means and studies, captured and recorded at least 60 Gulf sturgeon throughout Lake Pontchartrain, Lake Catherine, the Rigolets and Lake Borgne. A LDWF trammel net study conducted by Inland Fisheries Division in the spring of 2001 resulted in the capture of three young of the year juvenile sturgeon at the intersection of the East Pearl River and Little Lake. In 2002, LDWF Seafood Division reported the capture of a Gulf sturgeon in one of

their gill nets while sampling in a cove west of Alligator Point, Lake Borgne. By-catch of Gulf sturgeon has been reported by several recreational and commercial fishermen within these waters. A total of 177 Gulf sturgeon, measuring up to 7.2 feet in length and weighing from 2 to 152 lbs, were captured in these lakes and in the Rigolets from October 1991 to September 1992 (Rogillio, 1993). Reynolds (1993) reported that sturgeon measuring up to 7.2 feet in length and weighing up to 258 lbs were incidentally caught by shrimp trawlers, netters, and recreational anglers from 1889 to 1993 in Lake Pontchartrain.

2.2.2.2 Species Conservation Needs within the Action Area

There are currently no conservation plans for the Gulf sturgeon. However, there is a Recovery Plan dated 1995 that includes an outline for recovery actions addressing threats to the Gulf sturgeon. Below are the objectives that might be applicable to the action area. See Appendix C-2 for further details.

- Survey, monitor, and model populations.
- Reduce or eliminate unauthorized take.
- Identify and eliminate known or potentially harmful chemical contaminants, and water quantity and water quality problems which could impede recovery of Gulf sturgeon.
- Restore, enhance, and provide access to essential habitats.

2.2.2.3 Habitat Condition (General)

The extent of potential habitat for the Gulf sturgeon, within the project area, is the approximately 134-acre M2 borrow site located within Lake Pontchartrain and associated tributaries. Lake Pontchartrain contains suitable sturgeon habitat that is characterized by sandy bottoms and relatively shallow depths extending to 15 feet (NOAA Chart 11639). Desktop review of National Oceanic and Atmospheric Administration Bathymetric Data of Lake Pontchartrain (ESD-PHB-21, W00561) indicate water depth between approximately 3 ft to 11 ft in the vicinity of the M2 borrow site.

2.2.2.4 Influences

Over- fishing, associated with the commercial uses, resulted in a significant decline in Gulf sturgeon numbers throughout most of the 20th century. Incidental catch of Gulf sturgeon in other fisheries occurred at significant levels during the same time periods. Habitat losses associated with the construction of water control structures including dams and sills along the Gulf of Mexico drainage basins have contributed to a decline in populations throughout the historic range. Dam construction in several of the rivers has severely restricted the sturgeon's access to historic

migration routes and spawning areas. Water quality such as pollution, temperature, and dissolved oxygen levels are also a threat.

2.2.2.5 Additional Baseline Information

There is no additional baseline information.

2.2.3 Effects of the Action

2.2.3.1 Indirect Interactions

Indirect impacts to Gulf Sturgeon could occur due to turbidity from construction which would be minimized by utilizing dikes to contain the dredged material. In addition, any runoff from construction activities on land would be controlled through the use of best management practices and adherence to regulations governing stormwater runoff at construction sites and staging areas.

Hypoxic and anoxic conditions can occur in deep borrow pits that have a tendency to accumulate organic material. This accumulation would be reduced for the M2 borrow pit within Lake Pontchartrain by limiting the depth of the pit to 10 feet. Therefore, effects to Gulf sturgeon from hypoxic or anoxic conditions are discountable.

No permanent indirect impacts to gulf sturgeon are expected to occur from construction of the propose project.

2.2.3.2 Direct Interactions

Gulf sturgeon may be physically injured if struck by construction equipment, vessels, or materials during dredging. This effect is discountable due to the ability of the species to move away from the project site if disturbed. Gulf sturgeon are mobile and are able to avoid construction noise, moving equipment, and placement or removal of materials during construction. NMFS has previously determined in dredging Biological Opinions (e.g., (NMFS 2007)) that, while ocean-going hopper-type dredges may lethally entrain sturgeon, non-hopper type dredging methods, such as the cutterhead dredging method used in this project, are slower and extremely unlikely to adversely affect Gulf sturgeon.

The construction activities and related construction noise may prevent or deter Gulf sturgeon from entering the project area. However, the effect to sturgeon from temporary avoidance of the project area due to construction activities, including related noise, would likely be insignificant. The size of the area from which animals would avoid is relatively small in comparison to the available similar habitat nearby, which would be accessible to sturgeon during construction. Disturbances and loss of habitat access would be temporary and

limited to days of in-water construction. After the project is completed, Gulf sturgeon would be able to return to the project area.

The effect to Gulf sturgeon from the potential loss of foraging habitat due to dredging is also expected to be insignificant. Gulf sturgeon are opportunistic feeders that forage over large areas and would be able to locate prey beyond the small dredging footprint (approximately 134 acres). Also, impacts to foraging resources from dredging are temporary since benthic invertebrate populations in dredged areas have been observed to recover in 3-24 months after dredging (Culter and Mahadevan 1982; Saloman et al. 1982; Wilber et al. 2007).

Construction and operation of flood/sluice/lift gates and pump stations could restrict movement of sturgeon to upper reaches of Lake Pontchartrain tributaries. To mitigate this impact, the proposed navigable gates at Bayou Paquet, Bayou Bonfouca and Bayou Liberty 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. Additionally, temporary bypass channels would be constructed at locations where a pump station or floodgate is proposed within the limits of a channel. The temporary bypass channel would route water around the structure in order to maintain pre-construction flow conditions and minimize environmental impacts during construction. The temporary bypass channels would be similarly sized to the channels being impacted.

2.2.4 Cumulative Effects

For purposes of consultation under ESA Section 7, cumulative effects are those caused by future state, tribal, local, or private actions that are reasonably certain to occur in the Action Area. Future Federal actions that are unrelated to the proposed action are not considered, because they require separate consultation under Section 7 of the ESA. At this time the USACE is unaware of any future state, tribal, local, or private non-Federal unrelated to the proposed action that are reasonably certain to occur in the Action Area.

2.2.5 Discussion and Conclusion

To reduce impacts to Gulf sturgeon, a cutterhead dredge would be utilized to remove borrow material from the designated borrow area. This equipment is slower moving and has not been identified as equipment that would impact Gulf sturgeon. Additionally, protected species construction conditions developed by NMFS would be implemented for the proposed project (Appendix D-1 and D-2).

Based upon literature review, available survey data, the current status of the species, the environmental baseline for the action area, and the effects of the action, the USACE has determined that implementation of the proposed action is not likely to adversely affect the Gulf sturgeon.

2.3 Louisiana Quillwort (*Isoetes louisianensis*)

2.3.1 Status of the Species

2.3.1.1. Legal Status

The Louisiana quillwort is listed as Endangered under the Endangered Species Act (Federal Register Vol. 57, No. 209, October 28, 1992).

2.3.1.2 Recovery Plans

The most recent recovery plan available for the Louisiana quillwort is dated September 1996 (Appendix C-3).

2.3.1.3 Life History Information

Louisiana quillwort is a small, semi-aquatic, facultative evergreen plant with spirally arranged leaves (sporophylls) arising from a globose, two-lobed corm. The hollow leaves are transversely septate, and measure approximately 0.12 inches wide and up to 16 inches long.

Louisiana quillwort occurs in the East Gulf Coastal Plain physiographic province in Pleistocene Prairie Terraces and Pleistocene High Terraces in southeastern Louisiana an in Pleistocene High Terraces in southern Mississippi. This species grows on sand and gravel bars on the accreting sides of streams and moist overflow channels within riparian forest and bay head swamp communities. The Louisiana quillwort is believed to be dependent on a special hydrologic regime resulting from the presence of small springs scattered at the base of banks or bluffs.

2.3.1.4 Conservation Needs

There are currently no conservation plans for the Louisiana quillwort. However, there is a Recovery Plan dated September 1996 that includes an outline for recovery actions addressing threats to the Louisiana quillwort. Below are the main objectives. See Appendix C-3 for further details.

- Protect known populations by protecting their habitat
- Conduct life history research
- Monitor population trends and developing threats
- Search for additional populations in southeastern Louisiana, southern Mississippi, and south Alabama
- Preserve genetic stock
- Inform the public about the conservation needs of the species

2.3.2 Environmental Baseline

2.3.2.1 Species Presence and Use

Louisiana quillwort is currently known to occur in Washington and St. Tammany parishes in Louisiana and two counties in southern Mississippi. In Washington parish the species has been identified within the Bogue Chitto River watershed in upper Mill Creek and the lower portions of Thigpen and Clearwater Creeks. In St. Tammany parish, the species had been identified within the Tchefuncta River watershed and is known to occur in the following locations:

- The Bogue Falaya River drainage: (1) Over 1,500 plants are located along a 1.0 km (0.6 mile) section of a tributary to the Bogue Falaya. (2) Approximately 50 plants occur near the headwaters of a small drainage of LaTice Branch Creek.
- The Little Bogue Falaya River drainage: Over 350 plants are located at the Little Bogue Falaya River southeast of Barkers Corner.
- The Abita River drainage: (1) Approximately 400 plants occur along a 0.5 km (0.3 mile) section of Abita Creek, and 18 plants occur at a site on Coon Creek, a small tributary of Abita Creek. These two sites are considered a single population. (2) Two plants are located at Ten-Mile Creek.
- Bayou Chinchuba drainage: Bayou Chinchuba drains directly into Lake Pontchartrain. This population of over 350 plants is atypical because it occurs in a seasonally-flooded small depression in wet-loblolly pine flatwoods instead of near a streamside.

2.3.2.2 Species Conservation Needs within the Action Area

There are currently no conservation plans for the Louisiana Quillwort. However, there is a Recovery Plan dated September 1996 that includes an outline for recovery actions addressing threats to the Louisiana Quillwort. Below are the objectives that might be applicable to the action area. See Appendix C-3 for further details.

- Protect known populations by protecting their habitat
- Monitor population trends and developing threats
- Search for additional populations in southeastern Louisiana, southern Mississippi, and south Alabama

2.3.2.3 Habitat Condition (General)

Louisiana quillwort is apparently restricted to areas in or near shallow (0.75 to 2.5 feet with occasional deeper pools), blackwater streams in riparian woodland and bayhead forests of pine flatwoods and upland pine forests. Within the Action Area, Mile Branch is located within the known range of the Louisiana quillwort.

However, the USFWS determined Mile Branch does not contain suitable habitat for the quillwort (Appendix B).

2.3.2.4 Influences

Major threats to this species include habitat loss through hydrologic modifications of stream habitat, and land use practices that significantly alter stream water quality and hydrology.

Habitat loss through land use practices that significantly transform riparian forest communities and alter stream quality and dynamics, poses the most serious threat to populations of Louisiana quillwort. This species is adapted to a dynamic stream environment and is negatively affected by adverse anthropogenic changes. Anthropogenic constraints change natural drainage patterns and stream dynamics, potentially damaging quillwort habitat and possibly inhibiting formation of new habitat. Dredging, ditching, channelization, road construction, and offroad vehicles (ORV) can alter natural processes and result in habitat loss.

Timber removal increases surface runoff and contributes to stream erosion and sediment siltation. Removal of canopy alters light and temperature regimes on the forest floor; soils become drier and weedy vegetation tends to invade. Logging adjacent to creeks creates debris and detritus which can obstruct water flow and change stream dynamics. While streamside management zones (SMZs) are theoretically protective buffers to the streams themselves, observations of logging practices in Mississippi show that logging sometimes occurs to the stream edge, that slash is frequently left in the drainage, and that quillwort habitat is crossed by skidders and trucks during timber harvest. These generally rough logging trails and roads are then used by hunters and others until saplings regenerate and block vehicular access.

Sand and gravel mining poses a significant threat, as evidenced by portions of Clearwater Creek in Washington Parish, Louisiana, that have been completely cleared, channelized, and re-routed. Degradation of water quality from siltation, prolific algal growth, and sediment pollution from overflow of adjacent gravel pits was observed at the creek site (McInnis 1991a). Mining operations in or adjacent to creeks and rivers can have a detrimental effect upon aquatic resources.

2.3.2.5 Additional Baseline Information

There is no additional baseline information.

2.3.3 Effects of the Action

2.3.3.1 Indirect Interactions

No indirect interactions are anticipated as existing data indicates the Louisiana quillwort do not utilize the project area.

2.3.3.2 Direct Interactions

No direct interactions are anticipated as existing data indicates the Louisiana quillwort do not utilize the project area.

2.3.4 Cumulative Effects

For purposes of consultation under ESA Section 7, cumulative effects are those caused by future state, tribal, local, or private actions that are reasonably certain to occur in the Action Area. Future Federal actions that are unrelated to the proposed action are not considered, because they require separate consultation under Section 7 of the ESA. At this time the USACE is unaware of any future state, tribal, local, or private non-Federal unrelated to the proposed action that are reasonably certain to occur in the Action Area.

2.3.5 Discussion and Conclusion

The Louisiana quillwort grows on sand and gravel bars on the accreting sides of streams and moist overflow channels within riparian forest and bay head swamp communities. Mile Branch does not contain suitable habitat for the Louisiana quillwort; therefore, it is unlikely that the proposed action will adversely affect the species.

Based upon literature review and available survey data, and the effects of the action, the CEMVN has determined that channelization at Mile Branch will have no effect on the Louisiana quillwort.

2.4 Red-Cockaded Woodpecker (*Picoides borealis*)

2.4.1 Status of the Species

2.4.1.1. Legal Status

The red-cockaded woodpecker (RCW) is listed as Endangered under the Endangered Species Act (Federal Register Vol. 35, No. 165, August 25, 1970).

2.4.1.2 Recovery Plans

The most recent recovery plan available for the RCW is dated January 2003 (Appendix C-4).

2.4.1.3 Life History Information

RCWs are black and white with a ladder back and large white cheek patches. These cheek patches distinguish RCWs from all other woodpeckers in their range. RCWs are black with black and white barring on their backs and wings. Their breasts and bellies are white to grayish white with distinctive black spots along the sides of the breast changing to bars on the flanks. Central tail feathers are black and outer tail feathers are white with black barring. Adults have black crowns, a narrow white line above the black eye, a heavy black stripe separating the white cheek from a white throat, and white to grayish or buffy nasal tufts. Bills are black, and legs are gray to black.

RCWs are endemic to open, mature and old growth pine ecosystems in the southeastern United States but were once common throughout the longleaf pine ecosystem, which covered at least 90 million acres before European settlement (Frost 2006). Historical population estimates are 1-1.6 million family groups (Conner et al. 2001a), the social unit of RCWs. The birds inhabited the open pine forests of the southeast from New Jersey, Maryland and Virginia to Florida, west to Texas and north to portions of Oklahoma, Missouri, Tennessee and Kentucky.

RCWs are a cooperatively breeding species, living in family groups that typically consist of a breeding pair with or without one or two male helpers. Females may become helpers but do so at a much lower rate than males. The ecological basis of cooperative breeding in this species is unusually high variation in habitat quality, due to the presence or absence of a critical resource. This critical resource is the cavities that RCWs excavate in live pines, a task that commonly takes several years to complete. RCWs exploit the ability of live pines to produce large amounts of resin, by causing the cavity tree to exude resin through wounds, known as resin wells, that the birds keep open. This resin creates an effective barrier against climbing snakes. Longleaf pine is a preferred tree species for cavity excavation

because it produces more resin, and for a longer period of time, than other southern pines.

2.4.1.4 Conservation Needs

The Recovery Plan for the RCW, dated January 2003 includes primary actions needed to accomplish the ultimate (delisting) and interim (downlisting) recovery goals. Below are the main objectives. See Appendix C-4 for further details.

- Application of frequent fire to both clusters and foraging habitat
- Protection and development of large, mature pines throughout the landscape
- Protection of existing cavities and judicious provisioning of artificial cavities
- Provision of sufficient recruitment clusters in locations chosen to enhance the spatial arrangement of groups
- Restoration of sufficient habitat quality and quantity to support the large populations necessary for recovery

2.4.2 Environmental Baseline

2.4.2.1 Species Presence and Use

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

2.4.2.2 Species Conservation Needs within the Action Area

The Recovery Plan for the RCW, dated January 2003 includes primary actions needed to accomplish the ultimate (delisting) and interim (downlisting) recovery goals. Below are the objectives that might be applicable to the action area.

- Protection and development of large, mature pines throughout the landscape
- Protection of existing cavities and judicious provisioning of artificial cavities

2.4.2.3 Habitat Condition (General)

RCWs require open pine woodlands and savannahs with large old pines for nesting and roosting habitat (clusters). RCWs also require abundant foraging habitat that consists of mature pines with an open canopy, low densities of small pines, little or no hardwood or pine midstory, few or no overstory hardwoods, and abundant native bunchgrass and forb groundcovers. Old growth pine savannas are scattered within the Action Area and are a managed habitat type within the Bayou Bonfouca NWR. Surveys conducted by the USFWS determined that suitable RCW nesting and foraging habitat exists within the Action Area.

2.4.2.4 Influences

Primary threats to species viability for red-cockaded woodpeckers all have the same basic cause: lack of suitable habitat. Red-cockaded woodpeckers require open mature pine woodlands and savannahs maintained by frequent fire, and there is very little of this habitat remaining (Lennartz et al. 1983, Frost 1993, Simberloff 1993, Ware et al. 1993). On public and private lands, both the quantity and quality of red-cockaded woodpecker habitat are impacted by past and current fire suppression and detrimental silvicultural practices (Ligon et al. 1986, 1991, Baker 1995, Cely and Ferral 1995, Masters et al. 1995, Conner et al. 2001). Serious threats stemming from this lack of suitable habitat include (1) insufficient numbers of cavities and continuing net loss of cavity trees (Costa and Escano 1989, James 1995, Hardesty et al. 1995); (2) habitat fragmentation and its effects on genetic variation, dispersal, and demography (Conner and Rudolph 1991b); (3) lack of foraging habitat of adequate quality (Walters et al. 2000, 2002a, James et al. 2001); and (4) fundamental risks of extinction inherent to critically small populations from random demographic, environmental, genetic, and catastrophic events (Shaffer 1981, 1987).

2.4.2.5 Additional Baseline Information

Surveys of the project area conducted by the USFWS identified four (4) RCW clusters within one-half mile of the action area. Per criteria #1 and 2 for managed stability in the RCW recovery plan, each group of RCWs must have a minimum of 30.4 ha (75 ac) of habitat that contain 689 m^2 (3000 ft^2) of pine basal area, including only pines > 25.4 cm (10 in) dbh. (USFWS, 2003; Appendix E-2).

A foraging habitat analysis determined the amount of available foraging habitat in 3 of the 4 clusters exceeded the 75-acre threshold under pre- and post-project conditions (Table 8). Although Paquet 3 (cluster #18) is below 75 acres, no suitable foraging habitat is lost as a result of the project (Table 9). Since changes to the availability of foraging habitat will be minimal and within RCW managed stability criteria, the proposed action should not significantly impact RCW foraging habitat.

Table 8. Available Foraging Habitat Pre- and Post-Project in Acres

RCW Cluster	Pre-Project Available Foraging Habitat	Post Project Available Foraging Habitat
Paquet 3 (cluster #18)	64.19	64.19
Salmen 1 (cluster #19)	132.07	107.33
Salmen 2 (cluster #20)	190.62	185.50
Salmen 3 (cluster #21)	266.53	242.68

Table 9. Habitat Within Levee ROW

RCW Cluster	Foraging Acres	Unsuitable	Total Acres
Paquet 3 (cluster #18)	0	10.68	10.68
Salmen 1 (cluster #19)	24.74	0	24.74
Salmen 2 (cluster #20)	5.12	0	5.12
Salmen 3 (cluster #21)	23.85	0.05	23.90

2.4.3 Effects of the Action

2.4.3.1 Indirect Interactions

Clearing of forested areas to construct the approximately 18.40-mile levee and floodwall system could result in removal of suitable RCW nesting trees. In a survey of the project area conducted by USFWS, four RCW clusters were identified near the proposed alignment. A foraging habitat analysis determined the proposed project did not significantly impact the amount of suitable habitat available to these clusters (Appendix E-2). In addition, indirect impacts from construction activities would be controlled through the use of best management

practices and adherence to regulations governing stormwater runoff at construction sites and staging areas. No permanent indirect impacts to RCWs are expected to occur from construction of the proposed project.

2.4.3.2 Direct Interactions

Noise and activity associated with construction would likely temporarily displace RCWs from active construction zones to other nearby habitat. Displacement of birds is not likelyto significantly impact the species as there is a sufficient amount suitable habitat available adjacent to the project area.

Additionally, RCWs may be physically injured or killed if struck by equipment or materials during construction. This effect is discountable due to the ability of the species to move away from the project site if disturbed.

2.4.4 Cumulative Effects

For purposes of consultation under ESA Section 7, cumulative effects are those caused by future state, tribal, local, or private actions that are reasonably certain to occur in the Action Area. Future Federal actions that are unrelated to the proposed action are not considered, because they require separate consultation under Section 7 of the ESA. At this time the USACE is unaware of any future state, tribal, local, or private non-Federal unrelated to the proposed action that are reasonably certain to occur in the Action Area.

2.4.5 Discussion and Conclusion

Surveys of the project area conducted by the USFWS determined that the proposed action does not significantly impact the amount of suitable habitat available to nearby RCW clusters.

Based upon literature review, available survey data, the current status of the species, the environmental baseline for the action area, and the effects of the action, the USACE has determined that implementation of the proposed action is not likely to adversely affect RCWs.

2.5 West Indian Manatee (*Trichechus manatus*)

2.5.1 Status of the Species

2.5.1.1. Legal Status

The West Indian manatee is listed as threatened under the Endangered Species Act (Federal Register Vol. 32, No. 48, March 11, 1967).

2.5.1.2 Recovery Plans

The most recent recovery plan available for the West Indian manatee is dated October 2001 (Appendix C-5).

2.5.1.3 Life History Information

West Indian manatees are massive fusiform-shaped animals with skin that is uniformly dark grey, wrinkled, sparsely haired, and rubber-like. Manatees possess paddle-like forelimbs, no hind limbs, and a spatulate, horizontally flattened tail. Adults average about 3.0 m (9.8 ft) in length and 1,000 kg (2,200 lbs) in weight but may reach lengths of up to 4.6 m (15 ft) (Gunter 1941) and weigh as much as 1,620 kg (3,570 lbs) (Rathbun et al. 1990).

In general, the data show that manatees exhibit opportunistic, as well as predictable patterns in their distribution and movement. They are able to undertake extensive north-south migrations with seasonal distribution determined by water temperature. When ambient water temperatures drop below 20° C (68°F) in autumn and winter, manatees aggregate within the confines of natural and artificial warm-water refuges or move to the southern tip of Florida (Snow 1991). Most artificial refuges are created by warm-water outfalls from power plants or paper mills. As water temperatures rise manatees disperse from winter aggregation areas. While some remain near their winter refuges, others undertake extensive travels along the coast and far up rivers and canals.

Manatees are herbivores that feed opportunistically on a wide variety of submerged, floating, and emergent vegetation. Because of their broad distribution and migratory patterns, West Indian manatees utilize a wider diversity of food items and are possibly less specialized in their feeding strategies than manatees in tropical regions (Lefebvre et al. 2000). Shallow grass beds with ready access to deep channels are preferred feeding areas in coastal and riverine habitats. Manatees often use secluded canals, creeks, embayments, and lagoons, particularly near the mouths of coastal rivers and sloughs, for feeding, resting, cavorting, mating, and calving (Marine Mammal Commission 1986, 1988). In

estuarine and brackish areas, natural and artificial fresh water sources are sought by manatees.

Female manatees appear to reach sexual maturity by about age five but have given birth as early as four (Marmontel 1995; Odell et al. 1995; O'Shea and Hartley 1995; Rathbun et al. 1995), and males may reach sexual maturity at 3 to 4 years of age (Hernandez et al. 1995). Breeding takes place when one or more males (ranging from 5 to 22) are attracted to an estrous female to form an ephemeral mating herd (Rathbun et al. 1995). Mating herds can last up to 4 weeks, with different males joining and leaving the herd daily (Hartman 1979; Bengtson 1981; Rathbun et al. 1995). Although breeding has been reported in all seasons, Hernandez et al. (1995) reported that histological studies of reproductive organs from carcasses of males found evidence of sperm production in 94% of adult males recovered from March through November. Only 20% of adult males recovered from December through February showed similar production. The length of the gestation period is uncertain but is thought to be between 11 and 14 months (Odell et al. 1995; Rathbun et al. 1995; Reid et al. 1995). The normal litter size is one, with twins reported rarely (Marmontel 1995; Odell et al. 1995; O'Shea and Hartley 1995; Rathbun et al. 1995). Manatees may live in excess of 50 years.

2.5.1.4 Conservation Needs

The Recovery Plan for the West Indian Manatee dated October 2001 includes actions needed to achieve species recovery. Below are the main objectives. See Appendix C-5 for further details.

- Minimize causes of manatee disturbance, harassment, injury and mortality
- Determine and monitor the status of the manatee population
- Protect, identify, evaluate, and monitor manatee habitats
- Facilitate manatee recovery through public awareness and education

2.5.2 Environmental Baseline

2.5.2.1 Species Presence and Use

The West Indian manatee is known to regularly occur in Lakes Pontchartrain and Maurepas and their associated coastal waters and streams. It also can be found less regularly in other Louisiana coastal areas, most likely while the average water temperature is warm. Based on data maintained by the Louisiana Department of Wildlife and Fisheries, Wildlife Diversity Program, over 80 percent of reported manatee sightings (1999-2011) in Louisiana have occurred from the months of June through December. Manatee occurrences in Louisiana appear to be increasing and they have been regularly reported in the Amite, Blind, Tchefuncte, and Tickfaw Rivers, and in canals within the adjacent coastal

marshes of southeastern Louisiana. Manatees may also infrequently be observed in the Mississippi River and coastal areas of southwestern Louisiana. Cold weather and outbreaks of red tide may adversely affect these animals. However, human activity is the primary cause for declines in species number due to collisions with boats and barges, entrapment in flood control structures, poaching, habitat loss, and pollution.

2.5.2.2 Species Conservation Needs within the Action Area

The Recovery Plan for the West Indian Manatee dated October 2001 includes actions needed to achieve species recovery. Below are the objectives that might be applicable to the action area. See Appendix C-5 for further details.

- Minimize causes of manatee disturbance, harassment, injury and mortality
- Protect, identify, evaluate, and monitor manatee habitat
- Facilitate manatee recovery through public awareness and education

2.5.2.3 Habitat Condition (General)

The West Indian manatee lives in freshwater, brackish and marine habitats. The extent of potential habitat for the manatee, within the project area, is the approximately 134-acre M2 borrow site located within Lake Pontchartrain and adjacent tributaries. Habitat within Lake Pontchartrain is characterized by sandy bottoms and relatively shallow depths extending to 15 feet.

2.5.2.4 Influences

Human activity is the primary cause for declines in species number due to collisions with boats and barges, entrapment in flood control structures, poaching, habitat loss, and pollution. Collisions with watercraft account for an average of 24 percent (%) of known manatee deaths in Florida annually (1976-2000), with 30% in 1999 and 29% in 2000. Deaths attributed to water control structures and navigational locks represents 4% of known deaths. The future of the current system of warm-water refuges for manatees is uncertain as deregulation of the power industry in Florida occurs, and if minimum flows and levels are not established and maintained for the natural springs on which many manatees depend.

2.5.2.5 Additional Baseline Information

There is no additional baseline information.

2.5.3 Effects of the Action

2.5.3.1 Indirect Interaction

Indirect impacts could occur due to turbidity from construction degrading water quality. Turbidity would be minimized by utilizing dikes to contain the dredged material within the M2 marsh creation area. In addition, any runoff from construction activities on land would be controlled through the use of best management practices and adherence to regulations governing stormwater runoff at construction sites and staging areas. No permanent indirect impacts to manatees are expected to occur from construction of the proposed project.

2.5.3.2 Direct Interactions

Proposed construction at the M2 mitigation site would convert approximately 200 acres of shallow open water to brackish marsh. The average depth at this location is less than 2 feet and is not prime habitat for manatee foraging due to the limited amount of grass beds and access to deeper waters. The proposed borrow location would be approximately 134 acres within Lake Pontchartrain and would be more conducive to manatee moving through the area based on depth and access to deeper waters, but foraging potential is still low based on the limited amount of grass beds. During borrow excavation, increased turbidity would occur, but would be reduced by the movement of the tides. Based on the footprint and location of the borrow area in relation to the 403,000-acre lake, significant impacts to manatee would not be anticipated.

2.5.4 Cumulative Effects

For purposes of consultation under ESA Section 7, cumulative effects are those caused by future state, tribal, local, or private actions that are reasonably certain to occur in the Action Area. Future Federal actions that are unrelated to the proposed action are not considered, because they require separate consultation under Section 7 of the ESA. At this time the USACE is unaware of any future state, tribal, local, or private non-Federal unrelated to the proposed action that are reasonably certain to occur in the Action Area.

2.5.5 Discussion and Conclusion

To minimize the potential for construction activities to cause adverse impacts to manatees, *Standard Manatee Conditions for In-Water Activities*, developed by the USFWS, Lafayette, Louisiana Field Office, would be implemented when activities are proposed that would impact habitat where manatees could occur (Appendix D-3).

Based upon literature review, available survey data, the current status of the species, the environmental baseline for the action area, and the effects of the action, and implementation of minimization measures, the CEMVN has determined that implementation of the proposed action is not likely to adversely affect the West Indian Manatee.

3 Critical Habitat Effects Analysis

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.

Primary consideration must be given to the physical and biological features (PBFs) of the habitat under review that are essential to the conservation of the species and that may require special management considerations or protection.

The PBFs essential for the conservation of the Gulf sturgeon populations include those habitat components that support feeding, resting, and sheltering, reproduction, migration and physical features necessary for maintaining the natural processes that support these habitat components.

Based upon the identified PBFs for the Gulf sturgeon, the USFWS and NMFS identified a total of fourteen (14) Critical Habitat Units. Critical Habitat Unit 8 covers the proposed project area and includes Lake Pontchartrain, Lake St. Catherine, The Rigolets, Little Lake, Lake Borgne, and Mississippi Sound in Jefferson, Orleans, St. Tammany, and St. Bernard Parish, Louisiana, Hancock, Jackson, and Harrison Counties in Mississippi, and in Mobile County, Alabama. The borrow area for the M2 mitigation site, located within Lake Pontchartrain, is included in Critical Habitat Unit 1

Of the PBFs identified for Gulf sturgeon critical habitat, food, water quality, and sediment quality are found within the Action Area.

Adult and subadult Gulf sturgeon feed on amphipods, lancelets, polychaetes, gastropods, molluscs and/or crustaceans within estuarine and marine habitats. Dredging may remove substrates containing sturgeon prey items. However, overall impacts to sturgeon prey are expected to be insignificant since the estimated impact area is relatively small compared to the surrounding area available (approximately 134 acres). Effects to sturgeon prey are also expected to be temporary and short-term in nature, consisting of a temporary loss of benthic invertebrate populations in the dredged areas. Observed rates of benthic community recovery after dredging range from 3-24 months (Culter and Mahadevan 1982; Saloman et al. 1982; Wilber et al. 2007). The relatively species-poor benthic assemblages associated with low salinity estuarine sediments can recover in periods of time ranging from a few months to approximately one year, while the more diverse communities of high salinity estuarine sediments may require a year or longer.

Localized and temporary reductions in water quality through increased turbidity may result from dredging. Effects to water quality from localized and temporary increased turbidity are expected to be insignificant because the Action Area is also in a high wave/current area where construction-induced turbidity is not expected to remain and where turbidity curtains are not practical to use. Effects to temperature, salinity, pH,

hardness, oxygen content, and other chemical characteristics of water quality are also not expected to result from dredging activities.

Effects to sediment quality from dredging would be insignificant. During prior consultations (BAs for SER-2010-4236 and SER-2014-14728, hereby incorporated by reference), surveys were conducted by USGS and NOAA that used remote imagery to determine bottom substrates within Lake Pontchartrain. The majority of Lake Pontchartrain bottoms were defined as having sandy composition and thus prime habitat for sturgeon.

The borrow site is approximately 2,000 ft from the shoreline and likely receives fine sediment from wave induced shoreline erosion. The sandier composition areas, which are located further into the lake center, would be avoided and thus minimizing impacts to sturgeon foraging. Given that prime habitat is available nearby, any Gulf Sturgeon that may be present would likely congregate in the ample nearby prime habitat, especially during construction. No permanent alteration of habitat composition is expected to occur within the action area.

Based upon the assessment completed, it was determined that the proposed action would not result in an adverse modification to Gulf sturgeon critical habitat.

4 Summary Discussion, Conclusion, and Effect Determinations

4.1 Effect Determination Summary

Species Common Name	Scientific Name	Listing Status	Present in the Action Area	Effect Determination
West Indian Manatee	(*Trichechus manatus)*	Threatened	Yes	NLAA
Red-Cockaded Woodpecker	(*Picoides borealis)*	Endangered	Yes	NLAA
Gopher Tortoise	(*Gopherus polyphemus)*	Threatened	No	NLAA
Gulf Sturgeon	(*Acipenser oxyrinchus desotoi*)	Threatened	Yes	NLAA
Louisiana Quillwort	(*Isoetes louisianensis*)	Endangered	No	NE
Gulf Sturgeon Critical Habitat		Final	Yes	NLAA

4.2 Summary Discussion

The proposed action consists of the construction of approximately 18.4 miles of earthen levee and floodwall in St. Tammany Parish, Louisiana, channelization of the lower 2.15 miles of Mile Branch in Covington, Louisiana, creation of an approximately 200 acres marsh site on the north shore of Lake Pontchartrain utilizing borrow from Lake Pontchartrain, and other mitigation measures to offset losses within the project's construction footprint areas.

A search on the USFWS' IPaC site indicated that the ESA-listed, eastern black rail, West Indian manatee, red-cockaded woodpecker, gopher tortoise, ringed map turtle, Gulf sturgeon, monarch butterfly, Louisiana quillwort, and Gulf sturgeon Critical Habitat could occur in the project area and should be considered when assessing the impacts of this project. Upon further conference with the USFWS on the project, the USFWS and CEMVN determined that the ringed map turtle and eastern black rail are unlikely to occur in the project area, therefore, only impacts to the West Indian manatee, Louisiana quillwort, Gulf sturgeon, Gulf sturgeon critical habitat, Gopher tortoise, and red-cockaded woodpecker were evaluated in this BA.

The monarch butterfly is listed in the ESA as a "candidate" species. Candidate species receive no protections under the ESA. Should a listing decision be made prior to completion of the proposed action, CEMVN will reinitiate consultation with the USFWS.

The alligator snapping turtle is listed in the ESA as “proposed threatened”. Proposed species are not protected by the take prohibitions of Section 9 of the ESA until the rule to list is finalized. However, under section 7(a)(4) of the ESA, Federal agencies must confer with the Service if their action will jeopardize the continued existence of a proposed species. Since the alligator snapping turtle may occur in the project area, the USFWS provided a list of minimization measures to reduce potential adverse effects to the species.

To reduce impacts to the West Indian manatee and the Gulf sturgeon, implementation of the proposed action would include Standard Manatee Conditions for In-Water Activities, Protected Species Construction Conditions, and Vessel Strike Avoidance Measures. In summary, the contractor will be responsible for instructing all personnel regarding the potential presence of protected species in the area and the need to avoid collisions with these animals. If protected species are sighted within 150 of the area, all operations of moving equipment must cease until the species has departed the area on its own volition. There also would be reporting requirements, restrictions on vessel operation, and restrictions on the use of siltation barriers.

4.3 Conclusion

Based on currently available historical and catch data; a review of current literature and studies; and with the employment of avoidance measures recommended through guidelines set up during coordination with USFWS and NMFS, the CEMVN believes that the actions, as proposed, may affect but are not likely to adversely affect the federally listed species of Gulf Sturgeon, West Indian manatee, Red-Cockaded woodpecker, gopher tortoise, and gulf sturgeon critical habitat, and will have no effect on the Louisiana quillwort,.

Based on the information provided in this document, the CEMVN requests concurrence with may affect, but are not likely to adversely affect determination for the gulf sturgeon, West Indian manatee, red-cockaded woodpecker, Louisiana Quillwort, gopher tortoise, and gulf sturgeon Critical Habitat.

The Record of Decision will not be signed until ESA coordination is complete.

5 References

Abadie, S.W., C.G. Brantley, S. Mickal, and S. Shively. 2000. “Distribution of the Manatee, Louisiana Coastal Wetlands Conservation and Restoration Task Force (LCWCRTW) & Wetlands Conservation and Restoration Authority (WCRA). 1999. Coast 2050: Toward a Sustainable Coastal Louisiana. Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority.

Ashton, R. E., Jr., and P. S. Ashton. 2004. The gopher tortoise: a life history. Pineapple Press, Sarasota, Florida, USA. 72pp.

Ashton, K.G., R.L. Burke, and J.N. Layne. 2007. Geographic Variation in Body and Clutch Size of Gopher Tortoises. Copeia 2007:355–363.

Ashton, R. E., and P.S. Ashton. 2008. The natural history and management of the gopher tortoise *Gopherus polyphemus* (Daudin): The natural history and management of the gopher tortoise *Gopherus polyphemus*, i-xii, 1-275 p.

Auffenberg, w. and R. Franz. 1982. The status and distribution of the gopher tortoise (*Gopherus polyphemus)*. Pages 95-126 in R.B. Bury, editor. North American Tortoises: Conservation and Ecology. U.S. Fish and Wildlife Service, Wildlife Research Report 12.

Baker, W. W. 1995. The distribution and status of the red-cockaded woodpecker (*Picoides borealis*) in Georgia. Pp. 465-469 *in* D. L. Kulhavy, R. G. Hooper, and R. Costa, eds. Red-cockaded woodpecker: recovery, ecology and management. Center for Applied Studies in Forestry, Stephen F. Austin State University, Nacogdoches, TX.

Bartoszek, I.A., Andreadis, P.T., Prokop-Ervin, C., Curry, G., & Reed, R.N. 2018. *Python bivittatus* (Burmese Python) and *Gopherus polyphemus* (Gopher Tortoise). Habitat Use, Breeding Aggregation, and Interspecific Interaction. Herpetological Review 49:353−354.

Basiotis, K. 2007. The effects of invasive cogongrass (*Imperata cylindrica*) on the threatened gopher tortoise (*Gopherus polyphemus*). MS Thesis, University of South Florida.

Bengston, J.L. 1981. Ecology of manatees (*Trichechus manatus*) in the St. Johns River, Florida. Ph.D. Thesis. Univ. of Minnesota, Minneapolis. 126 pp.

Berish J. E. D., Wendland, L.D., Keltie, R.A., Garrison, E.P., Gates, C.A. 2010. Effects of Mycoplasmal Upper Respiratory Tract Disease on Morbidity and Mortality of Gopher Tortoises in Northern and Central Florida. Journal of Wildlife Diseases 46(3):6955–705.

Birkhead R.D., C. Guyer, S.M. Hermann, and W.K. Michener. 2005. Patterns of folivory and seed ingestion by gopher tortoises (*Gopherus polyphemus*) in a southeastern pine savanna. American Midland Naturalist 154(1):143–151.

Butler, J. A. and T. W. Hull. 1996. Reproduction of the tortoise, *Gopherus polyphemus*, in northeastern Florida. Journal of Herpetology 30:14–18.

Butler, J. A., and S. Sowell. 1996. Survivorship and predation of hatchling and yearling gopher tortoises, Gopherus polyphemus. Journal of Herpetology 30:455–458.

Castellón, T.D., B.B. Rothermel, and J.M. Bauder. 2018. Gopher Tortoise Burrow Use, Home Range, Seasonality, and Habitat Fidelity in Scrub and Mesic Flatwoods of Southern Florida. Herpetologica 74:8–21.

Causey, M.K. and C.A. Cude. 1978. Feral dog predation of the gopher tortoise, *Gopherus polyphemus*, in southeast Alabama. Herpetological Review 9:94–95.

Cely, J. E., and D. P. Ferral. 1995. Status and distribution of the red-cockaded woodpecker in South Carolina. Pp. 470-476 in D. L. Kulhavy, R. G. Hooper, and R. Costa, eds. Red-cockaded woodpecker: recovery, ecology and management. Center for Applied Studies in Forestry, Stephen F. Austin State University, Nacogdoches, TX

Conner, Wouldiam H. and John W. Day, Jr . American Journal of Botany, Nov. – Dec., 1976, Vol. 63, No. 10 (Nov. – Dec., 1976), pp. 1354-1364

Conner, R. N., and D. C. Rudolph. 1991b. Forest habitat loss, fragmentation, and red-cockaded woodpeckers. Wilson Bulletin 103:446-457.

Conner, R. N., D. C. Rudolph, and J. R. Walters. 2001. The red-cockaded woodpecker: surviving in a firemaintained ecosystem. University of Texas Press, Austin, TX.

Costa, R., and R. Escano. 1989. Red-cockaded woodpecker: status and management in the southern region in 1986. US Forest Service Technical Publication R8-TP12.

Crooks, K.R., M.E. Soule. 1999. Mesopredator release and avifaunal extinctions in a fragmented system. Nature 400:563 –566.

Culter, J. K., and S. K. Mahadevan. 1982. Long-term effects of beach nourishment on the benthic fauna of Panama City Beach, Florida. Mote Marine Laboratory, Sarasota, FL., Miscellaneous Report No. 82-2, Fort Belvoir, Va.

Davis, W.J., J.P. Miller, and W.L. Wilson. 1970. Biology and utilization of anadromous alosides, Phase 3. Location of spawning sites and nurseries. In. Completion Rep. Anadromous Fish Project Va.Va. Inst. Mar. Sci. Gloucester Point, Va. 25 pp.

Desiderio, T. M., N. I. Stacy, R. J. Ossiboff, M. Iredale, L. L. Archer, A. B. Alexander, D. J. Heard, S. E. Crevasse, W. F. Craft, D. V. E. Fredholm, K. A. Donnelly, J. F. Rosenberg, A. L. Childress, K. Russell, and J. F. X. Wellehan, Jr. 2021 Identification of a novel mortality-associated *Helicobacter* species in gopher tortoises (*Gopherus polyphemus*), qPCR test development and validation, and correlation with mortality in a wildlife rehabilitation population. Veterinary Microbiology 259. https://doi.org/10.1016/j.vetmic.2021.109136.

Diemer, J.E. 1986. The ecology and management of the gopher tortoise in the southeastern United States. Herpetologia 42(1):125–133.

Diemer, J. E. 1987. The status of the gopher tortoise in Florida. Proceedings of the Southeastern Nongame and Endangered Wildlife Symposium 3:72-83, Athens, Georgia, USA.

Diemer, J. E. 1992a. Demography of the tortoise, *Gopherus polyphemus*, in northern Florida. Journal of Herpetology 26:281–289.

Douglass, J. F., and C. E. Winegarner. 1977. Predators of eggs and young of the gopher tortoise, *Gopherus polyphemus* (Reptilia, Testudines, Testudinidae) in southern Florida. Journal of Herpetology 11:236–238.

Dziadzio, M.C., R.B. Chandler, L.L. Smith, and S.B. Castleberry. 2016b. Impacts of red imported fire ants (*Solenopsis invicta*) on nestling and hatchling gopher tortoises (*Gopherus polyphemus*) in Southwest Georgia. Herpetological Conservation and Biology 11:527-538.

Enge, K. M., J. E. Berish, R. Bolt, A. Dziergowski, and H. R. Mushinsky. 2006. Biological status report - gopher tortoise. Florida Fish and Wildlife Conservation Commission, Tallahassee, USA. 60 pp.

Engeman, R. E., B. U. Constantin, M. L. Christie, and P. T. Hall. 2009. *Ctenosaura similis* (Black Spiny-Tailed Iguana), *Gopherus polyphemus* (Gopher Tortoise). Concurrent burrow use. Herpetological Review 40:84.

Engeman, R., E. Jacobson, M. L. Avery, and W. E. Meshaka, Jr. 2011. The aggressive invasion of exotic reptiles in Florida with a focus on prominent species: A review. Current Zoology 57:599-612.

Estes, T. and T. Mann. 1996. State land 16th Section Gopher Tortoise survey. Museum Technical Report No. 43. Mississippi Museum of Natural Science, Jackson, MS. 121 p.

Fitzpatrick, J. W., and G. E. Woolfenden. 1978. Red-tailed hawk preys on juvenile gopher tortoises. Florida Field Naturalist 6:49.

Frost, C. C. 1993. Four centuries of changing landscape patterns in the longleaf pine ecosystem. Pp. 1744 in S. M. Hermann, ed. The longleaf pine ecosystem: ecology, restoration, and management. Tall Timbers Fire Ecology Conference Proceedings, No. 18. Tall Timbers Research Station, Tallahassee, FL.

Frost, C. 2006. History and future of the longleaf pine ecosystem. In: Jose, S.; Jokela, E.J.; Miller, D.L., eds. The longleaf ecosystem: ecology, silviculture and restoration. New York: Springer Science: 9–48.

Garner, J.A. and J.L. Landers. 1981. Foods and habitat of the gopher tortoise in southwestern Georgia. Proceedings of the annual conference of the southeast association of fish and wildlife agencies. 35:120–134.

Goessling, J. M., C. Guyer, J. C. Godwin, S. M. Hermann, F. C. Sandmeier, L. L. Smith, and M. T. Mendonça. 2019. Upper respiratory tract disease and associated diagnostic tests of mycoplasmosis in Alabama populations of Gopher tortoises, *Gopherus polyphemus*. PLos One, 14: 1-12.

Griffith, B. J. M. Scott, J. W. Carpenter, and C. Reed. 1989. Translocation as a species conservation tool: status and strategy. Science 245:477–480.

Gunter, G. 1941. Occurrence of the manatee in the United States, with records from Texas. Journal of Mammalogy 22(1):60-64.

Hardesty, J. L., R. J. Smith, C. J. Petrick, B. W. Hagedorn, and H. F. Percival. 1995. Status and distribution of the fourth largest population of red-cockaded woodpeckers: preliminary results from Eglin AFB, Florida. Pp. 494-502

Hartman, D.S. 1979. Ecology and behavior of the manatee (*Trichechus manatus*) in Florida. American Society of Mammalogists Special Publication No. 5. 153 pp.

Hawkins, R. Z., and R. L. Burke. 1989. Of pens, pullers and pets: problems of gopher tortoise relocation. Page 99 in J. E. Diemer, D. R. Jackson, J. L. Landers, J. N. Layne, and D. A. Wood, editors. Proceedings of the gopher tortoise relocation symposium. Florida Game and Fresh Water Fish Commission, Nongame Wildlife Program Technical Report No. 5, Tallahassee, Florida, USA.

Hayhoe, K., D.J. Wuebbles, D.R. Easterling, D.W. Fahey, S. Doherty, J. Kossin, W. Sweet, R. Vose, and M. Wehner, 2018: Our Changing Climate. In Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II [Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, pp. 72–144.

Hermann, S.M., C. Guyer, J.H. Waddle, and M.G. Nelms. 2002. Sampling on private property to evaluate population status and effects of land use practices on the gopher tortoise, *Gopherus polyphemus*. Biological Conservation 108:289-298.

Hernandez, P., J.E. Reynolds, III, H. Marsh, and M. Marmontel. 1995. Age and seasonality in spermatogenesis of Florida manatees. Pages 84-97 *in* T.J. O'Shea, B.B. Ackerman, and H.F. Percival (eds.). Population Biology of the Florida Manatee. National Biological Service, Information and Technology Report No. 1. Washington D.C.

Hodges, J. D. 1997. Development and ecology of bottomland hardwood sites. Forest Ecology and Management, 90(2-3), 117-125. doi:10.1016/s0378-1127(96)03906-0

James, F. C. 1995. The status of the red-cockaded woodpecker in 1990 and the prospect for recovery. Pp. 439-451 i*n* D. L. Kulhavy, R. G. Hooper, and R. Costa, eds. Red-cockaded woodpecker: recovery, ecology, and management. Center for Applied Studies in Forestry, Stephen F. Austin State University, Nacogdoches, TX.

James, F. C., C. A. Hess, and B. C. Kicklighter. 2001. Ecosystem management and the niche gestalt of the red-cockaded woodpecker in longleaf pine forests. Ecological Applications 11:854-870.

Johnson, A., A. Pessier, J. Wellehan, A. Childress, T. Norton, N. Stedman, D. C. Bloom, W. Belzer, V. Titus, R. Wagner, J. Brooks, J. Spratt, and E. Jacobson. 2008. Ranavirus infection of free-ranging and captive box turtles and tortoises in the United States. Journal of Wildlife Diseases 44:851–863.

Karlin, M. L. 2008. Distribution of Mycoplasma agassizii in a gopher tortoise population in south Florida. Southeastern Naturalist 7(1):145-158.

Kupfer, J.A., A.J. Terando, P. Gao, C. Teske, J.K. Hiers J. 2020. Climate change projected to reduce prescribed burning opportunities in the south-eastern United States. International Journal of Wildland Fire 29:764-778.

Landers J.L. 1980. Recent research on the gopher tortoise and its implications. Pages 8–14 in R. Franz and R.J. Bryant (Eds). The dilemma of the gopher tortoise – is there a solution? Proceedings of the first annual meeting, Gopher Tortoise Council, Florida State Museum.

Landers, J.L., J.A. Garner, and W.A. McRae. 1980. Reproduction of the gopher tortoise (*Gopherus polyphemus*) in southwestern Georgia. Herpetologica. 36:353–361.

Lefebvre, L.W., J.P. Reid, W.J. Kenworthy, and J.A. Powell. 2000. Characterizing manatee habitat use and seagrass grazing in Florida and Puerto Rico: Implications for conservation and management. Pacific Conservation Biology 5(4):289-298.

Lennartz, M. R., H. A. Knight, J. P. McClure, and V. A. Rudis. 1983. Status of red-cockaded woodpecker nesting habitat in the south. Pp. 13-19 in D. A. Wood, ed. Red-cockaded woodpecker symposium II. Florida Game and Fresh Water Fish Commission, Tallahassee, FL.

Ligon, J. D., P. B. Stacey, R. N. Conner, C. E. Bock, and C. S. Adkisson. 1986. Report of the American Ornithologists' Union committee for the conservation of the red-cockaded woodpecker. Auk 103:848-855.

Ligon, J. D., W. W. Baker, R. N. Conner, J. A. Jackson, F. C. James, D. C. Rudolph, P. B. Stacey, and J. R. Walters. 1991. The conservation crisis—the red-cockaded woodpecker: on the road to oblivion? Auk 108:200-213.

Lippincott, C.L. 1997. Ecological consequences of *Imperata cylindrica* (cogongrass) invasion in Florida sandhill. Ph.D. diss., Department of Botany, University of Florida, Gainesville.

Lohoefener, R. and L. Lohmeier. 1984. The Status of Gopherus polyphemus (Testudines, Testudinidae) west of the Tombigbee and Mobile rivers. A report on research presented in conjunction with a petition to list the gopher tortoise west of the Tombigbee and Mobile rivers as an endangered species without critical habitat. 141 p.

Louisiana Department of Wildlife and Fisheries. 2005. Louisiana Department of Wildlife and Fisheries (LDWF) 2020-2021 Annual Report. Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA. 65 pp.

Macdonald, L.A. and H.R. Mushinsky. 1988. Foraging ecology of the gopher tortoise, *Gopherus polyphemus*, in a sandhill habitat. Herpetologica 44:345-353.

Mann, T.M. 1995. Tortoise densities and burrow occupancy rate for Gopher Tortoises on selected sites in Mississippi. Museum Technical Report No. 24. Corrected Edition Dec. 1995. Mississippi Museum of Natural Science, Jackson, MS. 54 p.

Marine Mammal Commission. 1986. Habitat protection needs for the subpopulation of West Indian manatees in the Crystal River area of northwest Florida. Document No. PB86-200250, National Technical Information Service. Silver Spring, Maryland. 46 pp.

Marine Mammal Commission. 1988. Preliminary assessment of habitat protection needs for West Indian manatees on the east coast of Florida and Georgia. Document No. PB89-162002, National Technical Information Service. Silver Spring, Maryland. 120 pp.

Marmontel, M. 1995. Age and reproduction in female Florida manatees. Pages 98-119 *in* T.J. O'Shea, B.B. Ackerman, and H.F. Percival (eds.). Population Biology of the Florida Manatee. National Biological Service, Information and Technology Report No. 1. Washington, D.C.

Marshall, J.E. 1987. The effects of nest predation on hatchling gopher tortoises (*Gopherus polyphemus*). Unpubl. master's thesis, Univ. of South Alabama, Mobile.

Masters, R. E., J. E. Skeen, and J. Whitehead. 1995. Preliminary fire history of McCurtain County Wilderness Area and implications for red-cockaded woodpecker management. Pp. 290 302 *in* D.L. Kulhavy, R. G. Hooper and R. Costa, eds. Red-cockaded woodpecker: recovery, ecology and management. Center for Applied Studies in Forestry, Stephen F. Austin State University, Nacogdoches, TX.

McGuire, J. L., L. L. Smith, C. Guyer, J. M. Lockhart, G. W. Lee, and M. J. Yabsley. 2014a. Surveillance for Upper Respiratory Tract Disease and Mycoplasma in free-ranging gopher tortoises in Georgia, USA. Journal of Wildlife Diseases 50:733-744.

McInnis, N. C. 1991a. Status survey report for *Isoetes louisianensis* Thieret. Unpublished report to U.S. Fish and Wildlife Service, Jackson, Mississippi. 13 pp.

McRae, W.A., J.L. Landers, and G.D. Cleveland. 1981. Sexual dimorphism in the gopher tortoise (Gopherus polyphemus). Herpetologica 37:46-52.

Means, D.B. 2009. Effects of rattlesnake roundups on the eastern diamondback rattlesnake (*Crotalus adamanteus*). Herpetological Conservation and Biology 4(2):132–141.

Myers, D.A., R. Isaza, G. Ben–Shlomo, J. Abbott, and C.E. Plummer. 2009. Fungal keratitis in a gopher tortoise (*Gopherus polyphemus*). Journal of Zoo and Wildlife Medicine 40(3):579–582.

NMFS. 2007. Regional Biological Opinion on Hopper Dredging of Navigational Channels and Borrow Areas in Gulf of Mexico (https://www.fisheries.noaa.gov/webdam/download/91875709).

Odell, D.K., G.D. Bossart, M.T. Lowe and T.D. Hopkins. 1995. Reproduction of the West Indian manatee in captivity. Pages 192-193 *in* T.J. O'Shea, B.B. Ackerman, and H.F. Percival (eds.). Population Biology of the Florida Manatee. National Biological Service, Information and Technology Report No. 1. Washington D.C.

O'Shea, T.J. and W.C. Hartley. 1995. Reproduction and early-age survival of manatees at Blue Spring, Upper St. Johns River, Florida. Pages 157-170 *in* T.J. O'Shea, B.B. Ackerman, and H.F. Percival (eds.). Population Biology of the Florida Manatee. National Biological Service, Information and Technology Report No. 1. Washington D.C. 289 pp.

Ott-Eubanks, J., W. K. Michener, and C. Guyer. 2003. Patterns of movement and burrow use in a population of gopher tortoises (*Gopherus polyphemus*). Herpetologica. 59:311-321.

Perez-Heydrich, C., K. Jackson, L. D. Wendland, and M. B. Brown. 2012. Gopher tortoise hatchling survival: field study and meta-analysis. Herpetologica 68:334–344.

Pike, D. A., and R. A. Seigel. 2006. Variation in hatchling tortoise survivorship at three geographic localities. Herpetologica 62:125-131.

Powell, J.A. and C.R. Taylor, eds. 2005. Sirenews: Newsletter of the IUCN/SSC Sirenia Specialist Group. Number 44. October.

Rathbun, G.B., J. P. Reid, and G. Carowan. 1990. Distribution and movement patterns of manatees (*Trichechus manatus*) in Northwestern peninsular Florida. Florida Marine Research Publication No 48. 33 pp.

Rathbun, G.B., J.P. Reid, R.K. Bonde and J.A. Powell. 1995. Reproduction in free-ranging Florida manatees. Pages 135-156 *in* T.J. O'Shea, B.B. Ackerman, and H.F. Percival (eds.). Population Biology of the Florida Manatee. National Biological Service, Information and Technology Report No. 1. Washington D.C.

Reid, J.P. R.K. Bonde, and T.J. O'Shea. 1995. Reproduction and mortality of radio-tagged and recognizable manatees on the Atlantic Coast of Florida. Pages 171-191 *in* T.J. O'Shea, B.B. Ackerman, and H.F. Percival (eds.). Population Biology of the Florida Manatee. National Biological Service, Information and Technology Report No. 1. Washington, D.C.

Reynolds, C. R. 1993. Gulf sturgeon sightings, historic and recent - a summary of public responses. U.S. Fish and Wildlife Service. Panama City, Florida. 40 pp.

Richardson, J.C., and P. Stiling. 2019. Gopher tortoise herbivory increases plant species richness and diversity. Plant Ecology, 220:383–391.

Rogillio, H. E. 1993. Status survey of Gulf sturgeon in Louisiana. Louisiana Department of Wildlife and Fisheries. Project E1-1. 6 pp.

Rostal, D. C., E. D. McCoy, and H. R. Mushinsky. 2014. Biology & conservation of North American tortoises. Johns Hopkins University Press, Baltimore, MD, USA.

Ruppert, T.K., T. Ankerson, C. Coverington, R. Feinberg, Y. Huang, M. McDonnell, and A. Miller. 2008. Eroding long-term prospects for Florida's beaches: Florida's coastal management policy. Final report for Sea turtle grant program, contract number 07-019E. Sea Turtle Conservancy, Gainesville, Florida.

Saloman, C. H., S. P. Naughton, and J. L. Taylor. 1982. Benthic community response to dredging borrow pits, Panama City Beach, Florida. National Marine Fisheries Service, Gulf Coastal Fisheries Center, Miscellaneous Report No. 82-3, Panama City, FL.

Shaffer, M. L. 1981. Minimum population sizes for species conservation. Bioscience 31:131-134.

Shaffer, M. L. 1987. Minimum viable populations: coping with uncertainty. Pp. 69-86 *in* M. E. Soule, ed. Viable populations for conservation. Cambridge University Press, Cambridge, UK.

Simberloff, D. 1993. Species-area and fragmentation effects on old growth forests: prospects for longleaf pine communities. Pp. 1-14 in S. M. Hermann, ed. The longleaf pine ecosystem: ecology, restoration, and management. Tall Timbers Fire Ecology Conference Proceedings, No. 18. Tall Timbers Research Station, Tallahassee, FL.

Smith, K. R., J. A. Hurley, and R. A. Seigel. 1997a. Reproductive biology and demography of gopher tortoises (*Gopherus polyphemus*) from the western portion of their range. Chelonian Conservation and Biology 2:596-600.

Smith, L. L., D. A. Steen, L. M. Conner, and J. L. Rutledge. 2013. Effects of predator exclusion on nest and hatchling survival in the gopher tortoise. Journal of Wildlife Management 77:352-358.

Snow, R.W. 1991. The distribution and relative abundance of the Florida manatee in Everglades National Park, an annual report, October 1, 1991. South Florida Research Center. Everglades National Park. Homestead, Florida. 26 pp.

Speake, D. W., and R. H. Mount. 1973. Some possible ecological effects of "Rattlesnake Roundups" in the southeastern coastal plain. Proceedings of the Annual Conference of Association of Game and Fish Commissioners 27:267-277.

Stiles, J.H., R.H. Jones. 1998. Distribution of the red imported fire ant, *Solenopsis invita*, in road and powerline habitats. Landscape Ecology 13:335–346 https://doi.org/10.1023/A:1008073813734

Taylor, Robert W., JR. 1982. Human Predation on the Gopher Tortoise (*Gopherus polyphemus*) in North-Central Florida. Bul. Florida State Museum. Biol. Sci. 26(4):79-102.

Tuma M, Stanford CB. 2014. History of human interaction with North American tortoises. In: Rostal DC, McCoy ED, Mushinsky HR (eds) Biology & conservation of North American tortoises. John Hopkins University Press, Baltimore, pp 143–148.

U.S. Fish and Wildlife Service (USFWS). 1977. Endangered and Threatened Wildlife and Plants; Final Rule, Correction and Augmentation of Published Rulemaking on Critical Habitats. Federal Register 50 CFR Part 17, Volume 42, No. 184, pp. 44840 - 47845.

U.S. Fish and Wildlife Service (USFWS). 2001. Florida Manatee Recovery Plan (*Trichechus manatus latirostris),* third revision. USFWS Southeast Region. October 30, 2001.

U.S. Fish and Wildlife Service (USFWS). 2003. Recovery Plan for the Red-Cockaded Woodpecker (Picoides borealis), second revision. USFWS Southeast Region. January 27, 2003.

Walters, J. R., S. J. Daniels, J. H. Carter, III, P. D. Doerr, K. Brust, and J. M. Mitchell. 2000. Foraging habitat resources, preferences and fitness of red-cockaded woodpeckers in the North Carolina sandhills. Fort Bragg Project Final Report. Virginia Polytechnic Institute and State University, Blacksburg, VA, and North Carolina State University, Raleigh, NC.

Walters, J. R., S. J. Daniels, J. H. Carter III, and P. D. Doerr. 2002a. Defining quality of red-cockaded woodpecker foraging habitat based on habitat use and fitness. Journal of Wildlife Management, in press.

Ware, S., C. Frost, and P. D. Doerr. 1993. Southern mixed hardwood forest: the former longleaf pine forest. Pp. 447-493 in W. H. Martin, S. G. Boyce, and A. C. Echternacht, eds. Biodiversity of the southeastern United States: lowland terrestrial communities. John Wiley and Sons, Inc., New York, NY.

Wetterer, J. K. and J. A. Moore. 2005. Red imported fire ants (Hymenoptera: Formicidae) at gopher tortoise (Testundines:Testunididae) burrows. Florida Entomologist 88(4):349-354.

White, C.L. 2009. Gopher tortoise (*Gopherus polyphemus*) habitat selection, health, and fecundity. Dissertation. University of Florida, Gainesville, Florida.

Wilber, D. H., D. G. Clarke, and S. I. Rees. 2007. Responses of benthic macroinvertebrates to thin-layer disposal of dredged material in Mississippi Sound, USA. Marine Pollution Bulletin 54(1):42-52.

Wilson, D. S. 1991. Estimates of survival for juvenile gopher tortoises, *Gopherus polyphemus*. Journal of Herpetology 25:376-379.

Wright, J.S. 1982. Distribution and population biology of the gopher tortoise, *Gopherus polyphemus*, in South Carolina. Clemson University. Master Thesis. 74 pp.

.