DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
7400 LEAKE AVENUE
NEW ORLEANS, LOUISIANA 70118

REPLY TO ATTENTION OF

April 27, 2023

Regional Planning and Environment
Division South

Project Name: Supplemental Environmental Impact Statement for the St. Tammany Parish Feasibility Study

Mr. David Bernhart
NMFS - Protected Resources Division
Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701

Dear Mr. Bernhart,

The U.S. Army Corps of Engineers (USACE), New Orleans District (CEMVN) has prepared this Biological Assessment (BA) to evaluate the potential impacts associated with proposed flood risk reduction project and associated mitigation project in St. Tammany Parish, Louisiana. This BA provides the information required pursuant to the Endangered Species Act (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; and the Migratory Bird Treaty Act of 1918.

The proposed project consists of construction of a levee and floodwall system, channelization of a section of Mile Branch, and creation of marsh to offset construction impacts. The levee and floodwall system would be constructed in southeast St. Tammany Parish near Slidell, Louisiana. The Mile Branch channel improvement project is located in St. Tammany Parish, Louisiana within the City of Covington. The marsh creation site (M2) is located along the northeast shore of Lake Pontchartrain near Big Branch Marsh National Wildlife Refuge.

CEMVN has determined that the proposed project “may affect but is not likely to adversely affect” (NLAA) the federally listed Gulf sturgeon and Gulf sturgeon critical habitat. This species could potentially be found in the project area, which also contains its critical habitat; therefore, CEMVN is submitting a request for consultation and requesting concurrence with our determinations pursuant to Section 7 of the ESA of 1973, as amended (16 U.S.C. § 1536), and the consultation procedures at 50 C.F.R. Part 402.

This ESA letter is being submitted to the National Marine Fisheries Service (NMFS) by the CEMVN to initiate informal consultation regarding potential impacts to threatened and endangered species from construction projects related to the St. Tammany Parish Feasibility Study SEIS.

Pursuant to our request for informal consultation, CEMVN is providing, enclosing, or otherwise identifying the following information:

- A description of the action to be considered;
- A description of the action area;
- A description of any listed species or designated critical habitat (DCH) that may be affected by the action; and
- An analysis of the potential routes of effect on any listed species or DCH.

Questions and/or concerns should be directed to Ms. Kristin Gunning; U.S. Army Corps of Engineers; Regional Planning and Environment Division, South; CEMVN PDS-C; Room 139; 7400 Leake Avenue, New Orleans, Louisiana 70118. Ms. Gunning may also be contacted by email at kristin.t.gunning@usace.army.mil or by phone 504-862-1514.

Proposed Action

Description of Proposed Action

Construction Elements

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, and the creation of new habitat mitigation areas to offset losses within the project's construction footprint areas. See Appendix for details of the project features.

Channel improvements would occur on the lower 2.15 miles (11,341 ft channel) of Mile Branch in Covington, Louisiana (Figure 1). The proposed work would consist of approximately 20 acres of channel that would be cleared and grubbed prior to mechanical dredging. 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 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. All work would be performed from the bank. The trees located close to the bank would be removed. The banks would be stabilized and seeded and fertilized to have a grass cover. Work would be done by excavators or small skid steers. Material removed may include sediment, trees, debris, or other obstructions within the waterway. Up to 130,000 cubic yards of material 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. Table 1 lists the Mile Branch attributes of the TSP for the 50-year period of analysis.

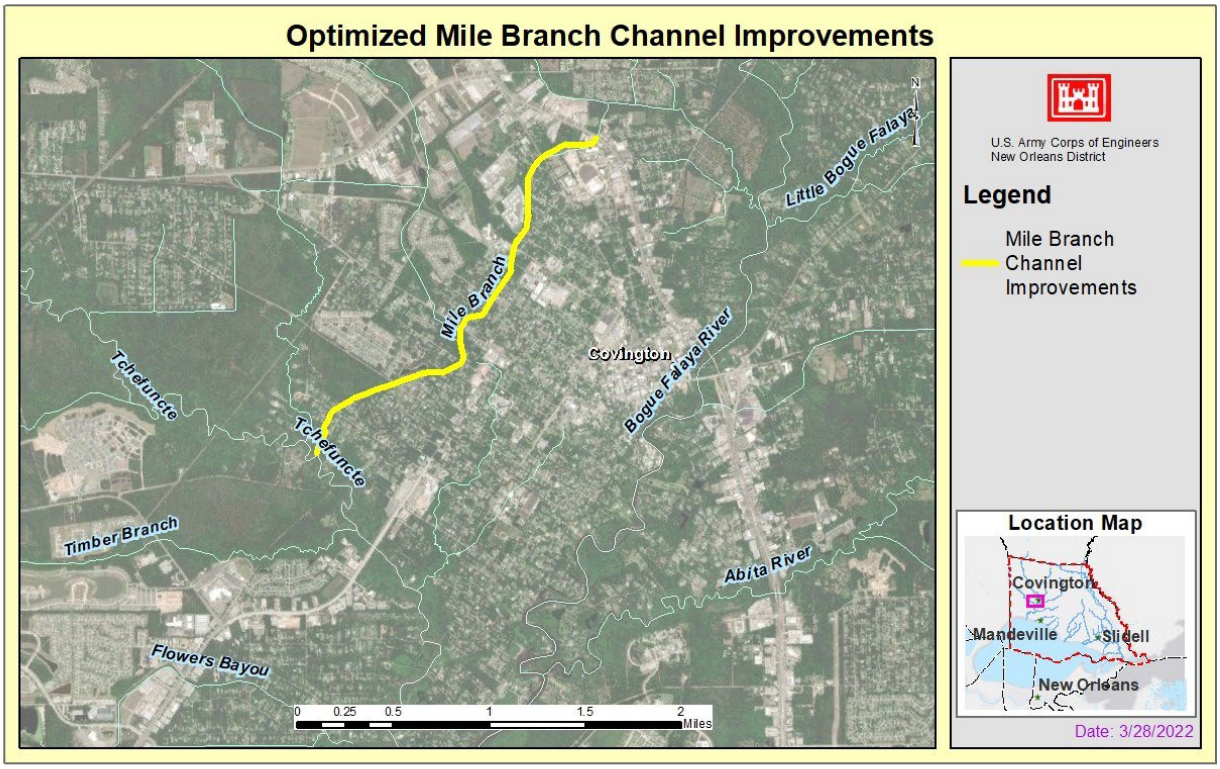

Figure 1. Mile Branch Channel Improvements

Table 1. 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 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 2). 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 2 provides a summary of the attributes of the South and West Slidell Levee and Floodwall System.

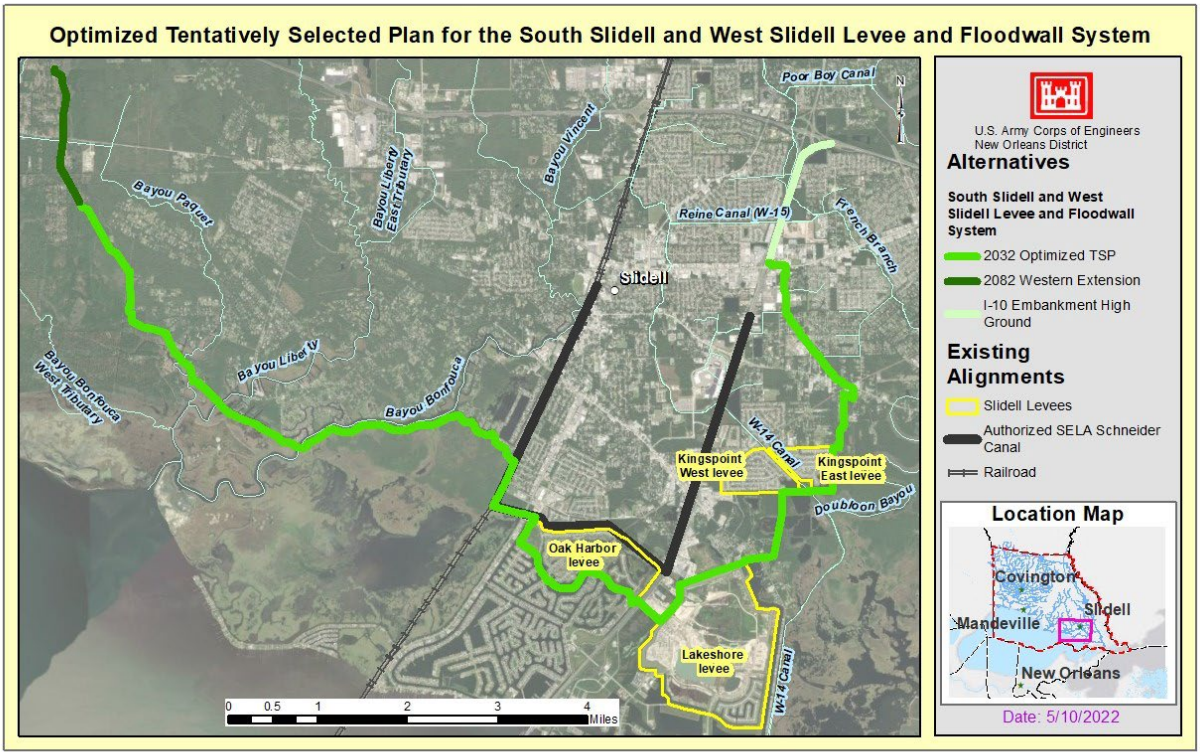

Figure 2. South and West Slidell Levee and Floodwall alignment in St. Tammany Parish, Louisiana

Table 2. 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

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 (Figure 3). 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.

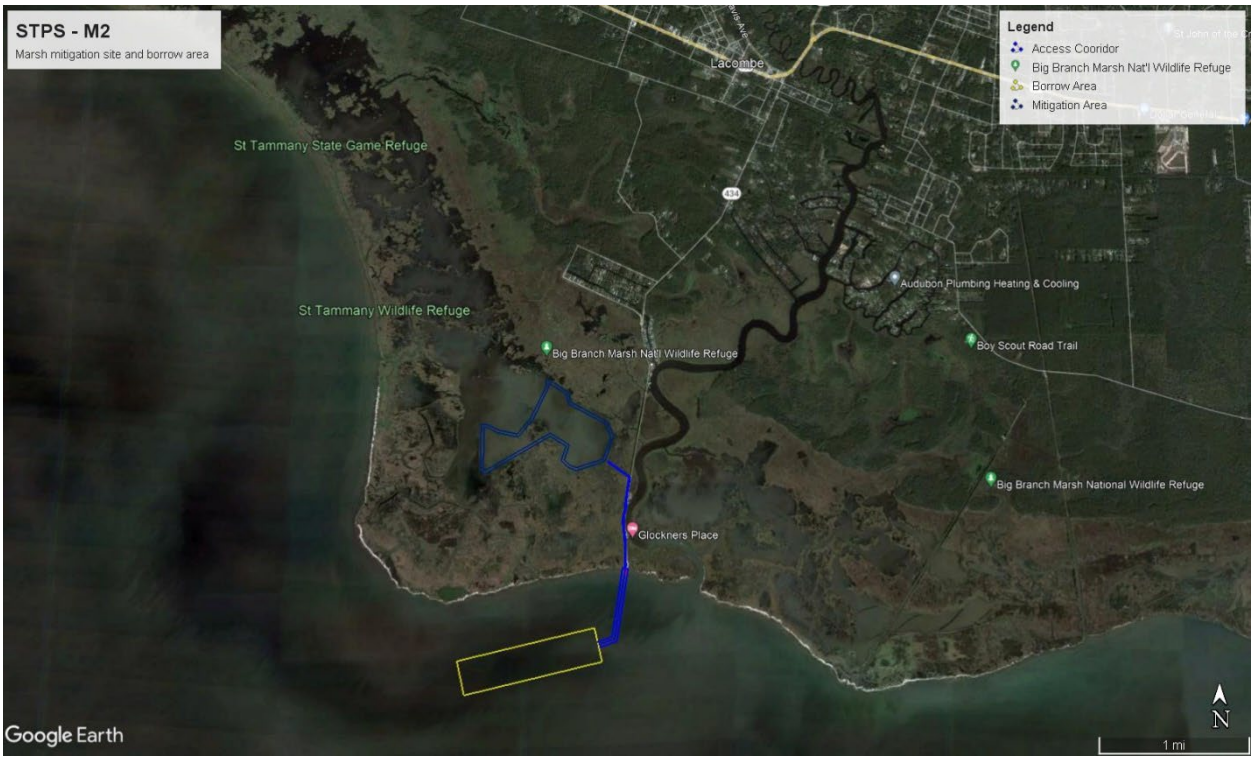

Figure 3. Marsh mitigation site and borrow area.

Borrow Excavation Component

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 2000 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.

Construction Access and Staging Components

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.

Levee and floodwall construction sites would be accessed via existing public roads to the maximum extent as possible. In locations where access cannot be achieved via existing roadways, a new road would be constructed. 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 VFZ on both sides of the road. Access roads would be constructed using crushed stone for the road surface.

For the construction of the levee on the 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. An access road would be constructed on the protected side of the ROW between the proposed crown of the levee and Bayou Bonfouca. The access road would be a temporary road. 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 2-acre staging area on the reach on the refuge land that would be considered a temporary easement. The staging area would be located off the refuge and would be used to process the material prior to building the levee. Staging areas would be required to be continuously accessible. Any trees would be removed and hauled away to an approved facility. The area would be restored to pre-construction elevation that existed prior to impacting the site due to construction activities.

Table 3 provides a summary of the necessary staging areas and permanent ROW required for construction of the levee and floodwall segments for the 50-yr period of analysis. The staging areas required during initial construction of the levee alignment would be the same staging areas required for construction of future levee lifts. 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.

Table 3. 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.

Operation and Maintenance Elements

During the operation and maintenance (O&M) phase of the project, prior to transfer of monitoring responsibilities to the non-Federal sponsor (NFS), the site would be monitored and surveyed to ensure the marsh creation area has met the initial success criteria. At a minimum, these actions would include periodic eradication of invasive/nuisance plants in the mitigation feature and mitigation monitoring and reporting. Approximately one year after the construction of the marsh platform is complete, once dewatering and settlement of the marsh platform has occurred, the retention dikes would be degraded to the target marsh elevation. 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. The marsh feature is not expected to require planting, since it is assumed that native marsh plants would colonize the marsh naturally. If marsh species do not colonize the site on their own, marsh plant species would be planted.

Description of Project Purpose

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 200-acres of new marsh habitat to mitigate losses within the project's construction footprint areas.

Conservation Measures and BMPs

To reduce impacts to Gulf sturgeon critical habitat, 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. CEMVN would also adhere to the Protected Species Construction Conditions[1].

Description of the 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.

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

Mile Branch

This measure 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 1). 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. Figure 2 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.

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 3 provides an illustration of the M2 mitigation site.

Physical and Biological Attributes of the Action Area

[1]NMFS. 2021. Protected Species Construction Conditions. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Regional Office, Saint Petersburg, FL.

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 to be impacted within the Action Area that may impact Gulf sturgeon and Gulf sturgeon critical habitat include freshwater marsh, intermediate marsh, and open water.

Freshwater marsh is found surrounding bodies of open water and is located along the shoreline of Lake Pontchartrain. 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.

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.

Potentially Affected NMFS ESA-Listed Species and Critical Habitat

Within St. Tammany Parish there are ten documented animal and one plant species under the jurisdiction of the ESA. Of the listed animal and plant species occurring in St. Tammany Parish, only the Gulf sturgeon is expected to potentially be found in the proposed borrow area in Lake Pontchartrain. Additionally, it would be highly unlikely that Gulf sturgeon would be found in the M2 mitigation site due to very shallow water. Gulf sturgeon are typically found in deeper water where they are able to maneuver and forage effectively. Project activities have the potential to affect listed species as shown in Table 4 below, and their DCH.

Table 4: DCH in the action area

Species	DCH in the Action Area	DCH Rule/Date	USACE Effect Determination (DCH)
Gulf sturgeon	Unit 8. 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	68 FR 13369/ March 19, 2003	Not likely to adversely affect

Gulf Sturgeon

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

Prior to the listing of the species, Davis et al. (1970) reported the collection of Gulf sturgeon from Lake Pontchartrain during a 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.

Gulf Sturgeon Critical Habitat

Critical habitat identifies specific areas that have been designated as essential to the conservation of a listed species. The project area is located within the boundary of critical habitat Unit 8. In 2003, Unit 8 was designated as critical habitat for Gulf sturgeon. Unit 8 encompasses Lake Pontchartrain east of the Lake Pontchartrain Causeway, all of Little Lake, the Rigolets, Lake St. Catherine, Lake Borgne, including Heron Bay, and the Mississippi Sound in Jefferson, Orleans, St. Tammany, and St. Bernard Parish, Louisiana, Hancock, Jackson, and Harrison Counties in Mississippi, and in Mobile County, Alabama.

Unit 8 includes approximately 1377 square miles of critical habitat with 277 square miles in Lake Borgne, 3 in Little Lake, 295 in Lake Pontchartrain, 10 in Lake St. Catherine, 5 in the Rigolets, 725 in Mississippi Sound, and 62 along the Mississippi near shore Gulf (68 FR 13369-13495). Critical habitat follows the shorelines around the perimeters of each included lake. The Mississippi Sound includes adjacent open bays, including Pascagoula Bay, Point aux Chenes

Bay, Grand Bay, Sandy Bay, and barrier island passes, including Ship Island Pass, Dog Keys Pass, Horn Island Pass, and Petit Bois Pass. Critical habitat excludes St. Louis Bay, north of the railroad bridge across its mouth; Biloxi Bay, north of the U.S. Highway 90 bridge; and Back Bay of Biloxi.

Critical habitat for the Gulf sturgeon has been designated within the project area, specifically the borrow area in Lake Pontchartrain (Figure 3) which is part of Unit 8 so the species may be present. USGS surveys of Lake Pontchartrain found that the majority of Lake Pontchartrain bottoms near the center of the lake were defined as having sandy composition which is prime habitat for sturgeon. As part of the design for this project those borrow locations closer to the Lake Pontchartrain center were avoided to minimize impacts to Gulf Sturgeon foraging habitat. The borrow site is approximately 2000 ft from the shoreline and likely receives fine sediment from wave induced shoreline erosion. However, the proposed borrow site is within the designated critical habitat but 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.

Route(s) of Effect to Gulf Sturgeon:
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.

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

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.

We believe the effect to Gulf sturgeon from the potential loss of foraging habitat due to dredging would 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).

Route(s) of Effect to Gulf Sturgeon Critical Habitat

The project is located in critical habitat unit 8. The essential features/primary constituent elements (PCEs) are present in Unit 8 and are those habitat components that support feeding, resting, sheltering, migration, and physical features necessary for maintaining the natural processes that support those habitat components. The following are the primary constituent elements for Gulf sturgeon critical habitat that are present and CEMVN's response on how the proposed action for the M2 borrow site in critical habitat would affect these elements. Only three of the four PCEs are likely to be affected. The CEMVN has determined the proposed action is "Not Likely to Adversely Affect" Gulf sturgeon critical habitat based on these responses for the three PCEs.

(1) Abundant prey items, such as amphipods, lancelets, polychaetes, gastropods, ghost shrimp, isopods, molluscs and/or crustaceans, within estuarine and marine habitats and substrates for subadult and adult life stages.

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.

(2) Water quality including temperature, salinity, pH, hardness, turbidity, oxygen content, and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages.

Localized and temporary reductions in water quality 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.

(3) Sediment quality including texture and other chemical characteristics necessary for normal behavior, growth, and viability of all life stages.

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 2000 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 on currently available historical and catch data; a review of current literature and studies; and with the employment of avoidance measures recommended through guidelines set up during coordination with NMFS; the CEMVN has determined that the proposed action is "Not Likely to Adversely Affect" the Gulf sturgeon species or Gulf sturgeon critical habitat.

Conclusion

CEMVN has reviewed the proposed project for its impacts to federally listed species and their DCH. Based on currently available historical and catch data; a review of current literature and studies; and with the employment of avoidance measures recommended through guidelines set up during coordination with NMFS; including protected species construction conditions; CEMVN has concluded the project may affect but is not likely to adversely affect Gulf sturgeon and DCH listed in Table 4. This analysis was prepared based on the best scientific and commercial data available.

CEMVN is requesting NMFS's written concurrence with these determinations. CEMVN appreciates your cooperation in completing this informal section 7 consultation by concurring with CEMVN's effect determination(s) a timely manner. If NMFS disagrees with the CEMVN effect determination(s) and requests formal Section 7 consultation, please contact Ms. Kristin Gunning (kristin.t.gunning@usace.army.mil) to discuss suggested modifications to the action to avoid potential adverse effects and NMFS' additional information needs. CEMVN would continue to coordinate with NMFS office via email to provide the requested information and, if warranted, a revised effects determination.

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Appendix: Project Description for the Optimized Tentatively Selected Plan
St. Tammany Parish Louisiana Feasibility Study

SUMMARY

PROJECT DESCRIPTION
for the
Optimized Tentatively Selected Plan
St Tammany Parish Louisiana Feasibility Study

1.0 INTRODUCTION

Subsequent to the release of the June 2021 Draft Integrated Feasibility Report and Draft Environmental Impact Statement (DIFR and DEIS), the Project Delivery Team (PDT) conducted additional engineering, economic, and environmental investigations on the individual features of the Optimized Tentatively Selected Plan (TSP) which is comprised of a structural plan and a non-structural plan. Information gathered by the PDT through these additional investigations, together with the consideration of comments received from the public, stakeholders, the U.S. Fish and Wildlife Service, and the National Marine Fisheries Service assisted the PDT in further refining the design of the Draft TSP. This document is a summary project description of the proposed Optimized TSP. Refer to Appendix F and H for the full description of the non-structural plan and Appendix D for full description of the structural plan.

1.1 SCOPE OF WORK

The Optimized TSP includes a non-structural plan and a structural plan. For planning purposes, the 50-yr period of analysis for the study was estimated to be from the year 2032 to 2082. Project authorization would occur in the year 2024 and kick-off planning, engineering, and design (PED). PED was originally estimated to be complete by the year 2027. Initial construction of the project would begin 2027 and conclude by the year 2032 (base year). These original assumptions will be revised once the construction schedule is prepared by the Cost team in MVN Engineering. Figure 1-1 illustrates the optimized TSP including a non-structural and a structural plan.

<u>Non-Structural Plan</u>:

Insert summary of the non-structural plan from Economics.

<u>Structural Plan</u>:

The structural plan consists of construction of a levee and floodwall system along an alignment in South and West Slidell and channelization of a portion of the Mile Branch in Covington.

1.2 **Mile Branch Channel Improvement:** This measure 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.

The mechanical dredging would consist of a maximum of 130,000 cubic yards of fill dredged from the channel. There are no surveys available for this area for this study, and no surveys will be conducted during the study phase. The existing elevations used for the hydraulic analysis and design of the Optimized TSP were obtained from the LIDAR raster dataset. Designs are based on existing information gathered from reports provided by the non-Federal sponsors as shown on Table 1.2 in the main report.

Design refinements would occur during PED based on field data collections. Based on data collected, the design would be refined to minimize impacts to aquatic and riparian habitat and real estate. Riparian Zone bioengineering techniques and nature-based-solutions (NBS) would be incorporated as appropriate during PED in coordination with the NFS and resource agencies. A backwater area has been incorporated in the design of Mile Branch.

Table 1.1 lists the Mile Branch attributes of the TSP for the 50-year period of analysis.

Table 1.1 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 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. All work would be performed from the bank. The trees located close to the bank would be removed. The banks would be stabilized and seeded and fertilized to have a grass cover. Work would be done by excavators or small skid steers.

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

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 21 acres of channel would be cleared and grubbed prior to mechanical dredging. An assumed maximum of 130,000 cubic yards of material may be mechanically dredged from the channel.

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.

1.3 <u>South and West Slidell Levee and Floodwall Alignment:</u> 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. 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 1.2 provides a summary of the attributes of the South and West Slidell Levee and Floodwall System. Table 1.3 is a summary of the levee quantities required for the initial construction.

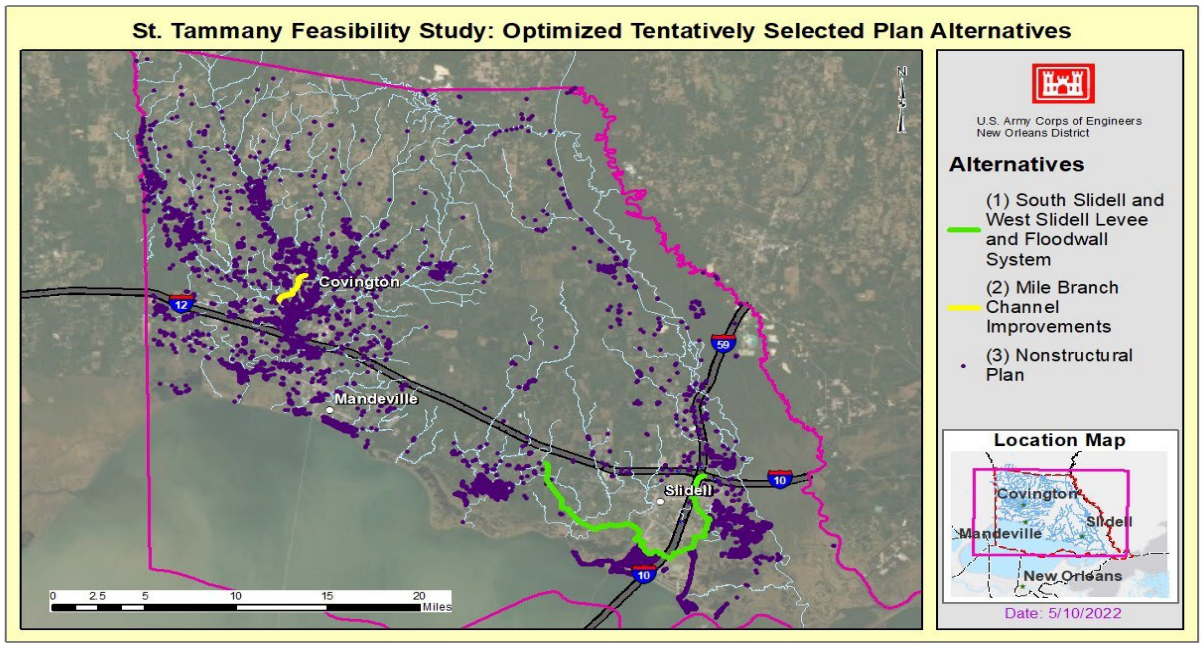


Figure 1-1. Optimized Tentatively Selected Plan

Table 1.2 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

The existing elevations utilized were obtained from the LIDAR raster dataset. No survey data was obtained at this stage of the study; therefore, a 30% contingency was

used for the calculation of the borrow quantities for the South Slidell and West Slidell levee alignment.

Table 1.3 Summary Table: TSP Levee Quantities for Initial Construction

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 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 1-4. 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. It is during the scheduled 4th lift that construction of the Western High Ground Tie-in would be necessary for year 2082. The fill quantities listed for the 4th lift, include quantities for the construction of the Western High Ground Tie-In.

Table 1.4. 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.

2 LEVEE AND FLOODWALL SYSTEM DESCRIPTION

The levee and floodwall system consists of a combination of portions of the West Slidell levee alignment and the South Slidell levee alignment. The two alignments would be connected by a new railroad gate across the existing Norfolk Southern Railway Corp. railroad tracks. The alignment is shown in lime green in Figure 1-2.

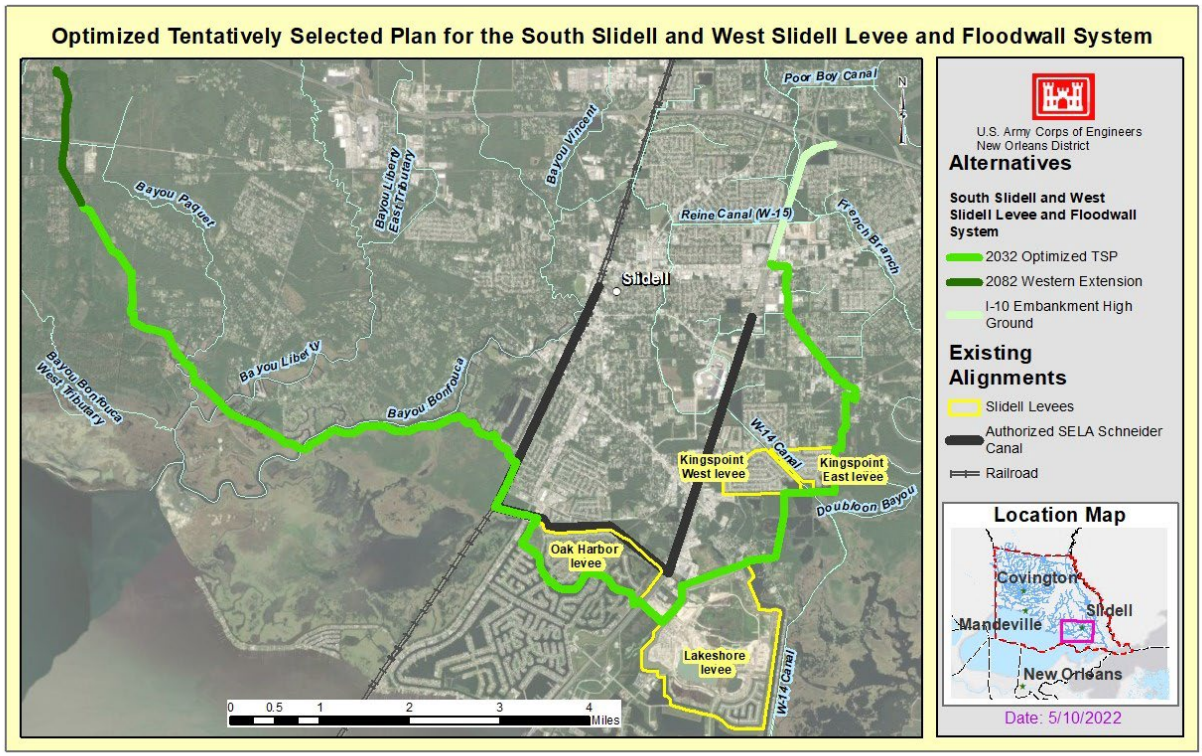


Figure 2-2. Optimized TSP for the West Slidell and the South Slidell Levee and Floodwall System

2.2 LEVEE AND FLOODWALL ALIGNMENT AND STRUCTURES

This section describes the alignment starting on the northwest end and continuing east. For floodwall segments refer to table 2.4, for pump stations refer to Table 2.9, for sluice, lift and sector gates refer to table 2.7, and for vehicular, pedestrian, and railroad floodgates refer to Table 2.8. All structural components would be constructed during initial construction.

2.2.1 WESTERN EXTENTION

Western Terminus: The intermediate scenario of relative sea level change between years 2032 and 2082 was used to develop the 2082 hydraulic design elevations. Based on that analysis, the levee was extended to the west to maintain a 1% risk reduction. The Western High Ground Tie-in for Year 2082 is shown in dark green in Figures 1-3 and 1-4. 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.

2.2.2 WEST SLIDELL ALIGNMENT

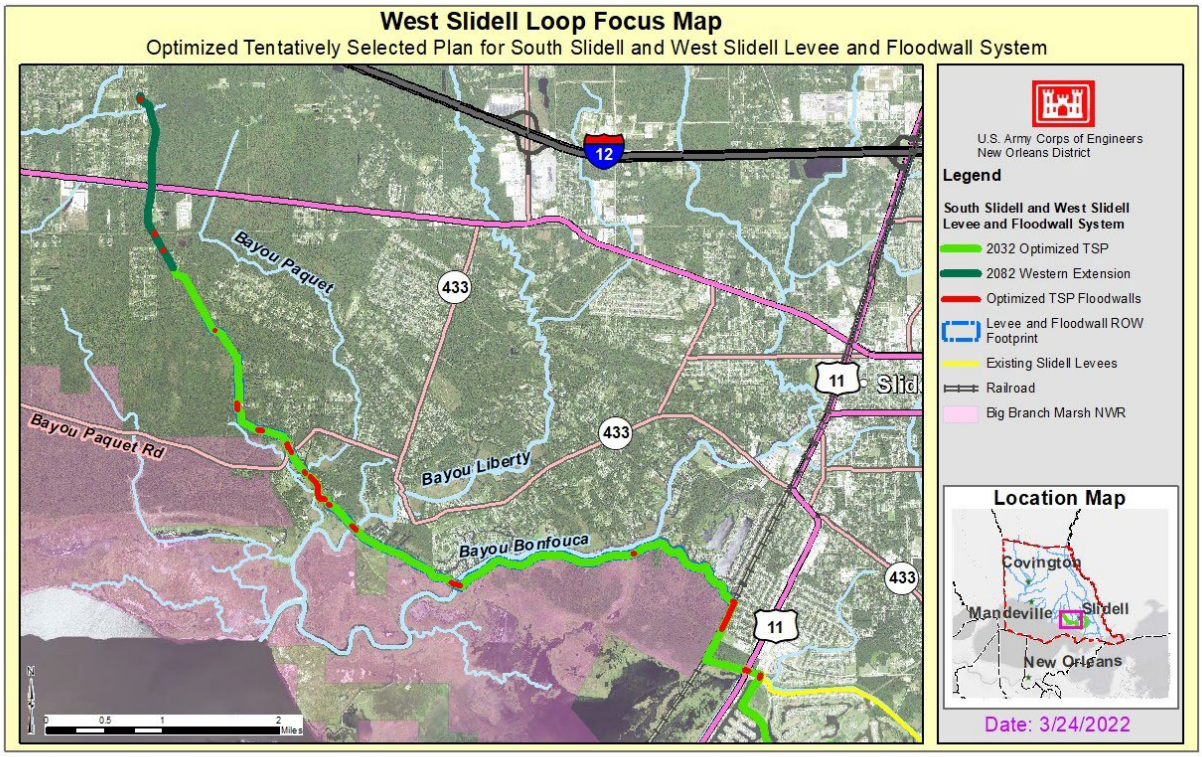


Figure 1-3. West Slidell Levee and Floodwall System- Optimized Tentatively Selected Plan Focus with Floodwall Segments

West Slidell Levee Segment: 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 would run on the west side of Tranquility Road (CC Road) and then it would turn in the southeast direction crossing Bayou Paquet Road and would stay on the east side of Bayou Paquet Channel to avoid impact to the Big Branch Marsh National Wildlife Refuge (NWR). The alignment would cross Bayou Paquet and Bayou Liberty and would continue eastward on the northside of the Big Branch Marsh NWR. The alignment would cross Bayou Bonfouca and would continue on the south bank of the bayou (northern side of the refuge) until reaching the Norfolk Southern Railway Corp. railroad tracks west of US Highway 11 in the vicinity of Dellwood Pump Station in Slidell.

2.2.3 SOUTH SLIDELL ALIGNMENT

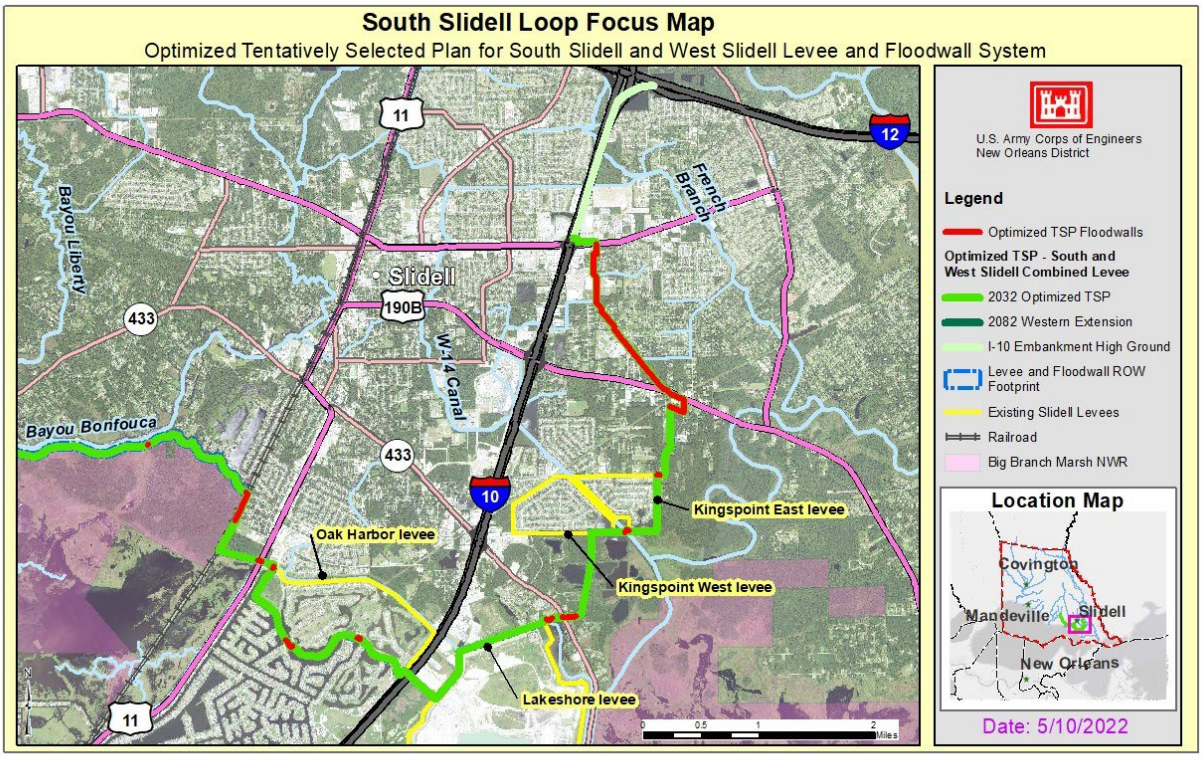


Figure 1-4. South Slidell Levee and Floodwall System- Optimized Tentatively Selected Plan Focus

South Slidell Levee Segment: The levee and floodwall system alignment from West Slidell would continue to South Slidell. From the railroad gate connecting West Slidell with South Slidell, the alignment would transition to a floodwall running parallel along the east side of the railroad tracks. The floodwall by the railroad tracks would have a hydraulic design elevation of 16.5 ft for year 2082.

The alignment would transition to levee when it turned east toward Highway 11. The alignment 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). The alignment would run on the south side of Oak Harbor Boulevard and would cross to the north side immediately past Mariners Cove Boulevard. The levee along the south side of 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. The alignment then would turn north and then east and cross Old Spanish Trail/Highway 433. The alignment would continue north and tie to a portion of the existing King's Point west levee. The section of levee would have a hydraulic design elevation of 16 ft for year 2032.

The alignment would cross the W-14 Canal and 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 the alignment would turn from levee to floodwall to provide risk reduction to the existing Hardin Road power substation. The floodwall would have a hydraulic design elevation of 18.5 ft for year 2082.

The alignment would cross Highway 190 Business and continue northwest on the west side of the existing CLECO Corporate Holdings, LLC utility corridor. The alignment would cross South Holiday Drive and continue north. The alignment would turn east on Manzella Drive and turn north in the middle of the block between Yaupon Drive and Malbrough Drive.

The alignment 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 existing highway embankment would serve as the means of risk reduction in order for the project to form a continuous system up to the elevation required in 2082. Refer to light green portion of the alignment in Figure 1-5.

CLECO Corporate Holdings, LLC has right-of-way use requirements pertaining to USACE work around their existing utility lines on the northeast corner of the floodwall alignment that would have to be met to provide clearance for construction activities (i.e., pile driving).

INTERSTATE 10 ELEVATION

The I-10 road surface would be raised to construction elevation 21.5 ft to ramp over the new levee section to stay above the hydraulic design elevation for year 2082, to ensure the entire pavement section remains above the hydraulic design elevation across the interstate. The hydraulic design elevation at this location for year 2082 is 18.5 ft. The pavement section was assumed to have a thickness of 2.5 ft.

The existing elevation of the I-10 at the proposed location is approximately 12.8 feet as per LIDAR raster dataset. This proposed location is the highest elevation of the I-10 in the vicinity of the proposed alignment. The I-10 elevation is lower (approximately 10 feet) on the adjacent areas.

The levee and the Interstate 10 would be lifted during initial construction in year 2032 to construction elevation of 21.5 ft to avoid future disruptions to the traffic on the interstate.

2.3 TYPICAL SECTION AND ELEVATIONS

2.3.1 WEST SLIDELL LEVEE DIMENSIONS AND QUANTITIES

The dimensions for the new West Slidell levee may be found in Table 2.1 and Figure 1-5.

Geotextile would be placed for West Slidell during initial construction under the levee. Geotextile would be placed 70 ft from the centerline of the levee on the floodside and 40 ft from the centerline of the levee on the land side for a total of 110 ft.

Table 2.1. West Slidell Levee

West Slidell Levee **Initial Construction**	
Levee Crown Width	10 ft
Side Slopes of Levee	1V:3H
Floodside Berm Slope	1V:42H
Landside Berm Slope	1V:33H
Construction Elevation	14.5 ft
Geotextile	13,200 lbs/ft

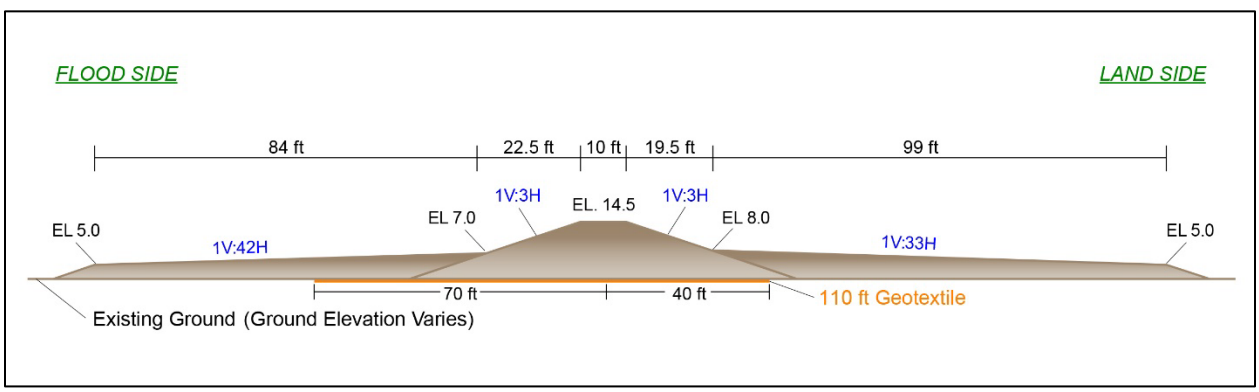


Figure 1-5. Typical Cross-Section with Berms for West Slidell

The hydraulic design elevations of the new West Slidell levee would be 13.5 feet (year 2032) and the 17.5 ft (year 2082). Right of way for the levee was assumed to be 300 ft wide.

2.3.2 SOUTH SLIDELL DIMENSIONS QUANTITIES

The dimensions for the new South Slidell levee may be found in Table 2.2 and Figure 1-6. The construction elevation for the first lift would vary depending on location. This portion of the alignment would not have berms or geotextile.

Table 2.2. South Slidell Levee

South Slidell Levee **Initial Construction**	
Levee Crown Width	10 ft
Side Slopes of Levee	1V:3H
Construction Elevation	Varies

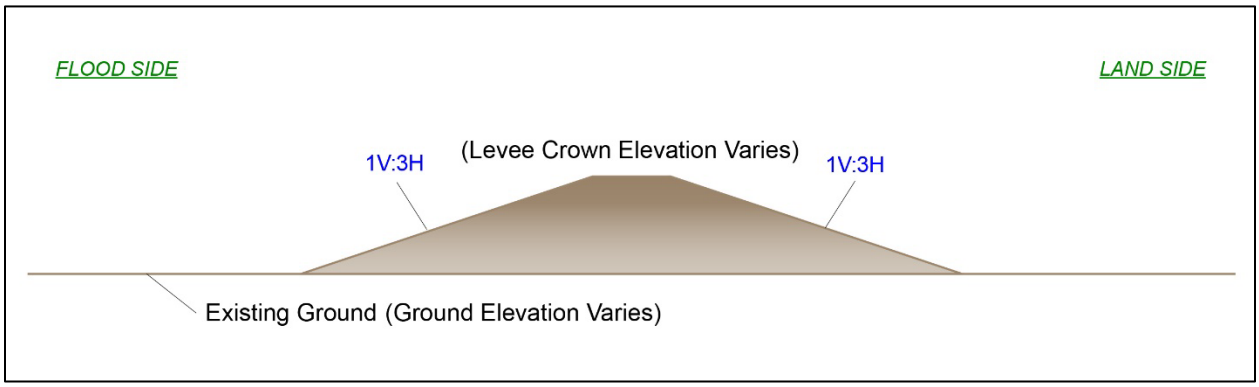


Figure 1-6. Typical Cross-section for South Slidell

The hydraulic design elevation of the new South Slidell levee would vary between 14 ft and 16 ft (year 2032) depending on the location.

2.4 FUTURE LEVEE LIFTS

To maintain the levee crown at or above the base year (2032) and future year (2082) design elevations while accounting for levee settlement and relative sea level rise, levees would be constructed in multiple lifts over the period of analysis. Both the design elevations and constructed "top of levee" elevations vary by location. Design elevations vary by levee location because of surge and wave differences due to storm path, wind speeds and direction, etc.

Levee portions of the Optimized TSP would require future lifts to bring the levees to hydraulic design elevations for year 2082.

For West Slidell, four future levee lifts are projected to be needed. The assumed cross-section for these lifts would have a 10 ft wide levee crown and side slopes of 1V:3H.

Existing berm sections from initial construction would be in place on both sides of the levee.

For the first lift (Year 2033) and the second lift (Year 2038), it was assumed that in addition to elevating the levee, the berm previously built during initial construction would settle 25 percent. Additional material would be placed on the berms during these two lifts.

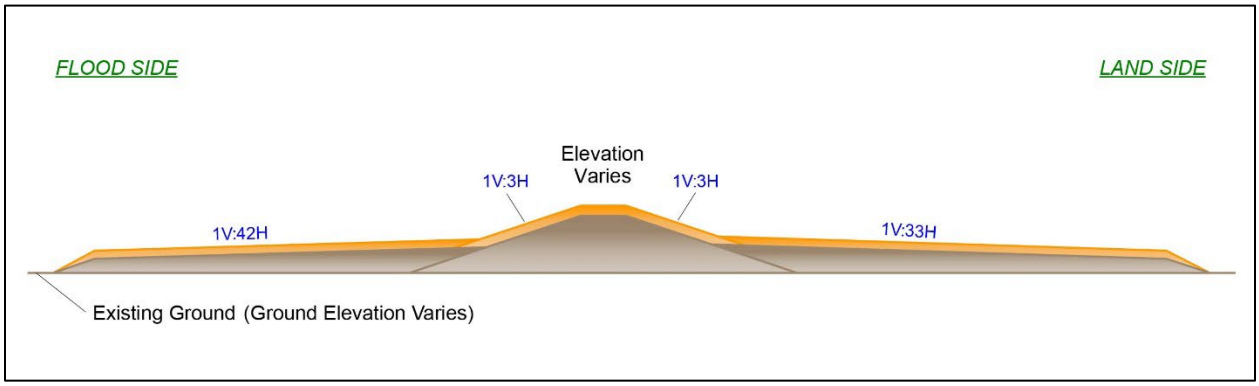


Figure 1-7. Typical Cross-section with berms for First and Second Lifts for West Slidell

For the third lift (Year 2051) and the fourth lift (Year 2076), it was assumed that no additional material would be placed on the berms.

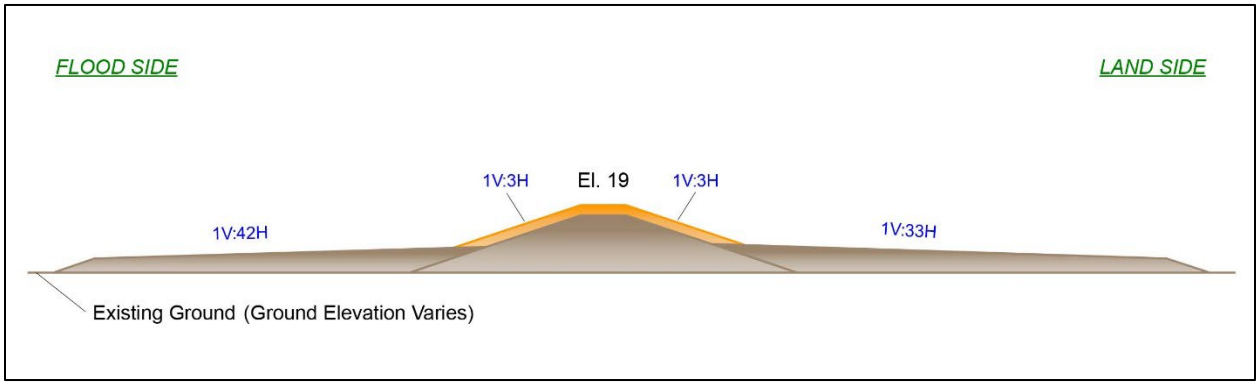


Figure 1-8. Typical Cross-section with berms for Third and Fourth Lifts for West Slidell

2.4.1 WESTERN HIGH GROUND TIE-IN LEVEE CONSTRUCTION

The construction of the Western High Ground Tie-In would be performed during the fourth lift for West Slidell which is projected for year 2076. The dimensions for the Western High Ground Tie-In may be found in Table 2.3 and Figure 1-9. This portion of the alignment would not have berms or geotextile.

Table 2.3. Western High Ground Tie-In *Levee*

Western High Ground Tie-In	
Levee Crown Width	10 ft
Side Slopes of Levee	1V:3H
Construction Elevation	19 ft

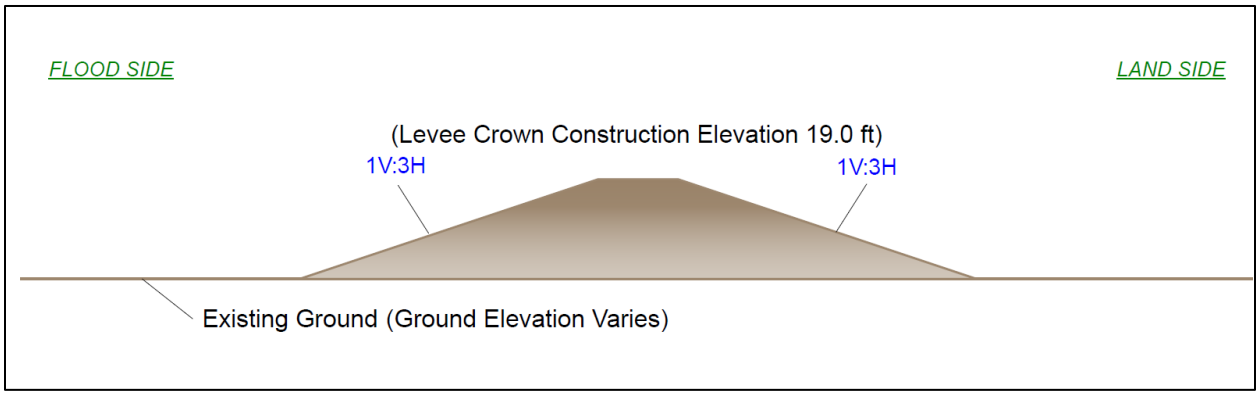


Figure 1-9. Typical Cross-section for the Western High Ground Tie-in for Year 2082

The lift schedules for West Slidell consisted of one geotechnical reach as shown in Figure 1-9. The hydraulic design elevation is 13.5 ft for year 2032 and 17.5 ft for year 2082 are shown in the design line in blue. The red lines represent the projected lifts.

2.4.2 SOUTH SLIDELL LEVEE TYPICAL CROSS SECTION FOR FUTURE LIFTS

The future lifts for South Slidell levee would have a 10 feet wide levee crown and side slopes of 1V:3H.

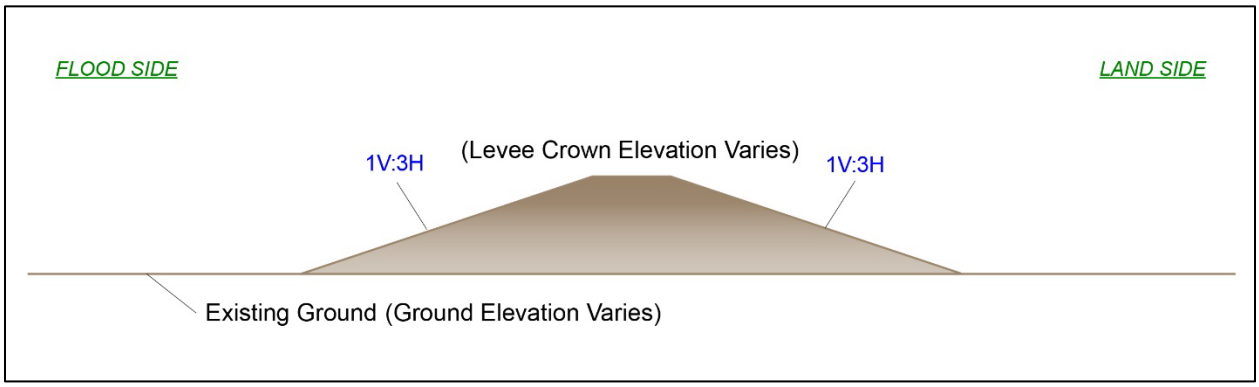


Figure 1-10. Typical Cross-section for South Slidell for Future Lifts

2.5 Typical Floodwall Section and Elevations

The T-wall sections would vary based on location. Table 2.4 lists the floodwall segment and the various dimensions for each floodwall segment.

Table 2.4. Floodwall Segment dimensions

Description of Floodwall Segment	Length of Floodwall Segment (ft)	Base of Slab BOS (ft)	Base of Wall BOW (ft)	Top of Wall TOW (ft)	Stem Height (ft)	Wall Thick (ft)	Slab Width (ft)	Number of piles per row
Western High Ground Tie-in for Year 2082								
N/A								
West Slidell								
Properties at the end of West Doucette	350	1.5	4.5	17.5	**13**	2	15	3
North Side Bayou Paquet Dr.	250	-1.5	1.5	16.5	**15**	2.5	20	4
Bayou Paquet/Mayer Dr.	1400	-1.5	1.5	16	**14.5**	2.5	20	4
South Slidell								
Front Street/ Railroad	1375	-0.5	2.5	16.5	**14**	2.5	20	4
Old Spanish Trail	300	-2.5	0.5	18.5	**18**	2.5	20	4
Esprit du Lac Street	450	1	4	18.5	**14.5**	2.5	20	4
Substation Floodwall	1950	4.5	7.5	18.5	**11**	2	15	3
Highway 190 Business	430	5	8	18.5	**10.5**	2	15	3
Utility Corridor	3530	5	8	18.5	**10.5**	2	15	3
Hollywood Dr. to Yaupon	3700	9	12	18.5	**6.5**	1.5	10	2
Manzella Dr. to Gause	650	10.5	13.5	18.5	5	1.5	10	2

2.6 CONCRETE AND PILE QUANTITIES FOR FLOODWALL SEGMENTS

The floodwall segments would require the following concrete quantities during initial construction as shown on Table 2.5.

Table 2.5: Concrete Quantities for Floodwall Segments

CONCRETE FLOODWALL SEGMENTS	
Total Concrete Quantities	36,200 cubic yards
Total Sheetpile Quantities	451,400 square feet
Total Length of Piles	887,000 linear feet

Total Slope Paving for floodwall/levees tie-ins	7,000 square feet

Table 2.6: Pile Quantities for Floodwall Segments

PILES FOR FLOODWALL SEGMENTS	
Type of pile	18-inch pipe
Configuration	1H:2V battered
Length of each pile	101 feet
Total Length of Piles	26,300 linear feet

2.7 FLOODGATES DESIGN INFORMATION

The Optimized TSP would include a total of 13 gates. Three (3) gates would be lift gates and one gate would be a sector gate. These gates would allow navigation of recreational vessels. There are nine (9) sluice gates which would be control structures (non-navigable).

During construction of the gated structures, temporary bypass channels would be constructed for recreational vessels in Bayous Paquet, Bonfouca, and Liberty.

Table 2.7: Floodgate Dimensions

Description of the Floodgate	Type of Gate	Width of Opening of the Gate (ft)	Ground/ Sill Elevation (ft)	Structural Height of Drainage Gate (ft)
Western High Ground Tie-in for Year 2082				
Sluice gate near Shannon Drive	Sluice	4	15.5	2.0
Tammany Trace Sluice Gate	Sluice	15	12	5.5
West Slidell				
Sluice Gate # 7 (Near CC Road)	Sluice	25	8.6	8.9
Sluice Gate # 6 (Bayou Paquet North Tributary)	Sluice	75	0.8	15.2
Bayou Paquet Gate Nav. Gate	Lift	90	-0.5	16.5
Bayou Liberty Nav. Gate	Lift	80	-6.8	22.8
Bayou Bonfouca Nav. Gate	Lift	110	-9	25.0
Sluice Gate # 2 (Bayou Bonfouca Sluice Gate)	Sluice	50	0.4	15.6
South Slidell				
W-14 Canal Nav. Gate	Sector	90	0.1	18.4
Sluice Gate # 8 (Kings Point East)	Sluice	90	4.4	14.1

Sluice Gate # 10 (Near Eastern Terminus)	Sluice	20	10.5	8.0
Reine Canal	Sluice	30	7.5	11.0
French Branch at I-10	Sluice	25	8.3	10.2

The floodgate locations and minimum sizes above are an estimate. A detailed interior drainage design would be provided during PED.

Limited information and estimates of channel depths and widths has been considered in estimates of the minimum gated opening dimensions. An increase in the size of the gated openings would likely benefit environmental conditions and would provide additional flood flow conveyance. Any channel constriction such as a gate has the potential to locally increase velocities, which could erode natural channels.

It is assumed that most of these floodgate locations would need to retain some flood conveyance capacity during construction. During PED, bypass channels would be considered as part of the design.

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 channel would route water around the structure 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.

2.8 TYPES OF FLOODGATES

2.8.1 FISH-FRIENDLY LIFT GATE

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

During PED, the PDT would consider additional fish-friendly studies and input provided by the NFS, USFWS and National Marine Fisheries Service criteria, including the rock arch and rock ramp designs.

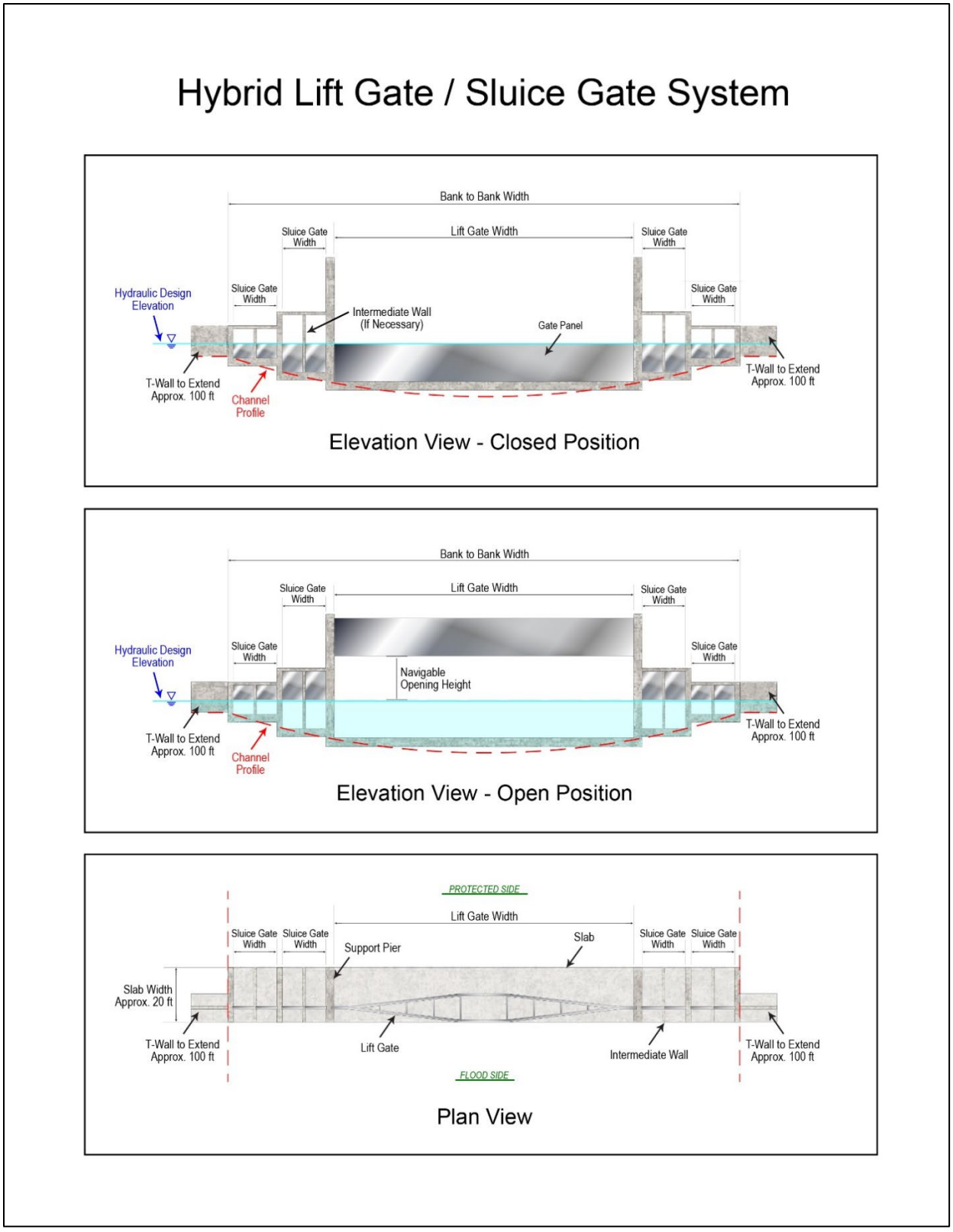
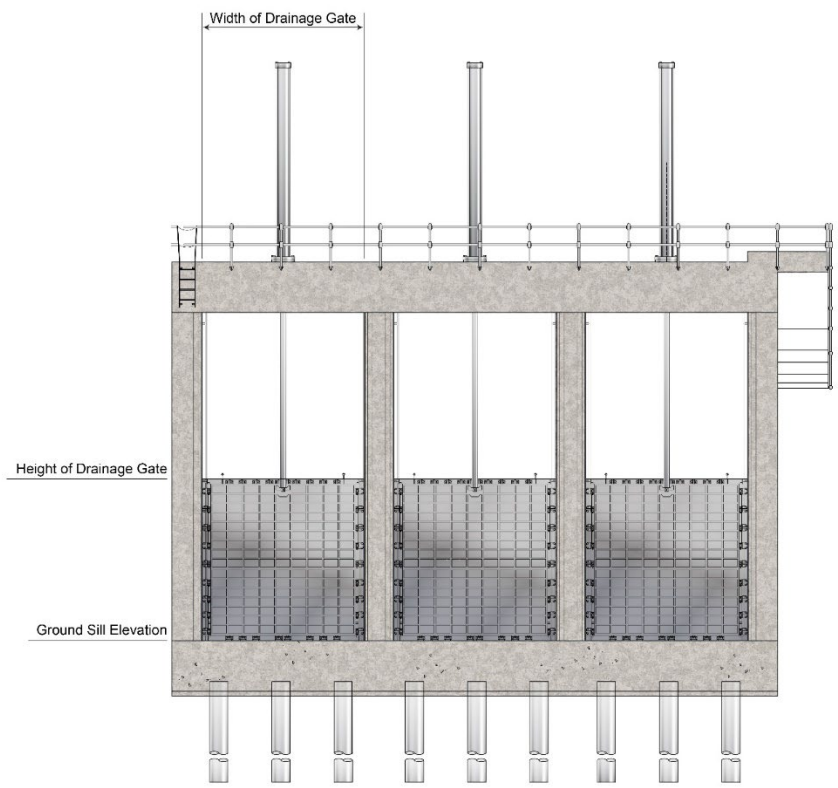


Figure 1.11. Typical Fish-Friendly Gate - Elevation and Plan Views

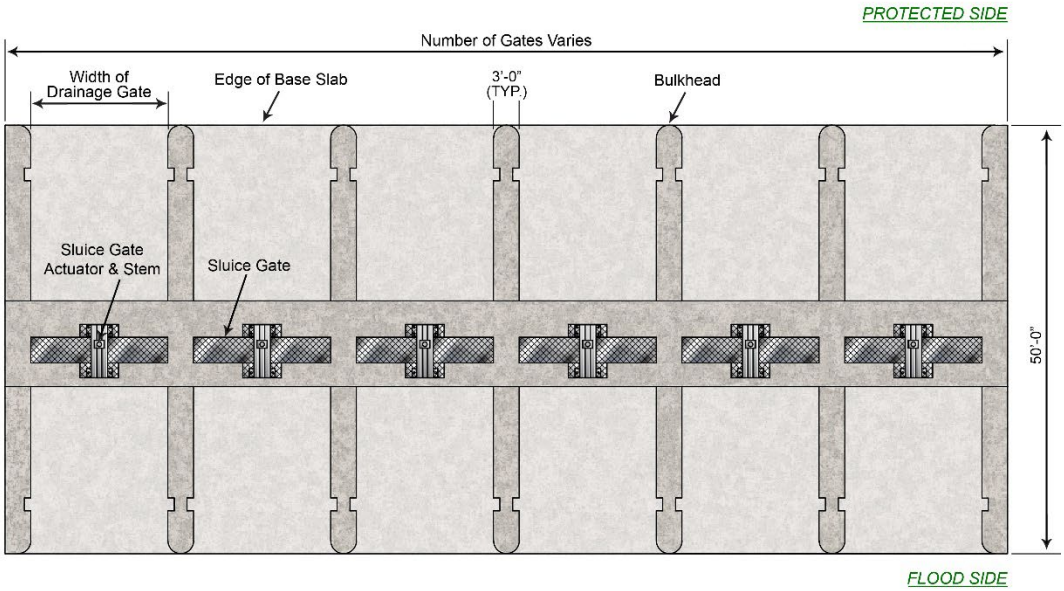
2.8.2 SLUICE GATE

A sluice gate is a structure that contains a movable gate or series of movable gates that, when lifted, allow material and water to flow under it. Generally, sluice gates are not navigable as they do not raise high enough, or they have fixed components that do not allow vessels to pass through."



Typical Sluice Gate - Elevation View

Figure 1-12. Sluice Gate - Elevation View

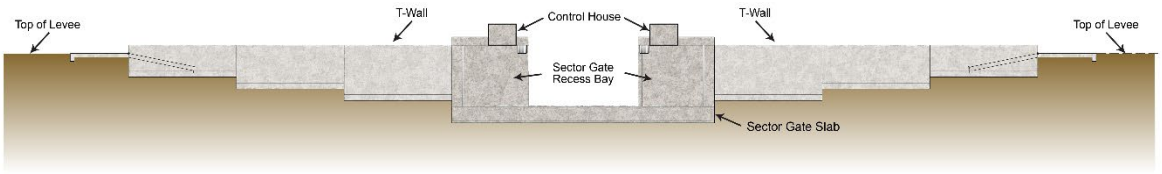


Typical Sluice Gate - Plan View

Figure 1-13. Sluice Gate - Plan View

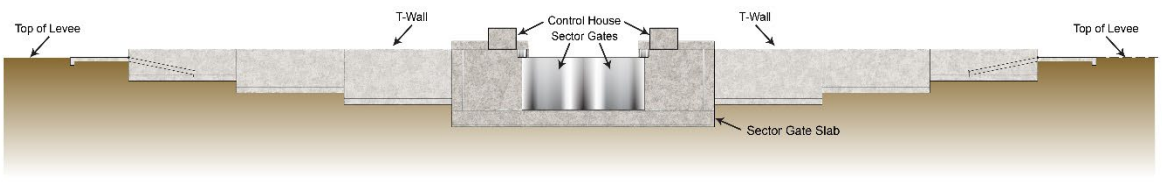
2.8.3 SECTOR GATE

A sector gate is a pie-slice structure that allows navigation to get through when in the open position.



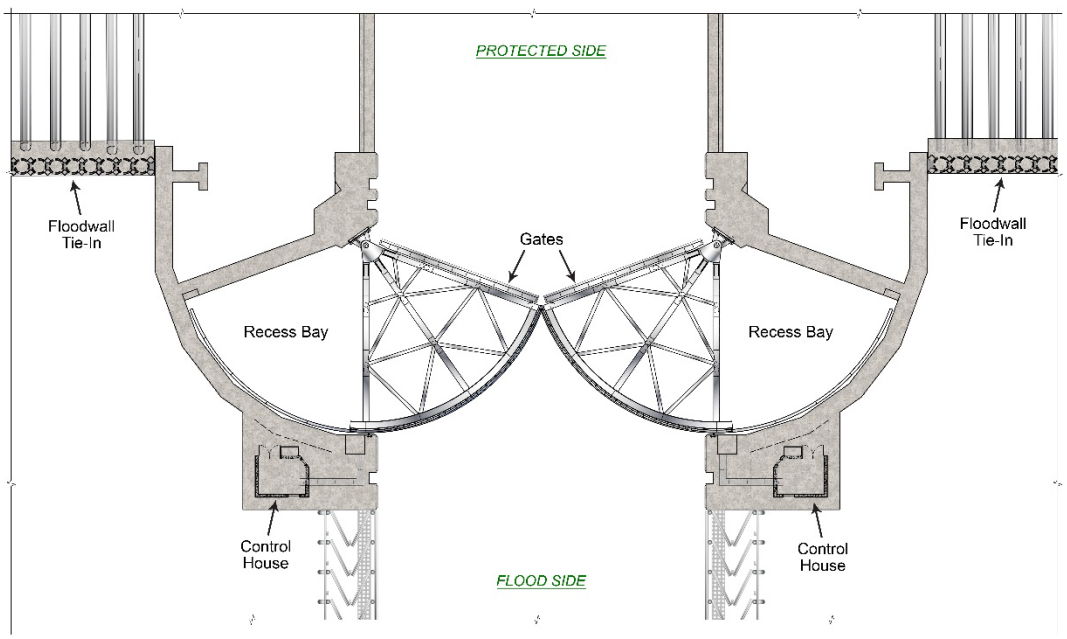
Sector Gate - Elevation View - Open Position

Figure 1-14. Sector Gate - Elevation View with Gates in Open Position



Sector Gate - Elevation View - Closed Position

Figure 1-15. Sector Gate - Elevation View with Gates in Closed Position

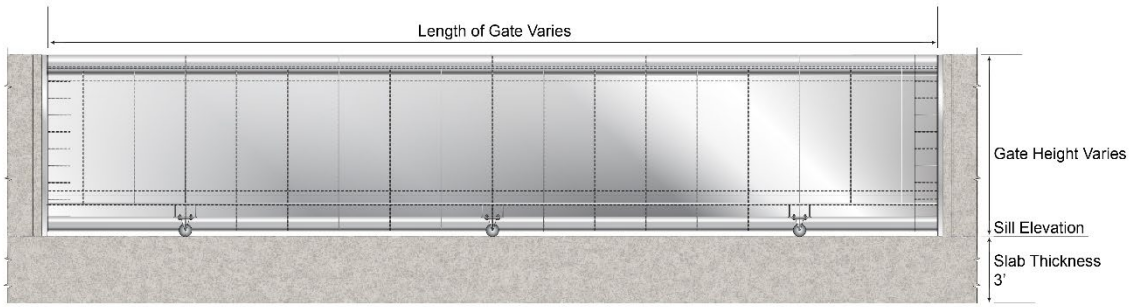


Sector Gate - Plan View - Closed Position

Figure 1-16. Sector Gate - Plan View

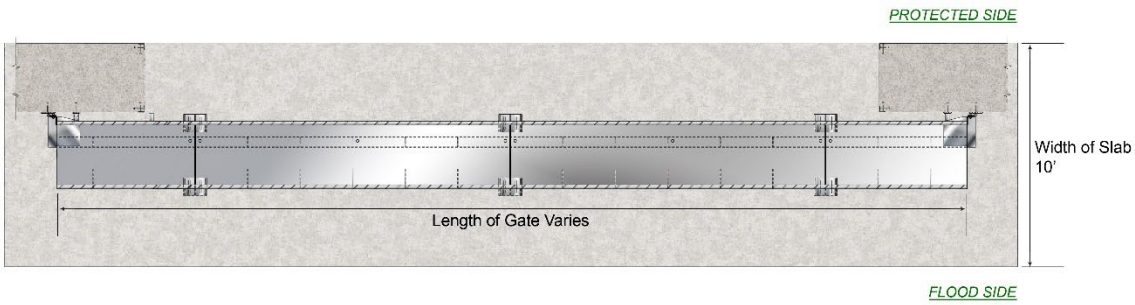
2.8.4 ROLLER GATE

A roller gate is a structure that uses rollers for the gate to open and close. The operating motion of the gate is typically parallel to the skin plate face of the gate.



Typical Roller Gate - Elevation View

Figure 1-17. Roller Gate - Elevation View



Typical Roller Gate - Plan View

Figure 1-18. Roller Gate - Plan View

2.8.5 SWING GATE

A swing gate is a structure that uses a hinge system to open horizontally. The gate can be actuated through automated mechanical means such as hydraulic arm or manually.

It was assumed that a swing gate would be constructed where the alignment crosses the Southern Railway Corp. railroad tracks. (The analysis for this gate was based on Mississippi River Levee (MRL) Carrollton Railroad Gate.)

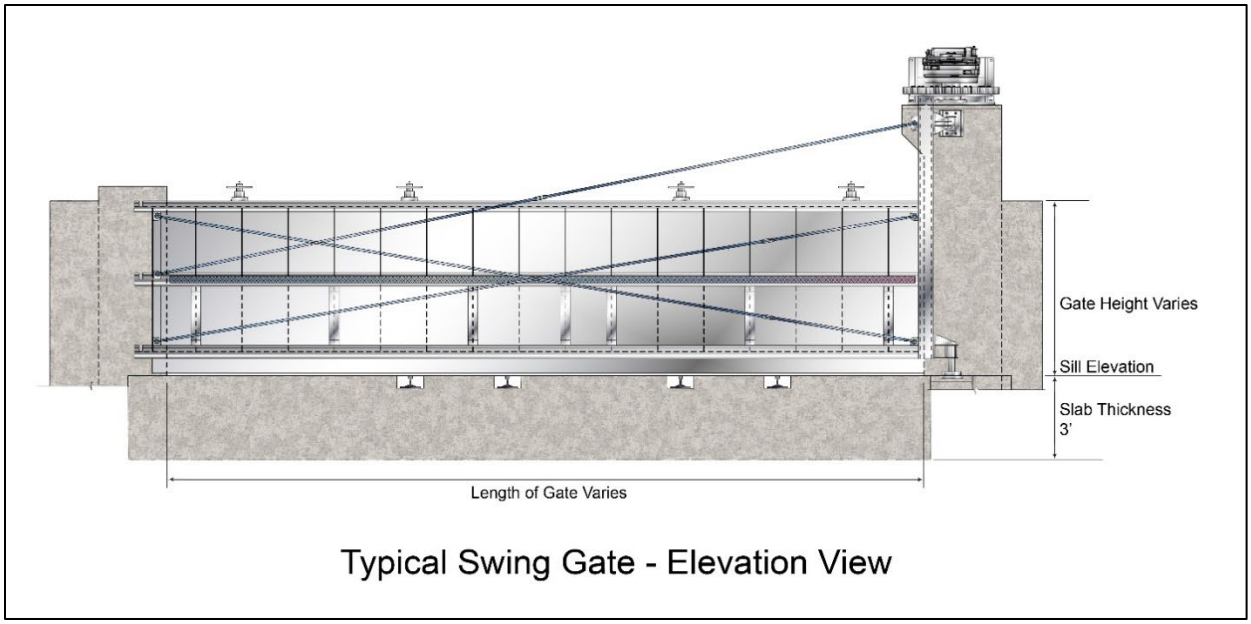


Figure 1-19. Swing Gate - Elevation View

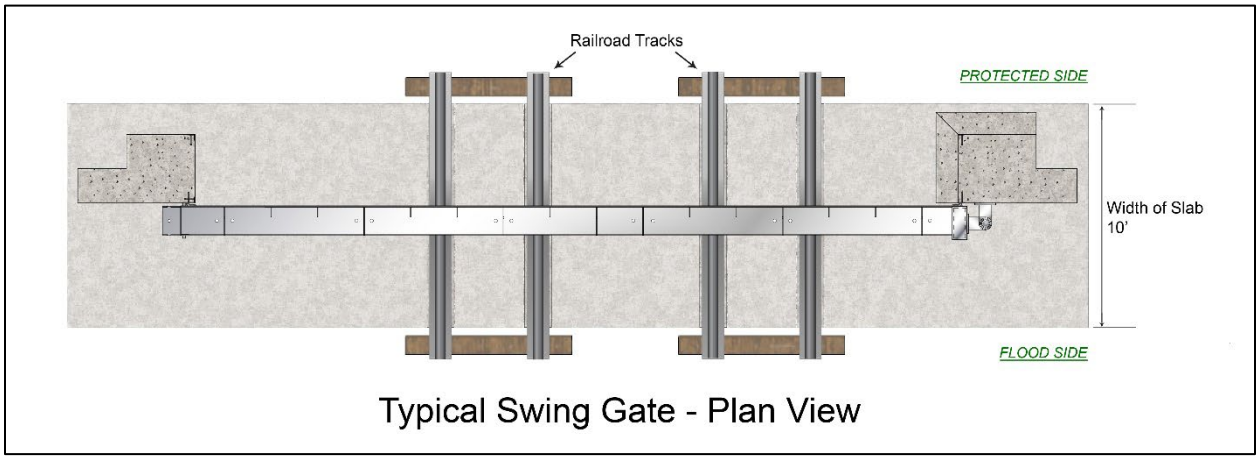


Figure 1-20. Typical Swing Gate - Plan View

2.9 VEHICULAR, PEDESTRIAN AND RAILROAD GATES DESIGN INFORMATION

Table 2.8 contains the design information for the vehicular, pedestrian and railroad gates for the Optimized TSP.

Table 2.8: Vehicular, Pedestrian and Railroad Gates

Name	Description	Type	Mode	Width	Ground/ Sill Elevation (ft)	Design Height (ft)	Height of Gate (ft)
Western High Ground Tie-in for 2082							
Tammany Trace Pedestrian Gate and Culvert	10-ft Pedestrian Gate at Tammany Trace with Lift Gate for Culvert on south side	Swing	Pedestrian	10	13	17.5	3.5
Tranquility Road Vehicular Gate	20-ft Vehicular Gate at Tranquility Road	Roller	Vehicle	20	12	17.5	4.5
West Slidell							
Bayou Paquet Road Floodgate # 2	60-ft Floodgate at Bayou Paquet Road	Roller	Vehicle	60	3	16	13
Mayer Drive Vehicular Gate	20-ft Vehicular Gate at Mayer Road	Roller	Vehicle	20	2.5	16	13.5
Railroad Floodgate	60-foot floodgate for Railroad	Swing	Railroad	60	0.5	16.5	16
South Slidell							
Hwy 11 Vehicular Gate	75-ft Roller Gate at Hwy 11 (Pontchartrain Drive)	Roller	Vehicle	75	4	16.5	12.5
Mariners Cove Floodwall and Vehicular Gate	500 Linear feet of floodwall for narrow section of Oak Harbor levee at Mariners Cove Blvd	Roller	Vehicle	50	10.5	16.5	6
Oak Harbor Vehicular Gate	Floodwall and 20-foot Vehicular Gate for Oak Harbor	Roller	Vehicle	20	11.5	16.5	5
Oak Harbor Country Club Vehicular Gate	Floodwall and 20-foot Vehicular Gate for access to Oak Harbor Country Club	Roller	Vehicle	20	11.5	16.5	
Old Spanish Trail Floodgate (Hwy 433)	30-foot roller gate at Hwy 433 east crossing (Old Spanish Trail)	Roller	Vehicle	30	3.5	18.5	15

Hardin Rd Substation Gate	20-foot roller gate for access from Hardin Road to power substation	Roller	Vehicle	20	8	18.5	10.5
Hwy 190-B Floodgate (East Floodwall)	50-foot roller gate at Hwy 190-B east crossing (Fremaux Road)	Roller	Vehicle	50	9	18.5	9.5
South Holiday Drive Vehicular Gate	20-foot roller gate at South Holiday Drive	Roller	Vehicle	20	14	18.5	4.5
Jaguar Drive Vehicular Gate	20-foot roller gate at Jaguar Avenue	Roller	Vehicle	20	12	18.5	6.5
Natchez Drive Vehicular Gate	20-foot roller gate at Natchez Avenue	Roller	Vehicle	20	12	18.5	6.5
Kisatchie Drive Vehicular Gate	20-foot roller gate at Kisatchie Avenue	Roller	Vehicle	20	14	18.5	4.5
Manzella Drive Vehicular Gate	20-foot roller gate at Manzella Drive (Added to extend floodwall to 18.5 ft ground elevation south of Hwy 190)	Roller	Vehicle	20	15	18.5	3.5

2.10 PUMP STATIONS DESIGN INFORMATION

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 2.9: 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

The Optimized TSP would include two (2) pump stations with large pumping capacity at Bayou Liberty (1,800 cfs) and Bayou Bonfouca (2,000 cfs). These pump stations were assumed to have similar components and configuration as the USACE West Shore Lake Pontchartrain Reserve Relief Canal Pump Station (WSLP Pump Station). The structural quantities from the Reserve Relief Canal Pump Station were scaled accordingly to reflect the size of the pump stations for this study.

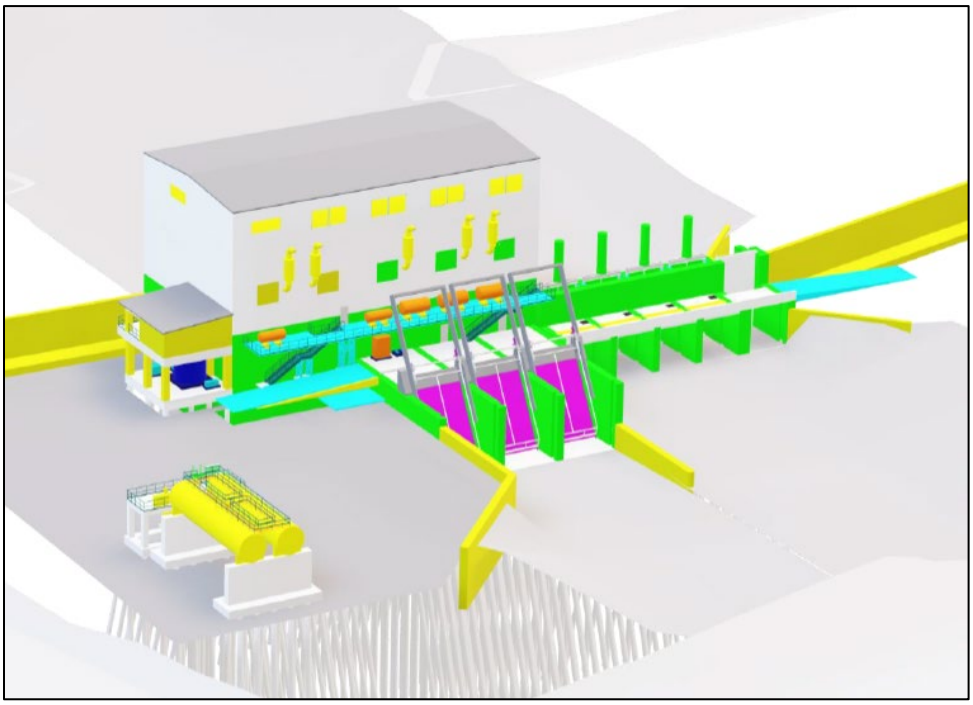


Figure 1-21. Typical Site Plan of a Pump Station with Large Pumping Capacity

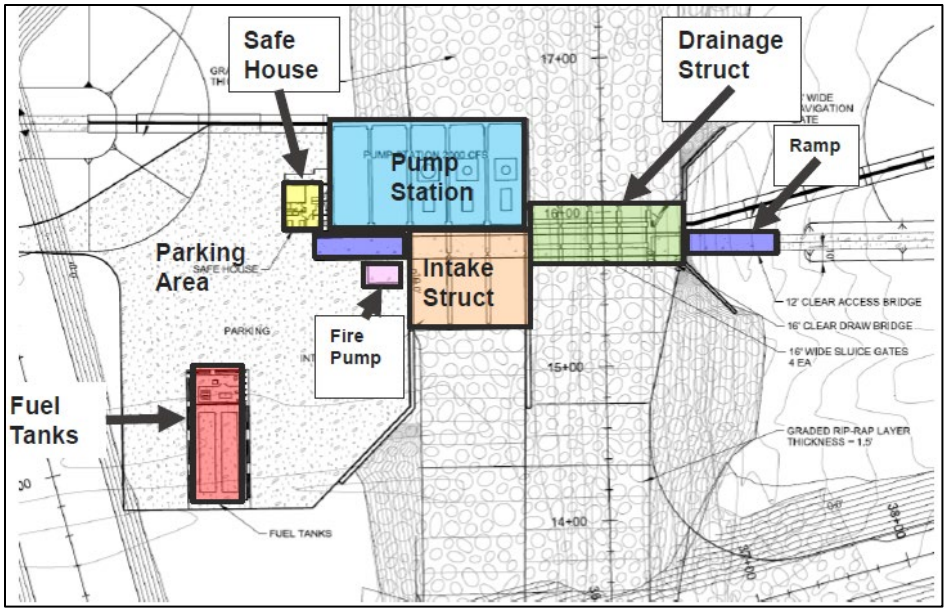


Figure 1-22. Typical Layout of a Pump Station with Large Pumping Capacity

The TSP would include six (6) pump stations with small pumping capacity at sluice gate #6 on the Bayou Paquet North Tributary (300 cfs), Bayou Paquet lift gate (500 cfs), W-14 Canal (1,000 cfs), sluice gate # 8 at Kings Point (200 cfs), Reine Canal (200 cfs) and at French Branch at the I-10 (450 cfs).

These pump stations would have similar pumping capacities to the Prescott Road Pump Station for the Lake Pontchartrain Lakeshore study. The structural quantities from the Prescott Road Pump Station were scaled accordingly to reflect the size of the pump stations for this study.

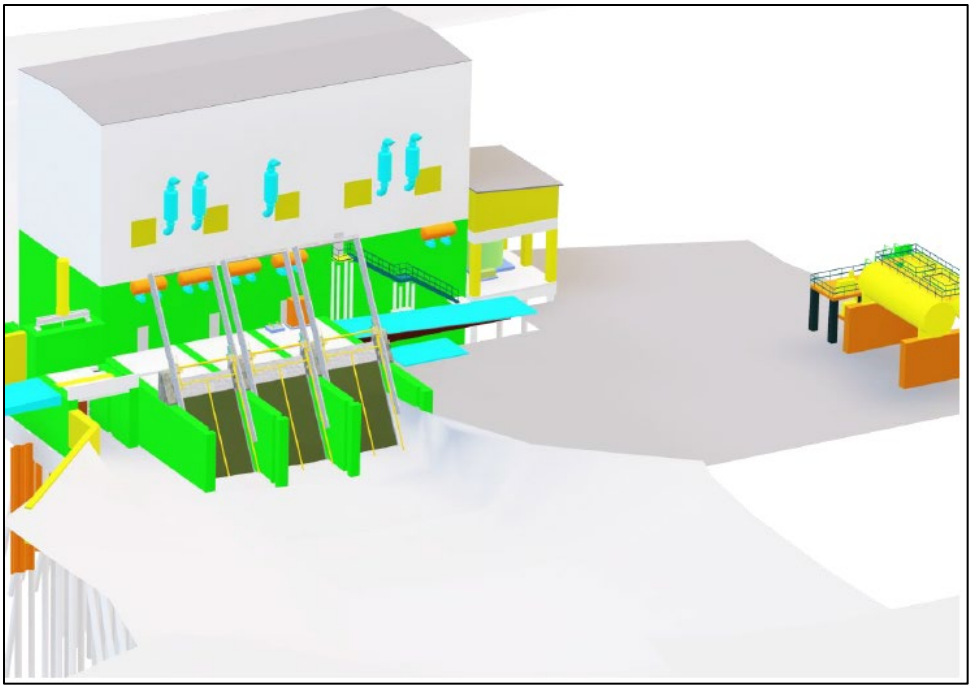


Figure 1-23. Typical Site Plan of a Pump Station with Small Pumping Capacity

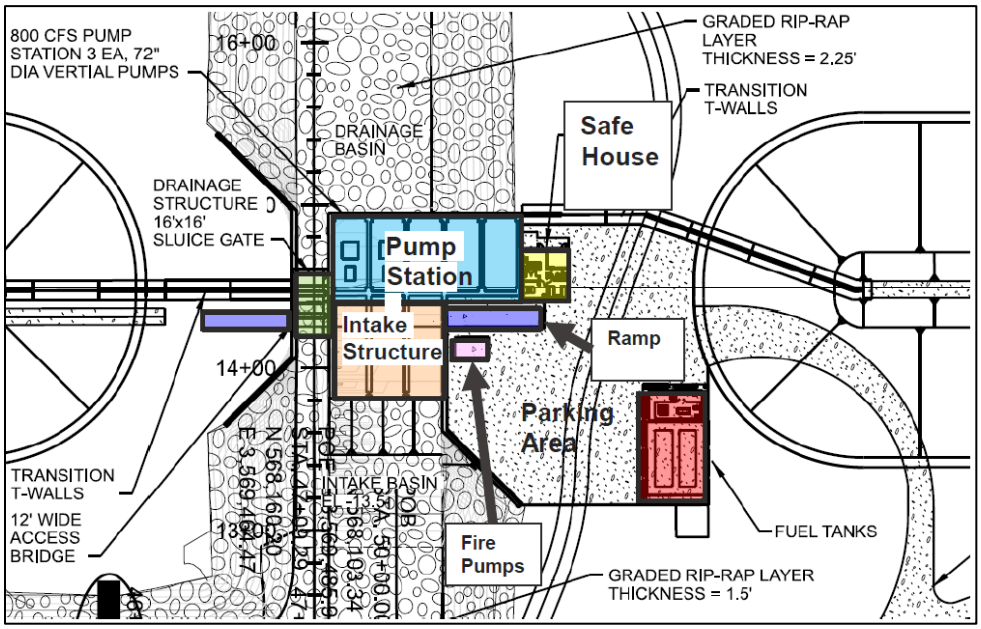


Figure 1-24. Typical Layout of a Pump Station with Small Pumping Capacity

Note: the schematics on this section were obtained from a presentation prepared by Stantec.

3 ACCESS ROUTES AND STAGING AREAS REQUIRED

Table 3.1 provides a summary of the necessary staging areas and permanent ROW required for construction of the levee and floodwall segments for the 50-yr period of analysis. The staging areas required during initial construction of the levee alignment would be the same staging areas required for construction of future levee lifts.

Table 3.1 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.

Table 3-2 lists the ROW width required per levee or floodwall segment. The width includes a 15 ft of vegetation free zone (VFZ) on each side of the levee/floodwall segment.

Table 3.2 Typical Widths of Permanent ROW for Levee and Floodwalls Segments

Levee and Floodwall Segments	Width of Permanent ROW (ft)*
Western High Ground Tie-in	160
West Slidell	300
South Slidell	160
Floodwall Segments	80
Access Roads	NA

***(Includes 15-ft VFZ on both sides)**

3.1 ACCESS ROUTES AND STAGING FOR MILE BRANCH

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.

3.1 ACCESS ROUTES AND STAGING FOR LEVEE CONSTRUCTION

There are locations where an existing road would be used for access. In other locations, a new road would be built.

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 VFZ on both sides of the road. Access roads would be constructed using crushed stone for the road surface.

LEVEE CONSTRUCTION EXCEPT REFUGE AREA

For staging areas for levee construction, crushed stone would be placed (assuming crushed stone for vehicle parking/staging and for path from road to area).

Any trees would be removed and hauled away to an approved facility. Contractor would use the area to process material prior to levee construction.

LEVEE CONSTRUCTION ON REFUGE AREA

For the construction of the levee on the 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. An access road would be constructed on the protected side of the ROW between the proposed crown of the levee and Bayou Bonfouca. The access road would be a temporary road. 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 2-acre staging area on the reach on the refuge land that would be considered a temporary easement. The staging area would be located off the refuge and would be used to process the material prior to building the levee. Staging areas would be required to be continuously accessible. Any trees would be removed and hauled away to an approved facility. The area would be restored to pre-construction elevation that existed prior to impacting the site due to construction activities.

3.2 ACCESS ROUTES AND STAGING AREAS FOR STRUCTURES

Existing public roads would be utilized for access to the maximum extent as possible. In locations where access cannot be achieved via existing roadways, a new road would be constructed. 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 VFZ on both sides of the road. Access roads would be constructed using crushed stone for the road surface.

For the floodwall segments, the temporary ROW (during construction) and the permanent ROW would be as shown in Table 3.3 below.

Table 3.3: ROW for Floodwall Segments

Floodwall Segments		Staging Area (Acres)	Permanent Access (Acres)
Western High Ground Tie-in for 2082			
N/A			
West Slidell			
Properties west of Doucette Road		0.4	0.4
North Side Bayou Paquet Drive		0.3	0.3

Bayou Paquet/Mayer Drive		1.6	1.6
South Slidell			
Front Street/Railroad		1.6	1.6
Mariners Cove Boulevard		0.6	0.6
Oak Harbor Country Club		0.2	0.2
Old Spanish Trail		0.3	0.3
Esprit du Lac Street		0.5	0.5
Substation Floodwall		2.2	2.2
Highway 190 Business		0.5	0.5
Utility Corridor		4.1	4.1
Hollywood Drive to Yaupon		4.2	4.2
Manzella Drive to Gause Boulevard		0.7	0.7
Total		**18**	**18**

For the floodgates and pump stations, the temporary ROW (staging area during construction) and the permanent ROW would be as shown in Table 3.4.

Table 3.4: ROW for Floodgates and Pump Stations

Floodgates and Pump Stations	Pump Station	Pumping Capacity (cfs)	Staging Area (Acres)	Permanent Area (Acres)
Western High Ground Tie-in for 2082				
Sluice gate near Shannon Drive	No		0.75	1.25
Sluice gate at Tammany Trace	No		0.75	1.25
West Slidell				
Sluice Gate # 7 (Near CC Road)	No		0.75	1.25
Sluice Gate # 6 (Bayou Paquet North Tributary)	Yes	300	0.75	1.25
Bayou Paquet Navigable Gate and Pump Station	Yes	500	0.75	1.25
Bayou Liberty Navigable Gate and Pump Station	Yes	1800	4	8
Bayou Bonfouca Navigation Gate and Pump Station	Yes	2000	4	8
Sluice Gate # 2 (Bayou Bonfouca Sluice Gate)	No		0.75	1.25
South Slidell				
W-14 Canal Navigable Gate and Pump Station	Yes	1000	0.75	1.25
Sluice Gate # 8 (Kings Point East) and Pump Station	Yes	200	0.75	1.25

Sluice Gate # 10 (Near East Terminus)	No		0.75	1.25
Reine Canal and Pump Station	Yes	200	0.75	1.25
French Branch at I-10 and Pump Station	Yes	450	0.75	1.25
Total for Floodgates and Pump Stations			**16.25**	**29.75**

3.3 ACCESS ROUTES AND STAGING AREAS FOR VEHICULAR, PEDESTRIAN AND RAILROAD GATES INITIAL CONSTRUCTION

For the vehicular, pedestrian and railroad gates, the temporary ROW (staging area during construction) and the permanent ROW would be as shown in Table 3.5:

Table 3.5: ROW for Vehicular, Pedestrian and Railroad Gates

Name	Staging Area (Acres)	Permanent ROW (Acres)
Western High Ground Tie-in for 2082		
Tammany Trace Pedestrian Gate	0.75	1.25
Tranquility Road Vehicular Gate	0.75	0
West Slidell		
Bayou Paquet Road Floodgate # 2	0.75	0
Mayer Drive Vehicular Gate	0.75	0
Railroad Floodgate	0.75	0
South Slidell		
Hwy 11 Vehicular Gate	0.75	0
Mariners Cove Floodwall and Vehicular Gate	0.75	0
Oak Harbor Vehicular Gate	0.75	0
Oak Harbor Country Club Vehicular Gate	0.75	0
Old Spanish Trail Floodgate (Hwy 433)	0.75	0
Hardin Road Substation Gate	0.75	0
Hwy 190-B Floodgate (East Floodwall)	0.75	0
South Holiday Drive Vehicular Gate	0.75	0
Jaguar Drive Vehicular Gate	0.75	0
Natchez Drive Vehicular Gate	0.75	0
Kisatchie Drive Vehicular Gate	0.75	0
Manzella Drive Vehicular Gate	0.75	0

3.4 STAGING AREAS AND ACCESS MATERIALS

LEVEE

For staging areas and access roads for levee construction, not including area for material processing during levee construction, a 7-inch depth of stone, and 115 lbs/cubic feet stone weight was assumed.

MILE BRANCH AND STRUCTURES

For the construction in Mile Branch and for the construction of structures, the staging areas and access roads, were assumed to have a 7-inch depth of crushed stone.

4 MILE BRANCH CHANNEL IMPROVEMENTS

The proposed work at Mile Branch would be located in a heavily populated area. There are properties in close proximity of the Mile Branch. There are no surveys available for this area.

Figure 4-1 provides the location of this work.

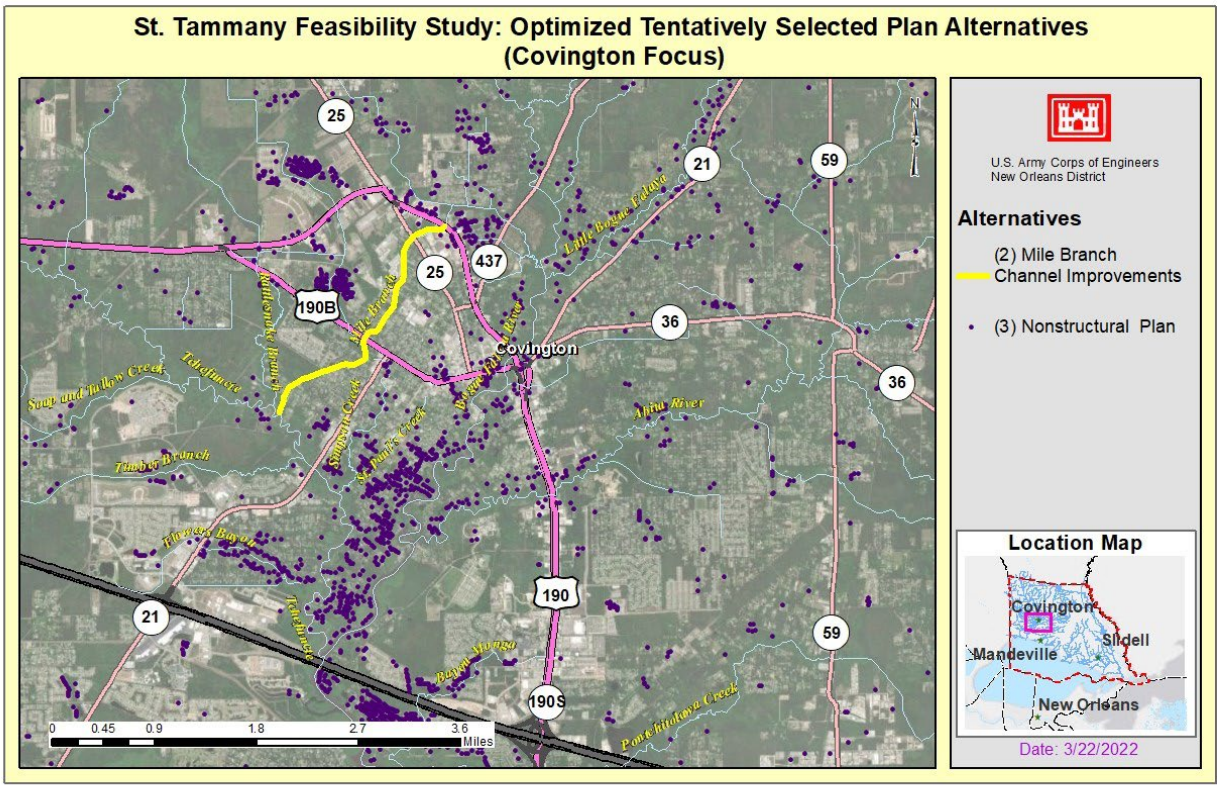


Figure 4-1. Optimized Tentatively Selected Plan Alternatives- Covington Focus

The Mile Branch channel improvements would start at the intersection of Mile Branch and Highway 190, crossing Highway 190 Business, and ending at the intersection of Mile Branch and the Tchefuncte River. Refer to Figure 4-2.

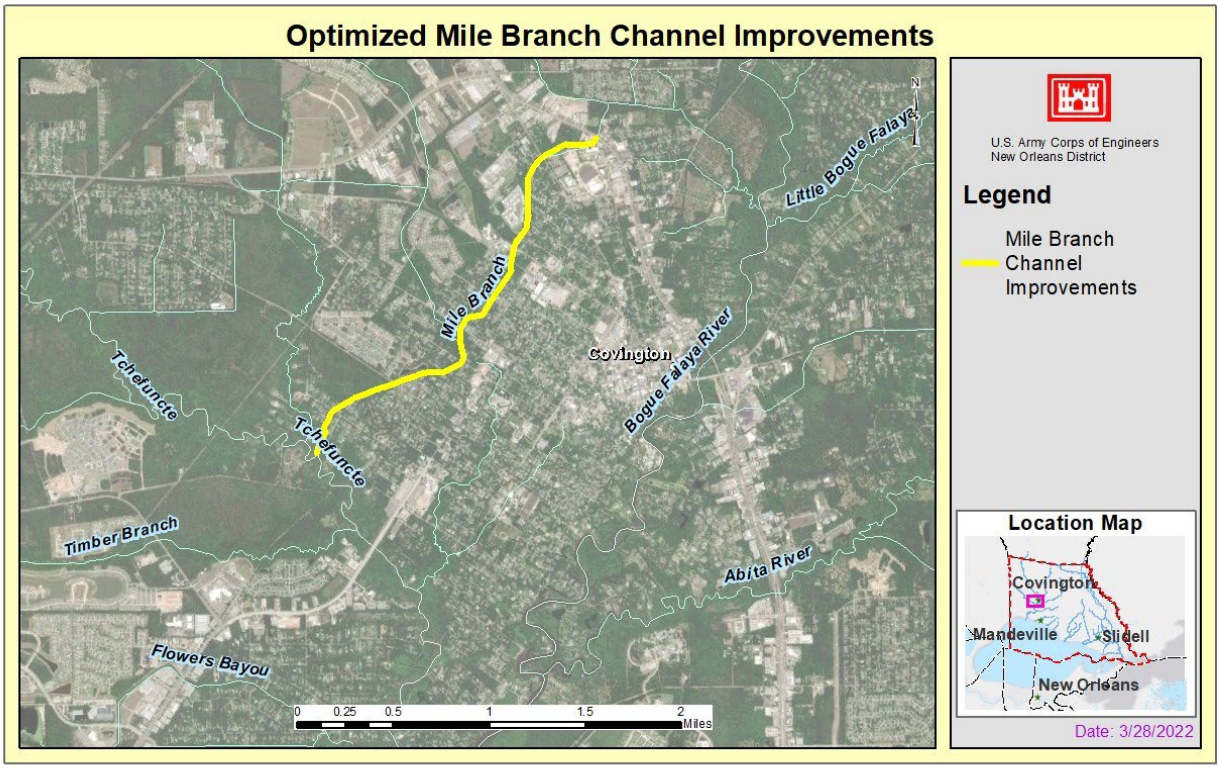


Figure 4-2. Optimized Mile Branch Channel Improvements

The preliminary design assumes an existing bank elevation of 1 ft, a 10-ft bottom width at elevation (-) 5 ft. The bank is at 1V:3H slope. The improvements would include clearing and grubbing and mechanical dredging of the channel. The channel bottom would be lowered by 5 ft. Refer to Figure 4-3 for typical cross-section.

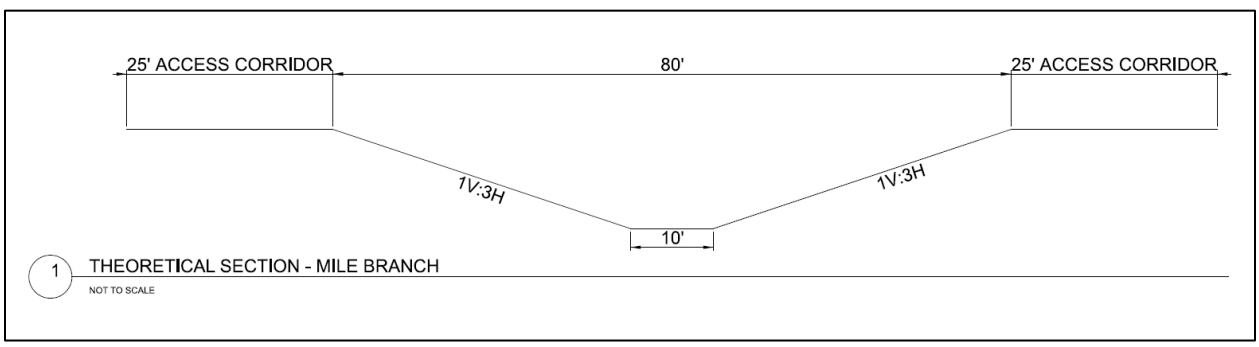


Figure 4-3. Mile Branch Improvements- Typical Cross-Section

Approximately 20 acres of channel would be cleared and grubbed prior to mechanical dredging. An assumed maximum of 130,000 cubic yards of material may be mechanically dredged from the channel. Material removed may include sediment, trees, debris, or other

obstructions within the waterway. For the channel improvements, approximately 34 acres of ROW would be needed for a temporary easement.

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 was included in the study phase.

4.1 STRUCTURAL IMPROVEMENTS

The Mile Branch channel improvements may include bridge replacements or new culverts (starting from north to south) at 29th, 28th, 25th, 23rd, 21st, 19th, and 18th Avenues. No work is anticipated at the 15th and 11th Avenue channel crossings as those bridges have been replaced prior to this study (and the new bridges were designed to safely pass higher flows on Mile Branch).

Assumptions for channel improvements included a 65 ft from the centerline of each side of the channel for ROW as a general guideline (total width of 130 ft); which includes space for equipment access. All work would be within the project footprint. Temporary work easement would be within ROW. The material to be disposed of would be trucked away from the site. Assumption is that all access would be through public lands.

Additional refinements would occur during PED. Future surveys would determine final channel section and bridge replacements or new culverts. Impacts to habitat and real estate would also be minimized. Opportunities to include natural features would be considered in future designs.

4.2 ACCESS ROUTES AND ROW CRITERIA FOR MILE BRANCH

Figure 4-4 provides the locations of the Mile Branch channel improvements including the structural improvements.

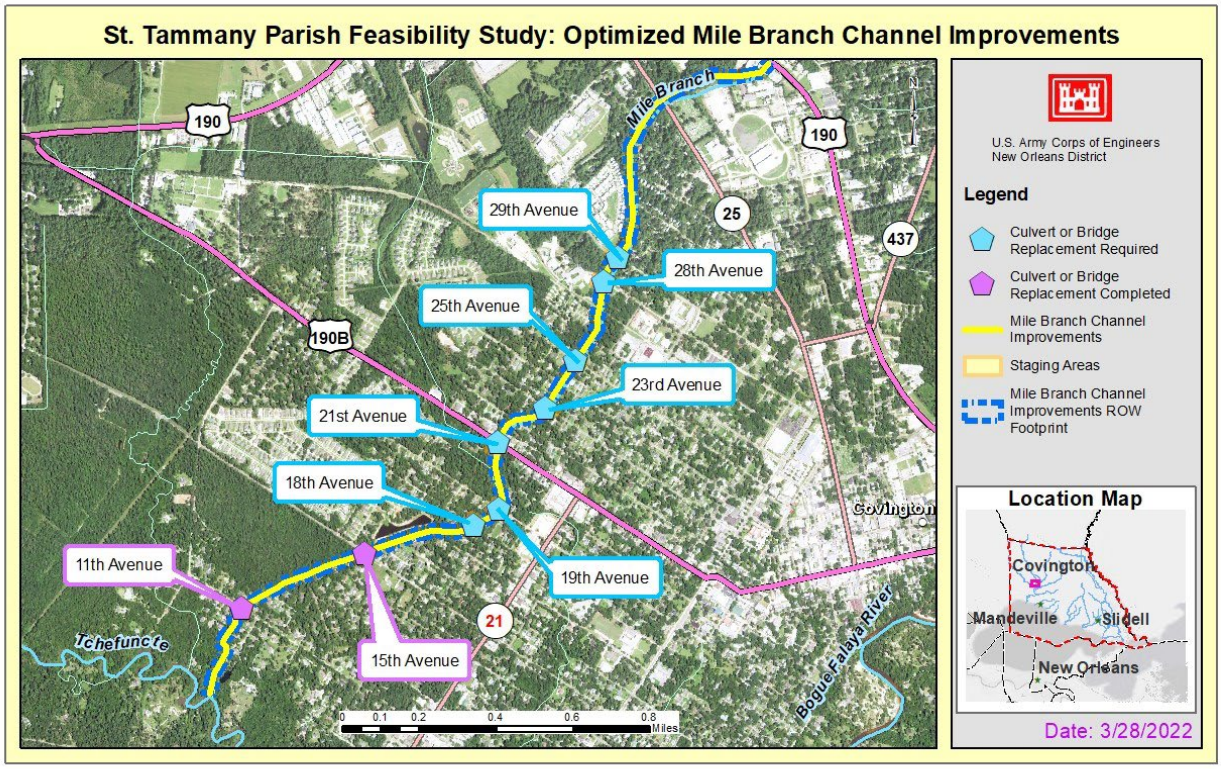


Figure 4.4. Optimized Mile Branch Improvements- Structural Improvements

Reference Table 3.1 for a listing of the staging areas and acres required for the structural improvements for Mile Branch. Table 4-1 below lists the staging area locations required for the bridge/culvert replacements and the necessary acres.

Table 4.1: Staging areas for the bridge/culvert replacements

Location	Temporary ROW Staging Area (Acres)
29th Avenue	0.37
28th Avenue	0.35
25th Avenue	0.20
23rd Avenue	0.21
21st Avenue	0.36
19th Avenue	0.36
18th Avenue	0.38
TOTAL	**2.23**