Mississippi Valley Division,
Regional Planning and Environment Division South

Morganza to the Gulf, Louisiana, Hurricane and Storm Risk Reduction Project SEIS

Appendix C – Compensatory Habitat Mitigation Plan

December 2025

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SECTION 1 INTRODUCTION

This document presents the compensatory mitigation plan for unavoidable habitat impacts associated with the Proposed Action assessed in the Morganza to the Gulf (MTG) Supplemental Programmatic Environmental Impact Statement (SEIS). The Draft SEIS and this mitigation plan supplement and update the 2013 Post-Authorization Change Report/Revised Programmatic Environmental Impact Statement (2013 PACR/RPEIS) and associated mitigation plan.

Compensatory mitigation is “the restoration (re-establishment or rehabilitation), establishment, enhancement, and/or in certain circumstances preservation of aquatic resources for the purposes of offsetting unavoidable adverse impacts which remain after all appropriate and practicable avoidance and minimization has been achieved” (see 40 CFR 230.92). The purpose of this mitigation plan is to identify a final array of target mitigation sites for each habitat type being mitigated, each with enough acreage to meet full compensatory mitigation needs for the entire MTG Proposed Action footprint in kind and establish an order of ranking for implementation such that, as advanced engineering design proceeds, compensatory mitigation requirements can be met. As MTG levee reach designs are completed and compensatory mitigation requirements for that reach are refined, specific mitigation projects within the larger footprint of the overall final array of target mitigation sites will be identified and designed before construction of each reach.

This plan addresses compensatory mitigation that would be necessary after all efforts to avoid, minimize, rectify, or reduce impacts from the Proposed Action have been undertaken. Details on those efforts are included in Sections 3.3.2, 3.3.4, and 3.3.5.2 of the Draft SEIS. Efforts that would be undertaken to avoid, minimize, rectify, or reduce habitat impacts would still result in unavoidable impacts to fish and wildlife resources and require development of a compensatory mitigation plan in accordance with Engineer Regulation (ER) 1105-2-100 and 33 USC 2283. This document details the work performed, including coordination, plan formulation, and environmental compliance, to develop the compensatory mitigation plan. The tentatively selected mitigation plan includes the purchase of mitigation bank credits as well as the construction of U.S. Army Corps of Engineers (“USACE” or “Corps”) constructed mitigation projects.

1.1 COORDINATION AND COLLABORATION

Development of this mitigation plan involved extensive coordination and collaboration with the project's non-federal sponsor (NFS) and state (Louisiana) and federal agencies. In compliance with ER 1105-2-100, Appendix C, Section C-2(a) and 3(b), this section documents these activities (USACE 2000). Public comments on the SEIS and the mitigation plan will be solicited during the National Environmental Policy Act (NEPA) public comment period for the Draft SEIS. Additional details on the study's public involvement efforts can be found in Section 7 Public and Agency Coordination of the SEIS.

An interagency team comprised of state and federal resource agencies met throughout the study planning process and contributed expertise, advice, and technical information used during the identification of habitat impacts and the development of this compensatory mitigation plan. The USACE will continue to coordinate and seek input from these agencies during advanced design and execution of the mitigation plan.

Under the NEPA, a cooperating agency is defined as a federal agency, other than the lead agency, that has jurisdiction by law or special expertise with respect to any environmental impact involved in a proposed major federal action or its reasonable alternatives (40 CFR 1508.5). The following agencies agreed to participate as cooperating agencies for the SEIS:

- United States Fish and Wildlife Service (USFWS)
- National Marine Fisheries Service (NMFS)
- Environmental Protection Agency (EPA)
- Louisiana Department of Wildlife and Fisheries (LDWF)
- Louisiana Department of Energy and Natural Resources (LDENR)

Regular meetings were held with the interagency team to provide opportunities for feedback on the SEIS and development of this mitigation plan. Meetings were held with a habitat evaluation team (HET) comprised of members from MVN, USFWS, NMFS, NFS, LDWF, and LDENR. A smaller habitat evaluation team (HET) comprised of MVN, USFWS and NMFS biologists was established to conduct the habitat impact analysis using the Wetland Value Assessment (WVA) model. Bi-weekly meetings were held with the USACE Project Development Team (PDT), the NFS, cooperating agencies, and the HET throughout the planning process for the SEIS and compensatory mitigation plan.

1.2 INVENTORY AND CATEGORIZE ECOLOGICAL RESOURCES

An ecological resources inventory within the study area is documented in Section 3 of the SEIS. Habitat surveys conducted by USACE and FWS from 2023 to 2025 as well as the data sources listed in Table C:1-1 were used to classify habitats in the study area.

Table C:1-1. Data Sources

Year	Source of Information	Information	Use in Mitigation Planning
2017	USGS	Land Area Change in Coastal Louisiana (1932 to 2016)	Historic Land Loss Rates
2023	LDWF	Natural Communities Fact Sheets	Source for information on resource significance, including rarity ranking, by habitat type
2023 to 2025	USACE and USFWS	Interagency field visit report	Inventory and forecast mitigation site resources and conditions. Data for habitat models.
2023	ArcGIS Pro Geographic Information systems (GIS) software version 3.3.2 – Supervised Classification	Categorize habitat types	Mapping software used to delineate habitats.
2023	USDA National Aerial Imagery Program (NAIP)	Digital aerial imagery	Source imagery used for habitat delineations.
2021	USGS	Vegetation types	Informed salinity modifiers to habitat data.

The study area includes fresh and intermediate marsh, brackish and saline marsh, bottomland hardwood forests, and swamp. These resources are recognized as significant across institutional, public, and technical perspectives, as described in Section 3 of the SEIS.

Bottomland hardwoods (BLH) are alluvial-forested wetlands typically found throughout southern Louisiana in the deltaic plain of the Mississippi River (Hodges, 1997). BLH found in coastal portions of the project area occur primarily on the natural levees of distributary channels. A variety of plant species, including live oak (Quercus virginiana), water oak (Quercus nigra), sugarberry (Celtis laevigata), and Drummond red maple (Acer rubrum drummondii) occur in this habitat.

Swamp habitats are defined by their higher proportional representation of bald cypress and tupelo and a repetitive wet-dry cycle. Cypress-tupelo swamps are located along the flanks of larger distributary ridges as a transition zone between bottomland hardwoods and lower-elevation marsh or scrub-shrub habitats. Cypress-tupelo swamps exist where there is little or no salinity and usually minimal daily tidal action. The Louisiana swamps generally lack a mature tree canopy because of historic logging and have lower productivity where isolated from riverine influences (Shaffer et al., 2003). Permanent inundation results in a loss of regeneration and eventually conversion to marsh (Hodges, 1997).

Freshwater marsh is found surrounding bodies of open water and is located in the northern portion of the project area along the Gulf Intracoastal Waterway (GIWW) (CPRA, 2023). Freshwater habitats generally have salinities less than 0.5 parts per thousand (ppt) and form in accreting, sediment rich, high-energy environments typical for this region. Fresh marshes provide nursery habitat for estuarine-dependent species important to recreational and commercial fisheries. Intermediate marsh reflects the shifts in salinity associated with proximity to marine environments (0.5-5.0 ppt), and the marsh species that are found in this type are capable of withstanding spikes of salinity that are associated with tropical storm surge events. It is commonly a narrow band of vegetation when compared with other marsh types due to the large differences between freshwater and brackish salinities.

Intermediate marsh is found between brackish marsh and freshwater marsh. This marsh is characterized by a diversity of species, many of which are found in freshwater marsh and some of which are found in brackish marsh (e.g. Cyperus spp., wire grass). Intermediate marsh has an irregular tidal regime and experiences a mean salinity equal to or less than 7 ppt during the growing season. Intermediate marsh is normally found between fresh marsh and brackish marsh.

Brackish marshes are characterized by low to moderate daily tidal energy and by soils ranging from firm mineral soils to organic semi-floating soils. Freshwater conditions may prevail for several months during early spring; however, low to moderate salinities occur during much of the year, with peak salinities in late summer or fall. Salinity averages about 8 ppt, and this community may be changed to another marsh type by shifts in salinity levels. Brackish marshes also act as nursery areas for myriads of larval forms of shrimp, crabs, redfish, seatrout, and menhadden, etc., and as important waterfowl habitat.

Saline marshes occur along the southern fringe of coastal wetlands. Those marshes usually exhibit firm mineral soils and experience moderate to high daily tidal energy. Saline marsh is found across coastal Louisiana and generally occurs adjacent to, or at the interface of, coastal lands with open waters of the Gulf. Saline marshes can vary in size from 1-15 miles in width and small pools or ponds are often scattered throughout. These marshes are regularly tidally flooded, flat, polyhaline areas dominated by salt-tolerant grasses. Mean salinity of a Louisiana salt marsh is about 16 ppt and the area of salt marsh is increasing due to saltwater intrusion resulting in shifts in marsh salinity levels and plant species composition.

1.3 NET LOSS OF HABITATS FROM CONSTRUCTION AND OPERATION OF PROPOSED MTG PROJECT

Section 906(d) of Water Resource Development Act (WRDA) 1986, as amended, requires functional assessments to define ecological impacts and to set mitigation requirements for impacted habitats. USACE policy in ER 1105-2-100, paragraph C-3(e), requires the use of a habitat-based methodology, supplemented with other appropriate information, to describe and evaluate the impacts of the alternative plans, and to identify the mitigation needs (USACE 2000). Please see Section 4.2 in the SEIS for how the impacts were assessed for MTG.

SECTION 2 ALTERNATIVE FORMULATION

2.1 MITIGATION PLANNING OBJECTIVES

The USACE is required by law and regulation to compensate for habitat losses through in-kind mitigation. In accordance with the WRDA of 1986 and 2007, unavoidable habitat impacts would be offset through compensatory mitigation by replacing the lost habitats' functions and services in-kind to the extent possible.

The objective of the proposed mitigation is to compensate for habitat losses that are expected to occur during the construction and operation of the Proposed Action to BLH, swamp, fresh/intermediate marsh, and brackish/saline marsh habitat. The goal is to replace the lost functions and services of the impacted BLH, swamp, fresh/intermediate (F/I) marsh, and brackish/saline (B/S) marsh habitat, as measured by Wetland Value Assessments (WVA) and quantified in AAHUs, in-kind and within the watershed of impact while passing tests of cost effectiveness and incremental cost analyses, acceptability, completeness, efficiency, and effectiveness.

2.2 MITIGATION PLANNING FOR REACH A AND REACH F

Overall mitigation planning for the F/I marsh and BLH habitats was completed during completion of the MTG Reach A Environmental Assessment (EA). Overall mitigation planning for the B/S marsh was completed during completion of the MTG Reach F EA. For both the Reach A and Reach F EAs (see SEIS section 2.3), the overarching goal for mitigation planning was to identify target areas with enough acreage to meet the full MTG mitigation need by habitat type at the watershed scale for the entire MTG project footprint. The intent was to design specific projects by habitat type within these larger target areas to address impacts for constructing portions of Reaches A and F.

After mitigation planning had been completed for BLH habitat impacts (during the Reach A EA), further engineering design, field work, and WVA model completion on the MTG alignment resulted in an increase the BLH impacts such that the BLH alternatives at that time (Amelia and Gibson) were unable to fully mitigate the impacts due site size limitations. As such, mitigation planning was reinitiated for BLH impacts. Since the TSP for BLH during completion of the Reach A EA was a combination of mitigation bank purchases and USACE constructed project, and the BLH impacts for Reach A were small, mitigation bank purchases were completed to mitigate the Reach A BLH requirement at that time.

2.3 MITIGATION MEASURE DEVELOPMENT AND SCREENING

2.3.1 Mitigation Formulation Requirements

2.3.1.1 In-Kind Replacement by Habitat Type

In accordance with the WRDA of 1986 and 2007, unavoidable habitat impacts would be offset through compensatory mitigation by replacing the lost habitats' functions and services in-kind to the extent possible. WRDA 1986, Section 906(d)(1), as amended by WRDA 2007, Section 2036(a), provides: "Specific mitigation plans shall ensure that impacts to bottomland hardwood forests are mitigated in-kind and other habitat types are mitigated to not less than in-kind conditions to the extent possible." As such, mitigation measures were required to either restore, establish, or enhance the same habitat types that were impacted by the MTG Project to the extent possible with one exception: BLH-dry impacts could be mitigated with either a BLH-dry or a BLH-wet mitigation project. Fresh/intermediate marsh impacts would be mitigation with a fresh/intermediate marsh mitigation project; brackish/saline marsh impacts would be mitigated with a brackish/saline marsh mitigation project; and swamp habitat impacts would be mitigated with a swamp mitigation project. BLH-wet impacts would be mitigated with a BLH-wet mitigation project.

2.3.1.2 Within Watershed Impacted

In accordance with standards and policies set forth in 33 CFR Part 332, compensatory mitigation was formulated to occur within the same watershed or hydrologic basin as the impacts. 33 CFR 332.2 defines a watershed as "a land area that drains to a common waterway, such as a stream, lake, estuary, wetland, or ultimately the ocean".

2.3.1.2.1 BLH and Swamp

To formulate options to mitigate BLH and swamp impacts, potential sites were bounded by the coastal portions of two Mississippi Alluvial Plain U.S. EPA ecoregions the Southern Holocene Meander Belts (73k) and Inland Swamps (73n) (Daigle et al. 2006). Though the northern limits of these two ecoregions extend outside of the Louisiana Coastal Zone, only the portions of these ecoregions within the coastal zone were included because project impacts on BLH and swamp habitat occurred within the coastal zone (see Figure C:2-1).

The Southern Holocene Meander Belts (73k) ecoregion stretches from just north of Natchez, Mississippi south to New Orleans, Louisiana. Point bars, oxbows, natural levees, and abandoned channels occur. Soils are somewhat poorly and poorly drained Inceptisols, Entisols, and Vertisols. The ecoregion contains minor species such as live oak, laurel oak, and Spanish moss that are generally not found in the more northerly regions. The bottomland forests have been cleared, and the region has been extensively modified for agriculture, flood control, and navigation. The levee system is extensive throughout the region. Soybeans, sugarcane, cotton, corn, and pasture are the major crops, with crawfish aquaculture common (Chapman et al. 2004).

The Inland Swamps (73n) ecoregion marks a transition, ranging from the fresh waters of the southern backswamps at its northern extent to fresh, brackish, and saline waters of the Deltaic Plain. Soils are mostly poorly or very poorly drained clayey Entisols and Vertisols. Swamp forest communities are dominated by bald cypress and water tupelo, which are generally intolerant of brackish water except for short periods. In areas where freshwater flooding is more prolonged, the vegetative community is dominated by grasses, sedges, and rushes. This region contains one of the largest bottomland hardwood forest swamps in North America. Deposits include organic clays and peats up to 20 feet thick, and inter-bedded fresh- and brackish-water carbonaceous clays (Chapman et al. 2004).

2.3.1.2.2 Fresh, Intermediate, Brackish, and Saline Marsh

The Deltaic Plain (see Figure C:2-1) was used as the watershed to formulate options to mitigate fresh, intermediate, brackish, and saline marsh impacts. Unlike forested systems that can be unique and distinct due to the geographic features of the watershed in which they exist, multiple watersheds become tidally connected along the coast as elevations decrease resulting in similar habitat and species being found on a scale larger than individual watersheds (Mcbride et al. 2011). Major estuaries within the deltaic plain include Barataria-Terrebonne estuary, Vermilion Bay, West Cote Blanche Bay, Lake Maurepas, Lake Pontchartrain, and Lake Borgne. This approach is consistent with the approach used by the MVN 404 Regulatory Program, which established the service area of tidal mitigation banks using a two-plain system (Chenier and Deltaic). The Deltaic Plain is a broad, low-lying land mass where the Mississippi River and its distributaries empty into the Gulf of America (Restore the Mississippi River Delta 2025). Major estuaries within the deltaic plain include Barataria-Terrebonne estuary, Vermilion Bay, West Cote Blanche Bay, Lake Maurepas, Lake Pontchartrain, and Lake Borgne. Louisiana’s deltaic plain is bounded to the west by the Vermilion/Iberia Parish line and bounded to the east by the Pearl River in St. Tammany Parish. Though the northern limits of the Deltaic Plain proceed farther north, since the outstanding brackish marsh and swamp impacts occurred within the Louisiana Coastal Zone, the northern boundary of the Louisiana Coastal Zone was used to limit the investigations of mitigation options.

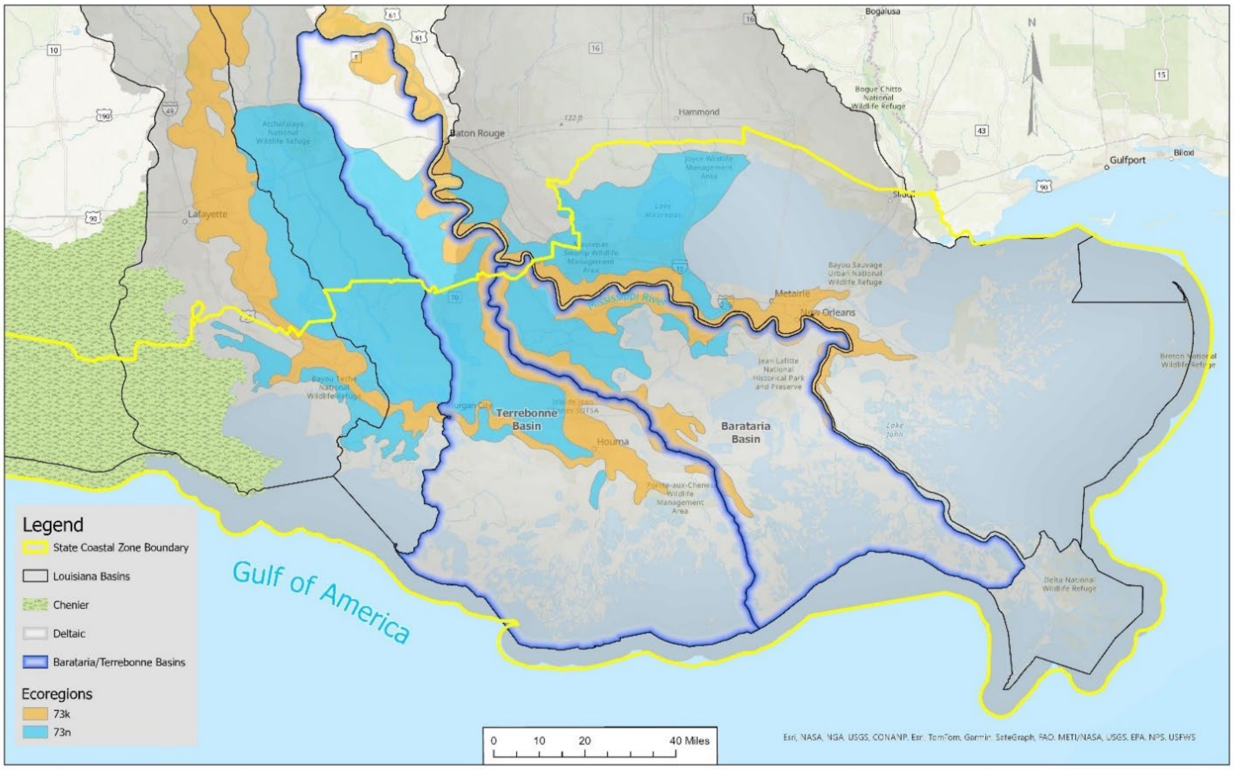

Figure C:2-1. The Deltaic Plain and the Southern Holocene Meander Belts (73k) and Inland Swamps (73n) Ecoregions in the Louisiana Coastal Zone

2.3.1.3 Flood Side of Proposed Levee System

The PDT decided to mitigate all protected-side impacts on the flood side of the levees to consolidate impacts and create large mitigation projects that would provide greater ecological benefits. In addition to achieving greater ecological benefits associated with larger contiguous tracts of habitat, added hydrologic benefits were also achieved by mitigating protected side impacts on the flood side of the levees. Since protected-side habitats are within an impounded system, cut off from tidal influences and subject to internal drainage and pumping, they have altered hydrology and are unable to provide the same habitat value for aquatic organisms as exterior habitats. In addition, the future viability of protected-side habitats can be difficult to ensure as they may be directly influenced by internal drainage regimes not subject to USACE jurisdiction. By replacing the altered hydrologic condition of a protected side habitat with a natural hydrologic condition of an exterior habitat, additional benefits were realized.

2.4 MEASURE DEVELOPMENT

Potential mitigation measures were developed by the PDT for BLH, swamp, F/I marsh, and B/S marsh habitat impacts in accordance with the formulation requirements set forth in SEIS Section 4.2. The proposed compensatory mitigation plan would replace the lost functions and values of the impacted areas through in-kind restoration, establishment, or enhancement activities that increase or improve the habitat functions and services within a particular mitigation site. Restoration would involve creating a habitat type from open water or cleared land parcels where none currently exists, but which historically occurred in the vicinity of the mitigation site area. Establishment would involve creating a habitat type from open water or cleared land parcels where none currently exists, but which could support target habitats. Enhancement would involve implementing actions to improve already existing low-quality habitat. Only one measure was not retained—the purchase of available in-lieu fee program credits, since these credits are not available for Civil Works projects. As the PDT developed and considered measures in early mitigation planning efforts, the NFS sites, shown in Figure C:2-2 below were also received and considered. The PDT coordinated with the NFS to obtain details on the sites provided and the same criteria was applied to all F/I and B/S potential sites during the evaluation process.

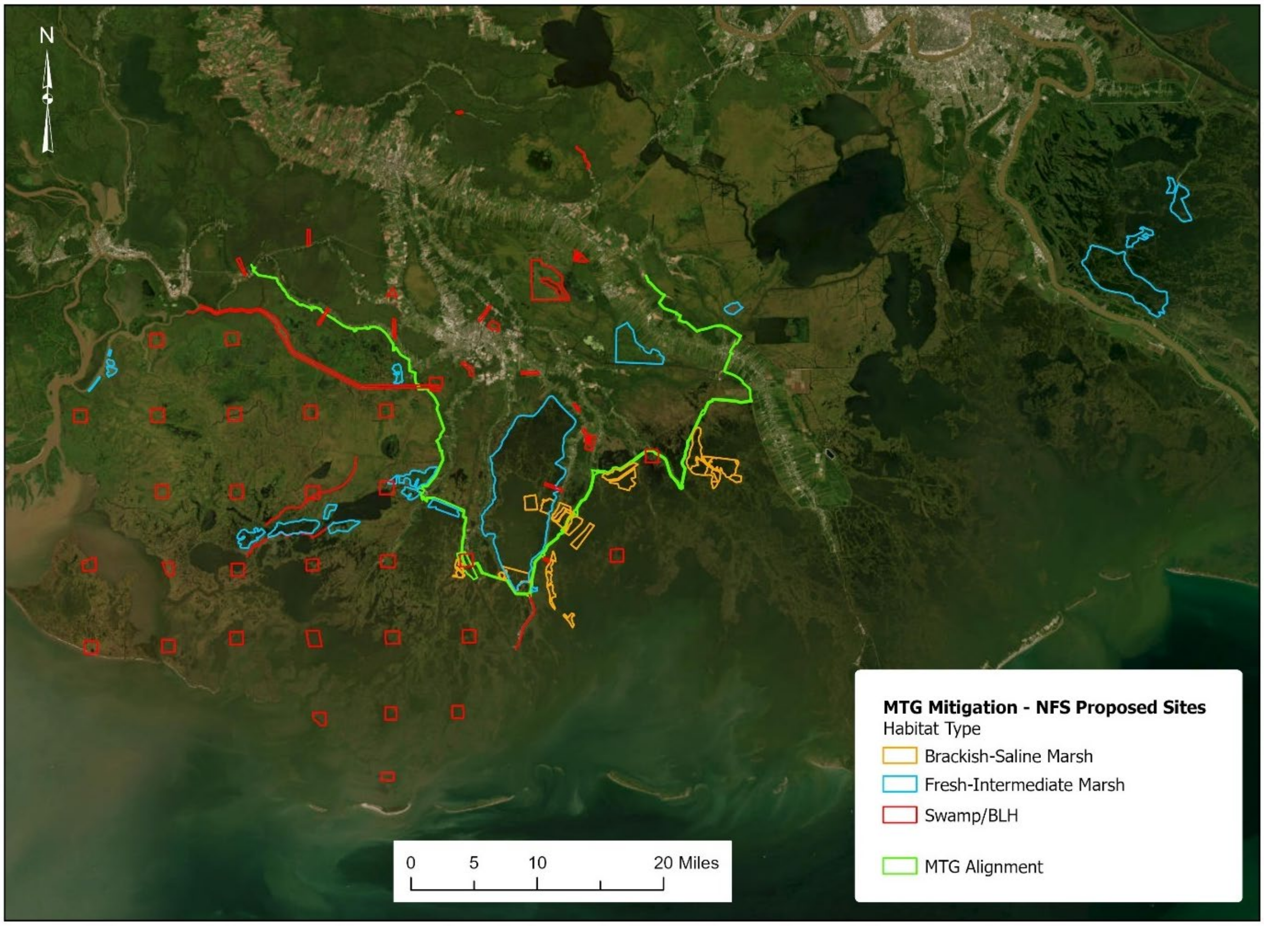

Figure C:2-2. NFS Proposed Sites

2.4.1 Construction of Mitigation Sites

As an alternative, the government (the USACE) may choose to construct a mitigation project to satisfy its compensatory mitigation requirements. Considered sites in which to restore, establish, or enhance habitat were pulled from other USACE projects, resources agencies, the NFS, and/or identified by the mitigation team to compensate for habitat impacts from the MTG Project. A Geographic Information Systems (GIS) analysis was completed to identify potential mitigation sites including open-water areas where marsh has been lost or cleared lands where habitat could be restored. The sites had to be of sufficient size to meet 100% of the MTG mitigation need per habitat type. To ensure cost efficiency, the initial maximum distance for borrow sources to supply the potential marsh mitigation sites was 3 miles. However, as impacts were refined, the size of the potential marsh projects increased to such an extent that sufficient borrow may not have been available solely within in 3-miles. As such, for some projects the borrow radius may have been extended to capture additional borrow sources to ensure sufficient borrow was obtainable. A geodatabase was created with:

- Current and historic aerial imagery,
- Vegetation types/salinity isohalines,
- Light Detection and Ranging (LiDAR)/ elevation for BLH and swamp
- Soil types - for BLH and swamp
- State-owned water bottoms, and
- Pipelines and wellheads.

2.4.2 Purchase of Mitigation Bank Credits

As an alternative, the government (the USACE) may choose to purchase in-kind mitigation bank credits to satisfy its compensatory mitigation requirements. Commercial mitigation banks sell credits for mitigation work performed at an approved mitigation site. Through the USACE Regulatory 404 program, the banks are approved and legally bound through banking instruments that hold the bank owners to certain standards of performance and reporting. The use of mitigation banks for a project may offer advantages to the government and non-federal sponsor by reducing performance risk and eliminating project-specific requirements for operations and maintenance work and development of monitoring and adaptive management plans. Availability of credits in mitigation banks changes over time; it is not known which banks would be available when the decision whether to purchase bank credits is made: some banks may not have enough credits remaining, some may be closed, and additional mitigation banks may be approved. As such, mitigation banks are discussed generally for those measures involving credit purchase and no specific banks are identified. The Regulatory In-Lieu Fee and Bank Information Tracking System (RIBITS) (https://ribits.ops.usace.army.mil/) has information on all currently approved banks in the watersheds impacted, including their credit availability. Information obtained from existing banks in the basin was used during mitigation planning of the final array of mitigation measures please refer to SEIS Section 4.2 for more information on the final arrays by habitat type and the use of mitigation bank credits to address the mitigation need.

2.4.3 Purchase of In-Lieu Fee Program Credits

In-lieu fee programs are established by a governmental or non-profit natural resource management entity and include projects that typically involve larger, more ecologically valuable parcels, and more rigorous scientific and technical analysis, planning and implementation than other types of mitigation projects. A formal agreement between the in-lieu-fee program sponsor and the agencies, like a banking instrument, defines the conditions under which the use of the program is considered appropriate. Louisiana state agencies have an In-Lieu Fee Program in Louisiana. However, the program is currently not available for USACE Civil Works projects.

2.4.4 Combination of Mitigation Bank Credit Purchases and Construction of Mitigation Site

One potential strategy is to combine multiple approaches together to achieve the mitigation objectives. This strategy allows for a tailored plan to utilize mitigation bank credit purchases in combination with constructing a mitigation project to achieve 100% of the mitigation need per habitat type. In-kind credit purchases of 25, 50, and 75 percent in combination with constructing the remaining percentage at a USACE site as necessary to achieve 100% of the mitigation need were evaluated.

2.5 INITIAL SCREENING

Screening criteria were developed to achieve large contiguous tracts of land for the purposes of obtaining greater ecological output within the watershed and to produce cost efficiencies that would be experienced during construction and operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) phases; as well as to ensure technical viability of proposed sites. Proposed measures had to meet the following criteria and those that did not meet all the criteria were eliminated from further consideration.

2.5.1 Initial Screening Criteria

The MTG PDT developed the following screening criteria to identify potential sites that should be carried forward as mitigation measures. Screening criteria comply with Congressional authority and other laws, policies, guidance, and include but are not limited to constraints. Proposed mitigation measures that did not meet one or more of the following screening criteria were discarded from further consideration. See Attachment 1 for additional information about the legal justification of these screening criteria.

2.5.2 Compliant with Applicable Laws and Policies

Any measure that would adversely impact cultural resources, wetlands, threatened and endangered species, oyster seed grounds, existing pipeline leases, or that contained hazardous, toxic, or radioactive waste or substances based on federal and state databases was screened from further consideration.

2.5.3 No Measures Appropriated or Authorized Under Other Authorities

Two principles of fiscal law prohibit the use of funds appropriated under one authority from being expended on actions pursuant to a different authority. First, 31 USC 1301(a) posits that appropriations may be used only for their intended purposes. Second, as a general principle, when both specific and general authorizations/ appropriations exist, the specific always rules over the general such that agencies do not have an option. For example, if a specific appropriation exists for a particular item, then that appropriation must be used and it is improper to "charge" the more general appropriation or any other appropriation. These principles were used to screen out projects that were authorized and recommended under authorities other than the MTG Project authority.

2.5.4 No Measures in the Future Without Project Condition

The Future Without Project Condition for MTG Mitigation is defined in part by the measures (projects) that would likely exist in the absence of the implementation of the MTG Mitigation. Establishment of the Future Without Project Condition is required for alternative plan evaluation in USACE civil works planning. The future-without-project condition is the most likely condition expected to exist in the future in the absence of a proposed water resources project. Proper definition and forecast of the future without-project condition are critical to the success of the planning process. For this project, federally authorized and construction-funded Civil Works projects, permitted Louisiana State Master projects, or authorized and funded Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) projects were considered as part of future without project conditions. Any potential mitigation measure located within or adjacent to the locations of these projects were screened out.

2.5.5 Measures Must Meet 100% of the Mitigation Requirement by Habitat Type

This criterion specifies that the MTG mitigation projects must address the entire mitigation requirement for the habitat type being restored. Specifically, mitigation measures were required to either restore, establish, or enhance the same habitat types that were impacted by the MTG Project to the extent possible with one exception: BLH-dry impacts could be mitigated with either a BLH-dry or a BLH-wet mitigation project. Fresh/intermediate marsh impacts would be mitigated with a fresh/intermediate marsh mitigation project; brackish/saline marsh impacts would be mitigated with a brackish/saline marsh mitigation project; and swamp habitat impacts would be mitigated with a swamp mitigation project. BLH-wet impacts would be mitigated with a BLH-wet mitigation project. Additionally, all mitigation measures must be located on the flood side of the proposed MTG levee system to ensure that impacted habitat is mitigated with equal or greater ecological value related to fish access and hydrologic connectivity. Impacts incurred in the Louisiana Coastal Zone would be mitigated with projects within the Louisiana Coastal Zone.

2.5.6 Technically Viable

This criterion means that the measure is capable of achieving success from a scientific or engineering standpoint. For example, the salinity, soil types, and elevations must be suitable for target habitat types.

2.5.7 Independent Utility

The mitigation project cannot be dependent on implementation of or modification to other projects for ecological success and fulfillment of AHHU requirements. If the sustainability or technical viability of the mitigation project is reliant on another project, the net benefits of the project cannot be guaranteed.

2.5.8 Easily Scaled to Meet Potential Changes in Mitigation Acreage Requirements

The number of AAHUs needed to mitigate for unavoidable losses due project construction will continue to evolve throughout the planning and design phases. The exact MTG Project mitigation requirement will not be determined until as-builts are available and final AAHU requirements are determined. The size of a given measure must have the ability to be increased or decreased to provide required AAHUs over the 50-year period of analysis in a practical, logical, and technically feasible manner. The PDT used aerial photography and

GIS capabilities to determine whether adequate acreage was available to increase a particular project polygon in case mitigation requirements increase in the future.

2.5.9 Retained and Screened Measures

Measures were refined by either combining them with other measures or reshaping (re-configuring) them by habitat type. Reshaping measures occurred when multiple measures existed in a common geographical area. In such cases, these measures were reshaped into a single project by habitat type that maximized the potential returns for that site while meeting the mitigation requirement only. Tables C:2-1 through C:2-3 list the mitigation measures developed by the PDT for each habitat type. Figure C:2-3 shows the general location of these sites.

Table C:2-1. BLH and Swamp Measures Considered

Sites Considered	Type	Outcome	Screening Outcome
Mitigation Banks	BLH/Swamp, Purchase of Mitigation Bank Credits	Retained	Met all screening criteria under current conditions, reassess at implementation for amount of in-kind available credits
Napoleonville	BLH/Swamp, USACE-Constructed	Retained	Met all screening criteria
Supreme	BLH/Swamp, USACE-Constructed	Retained	Met all screening criteria
Gheens	BLH/Swamp, USACE-Constructed	Screened	Screened under Future w/out Project Condition Criterion - proximity to Upper Barataria Basin project (UBB) tie in
Gheens (NFS)	BLH/Swamp, USACE-Constructed	Screened	Suggested by NFS. Screened under Future w/out Project Condition Criterion - proximity to UBB tie in
Choctaw Rd.	BLH/Swamp, USACE-Constructed	Screened	Suggested by NFS. This site would not provide 100% of the required mitigation, but it was retained for further evaluation to see if it could be combined with other NFS-proposed mitigation sites that would together provide 100% of the need.
Hwy. 307	BLH, USACE-Constructed	Screened	Suggested by NFS This site would not provide 100% of the required mitigation, but it was retained for further evaluation to see if it could be combined with other NFS-proposed mitigation sites that would together provide 100% of the need.

Sites Considered	Type	Outcome	Screening Outcome
Sugarland	BLH/Swamp, USACE-Constructed	Screened	Suggested by NFS. Screened under Technical Viability Criterion —soil and elevation but was retained for further evaluation to determine potential engineering options to overcome soil and elevation challenges.
Ag. Site	BLH/Swamp, USACE-Constructed	Screened	Suggested by NFS. Screened under Technical Viability Criterion — soil and elevation but was retained for further evaluation to determine potential engineering options to overcome soil and elevation challenges.
Amelia	BLH/Swamp, USACE-Constructed	Screened	Screened under 100% Mitigation Need Criterion
Gibson	BLH/Swamp, USACE-Constructed	Screened	Screened under 100% Mitigation Need Criterion

Table C:2-2. Fresh/Intermediate Measures Considered

Measure	Type	Outcome	Notes
Lake Salvador	USACE-Constructed	Retained	
Falgout Canal	USACE-Constructed	Screened	Screened due to technical viability (salinity)
GIWW	USACE-Constructed	Retained	
Avoca Island Cutoff	USACE-Constructed	Retained	
Delta Farms	USACE-Constructed	Retained	
Mitigation Bank	Purchase of Mitigation Bank Credits	Retained	

Table C:2-3. Brackish/Saline Measures Considered

Measure	Type	Outcome	Notes
Isle de Jean Charles	USACE-Constructed	Retained	
Falgout	USACE-Constructed	Screened	Screened. Insufficient size to meet 100% of the mitigation need.

Measure	Type	Outcome	Notes
North Barataria Bay	USACE-Constructed	Retained	
West Terrebonne	USACE-Constructed	Retained	
Three Mile Bay	USACE-Constructed	Retained	
Mitigation Bank	Purchase of Mitigation Bank Credits	Retained	

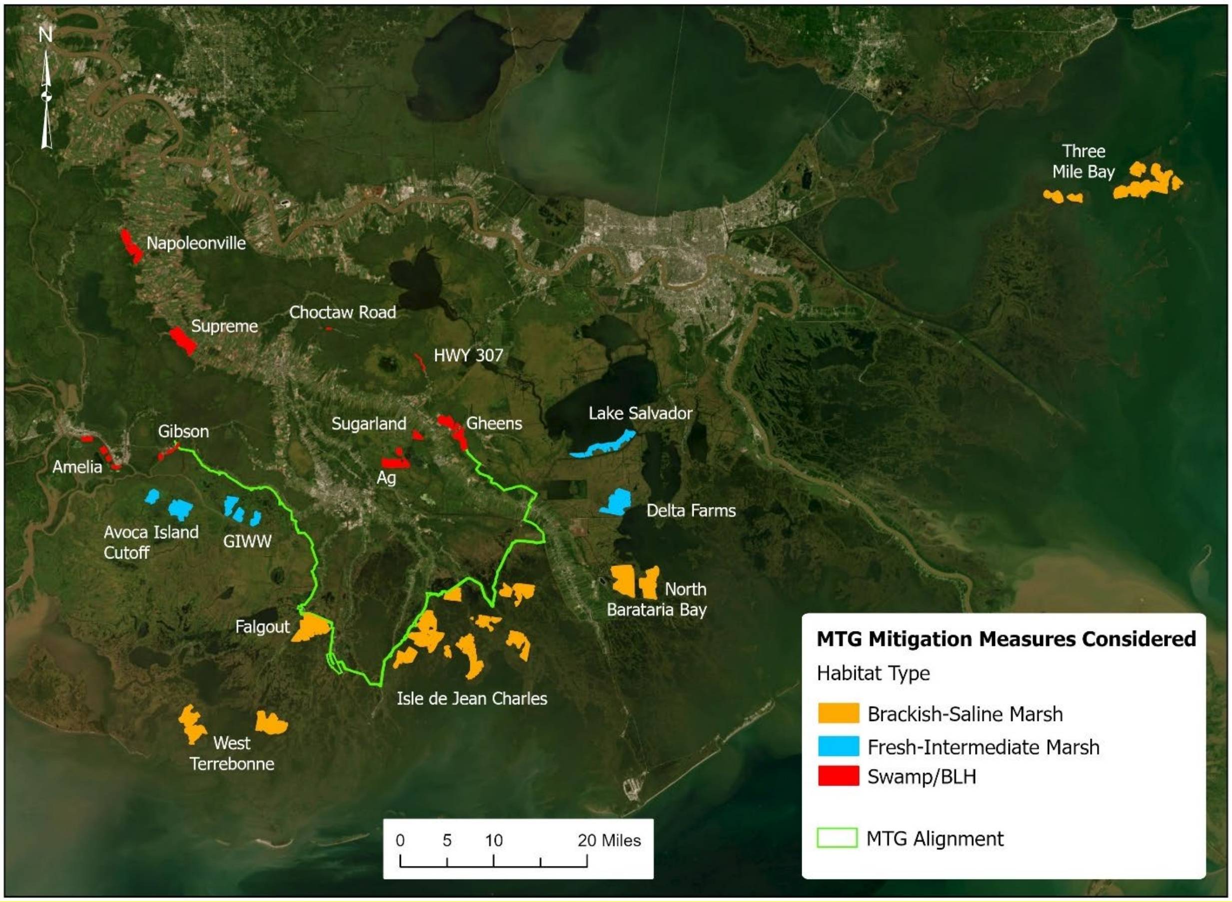

Figure C:2-3. Map of Mitigation Sites Considered

2.6 FINAL ARRAY OF MITIGATION ALTERNATIVES

A total of four BLH and swamp, six fresh/intermediate marsh, and six brackish/saline marsh alternatives remained after screening (see Table C:2-4 and Figure C:2-4). These mitigation alternatives are described in SEIS Sections 4.2.3 through 4.2.4. Maps and detailed descriptions of each USACE-constructed mitigation project are provided in Attachments 3 and 4, respectively.

Table C:2-4. Final Array of Mitigation Alternatives by Habitat Type

Alternative	Type
BLH Alternatives	
Napoleonville	USACE-Constructed
Supreme	USACE-Constructed
Mitigation Bank	Purchase of Mitigation Bank Credits
Combination Mitigation Bank/USACE-Constructed Mitigation Project	USACE-Constructed/Mitigation Bank Credits
Swamp Alternatives	
Napoleonville	USACE-Constructed
Supreme	USACE-Constructed
Mitigation Bank	Purchase of Mitigation Bank Credits
Combination Mitigation Bank/USACE-Constructed Mitigation Project	USACE-Constructed/Mitigation Bank Credits
Fresh/Intermediate Marsh Alternatives	
Avoca Island Cutoff	USACE-Constructed
GIWW	USACE-Constructed
Lake Salvador	USACE-Constructed
Delta Farms	USACE-Constructed
Mitigation Bank	Purchase of Mitigation Bank Credits
Combination Mitigation Bank/USACE-Constructed Mitigation Project	USACE-Constructed/Mitigation Bank Credits
Brackish/Saline Marsh Alternatives	
Isle de Jean Charles	USACE-Constructed
North Barataria Bay	USACE-Constructed
Three Mile Bay	USACE-Constructed

Alternative	Type
West Terrebonne	USACE-Constructed
Mitigation Bank	Purchase of Mitigation Bank Credits
Combination Mitigation Bank/USACE-Constructed Mitigation Project	USACE-Constructed/Mitigation Bank Credits

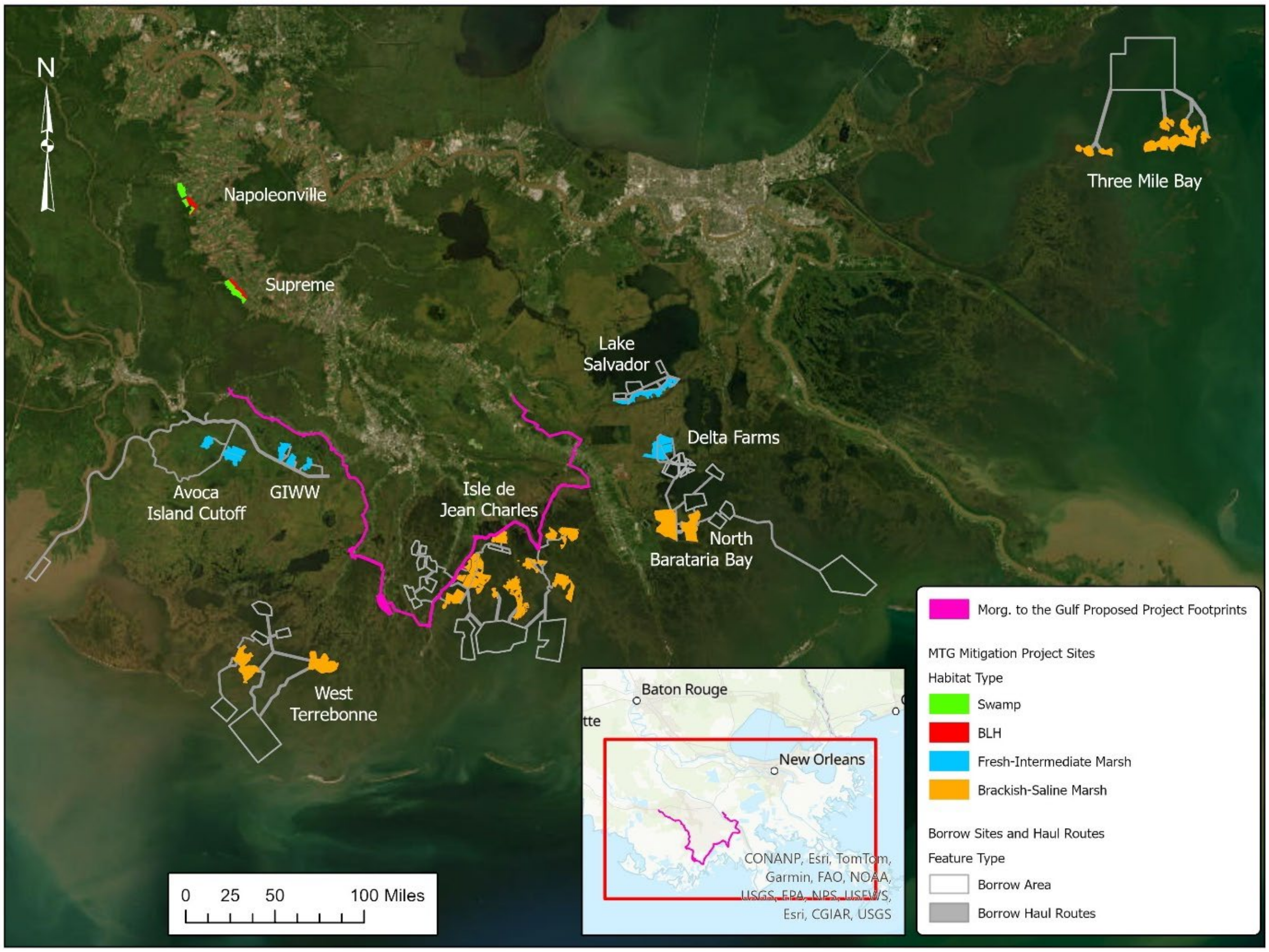

Figure C:2-4. Final Array of USACE-Constructed Mitigation Sites

At the request of the NFS, the PDT will continue to consider the NFS sites for BLH/Swamp habitat shown in Figure C:2-*5* in the future as well as other reasonable alternatives. This would include additional plan formulation, engineering design, cost development, and alternative comparison similar to what has already been done for the current BLH/swamp final array. If changes to the current mitigation plan for BLH/swamp are identified, future additional NEPA and environmental compliance would be necessary.

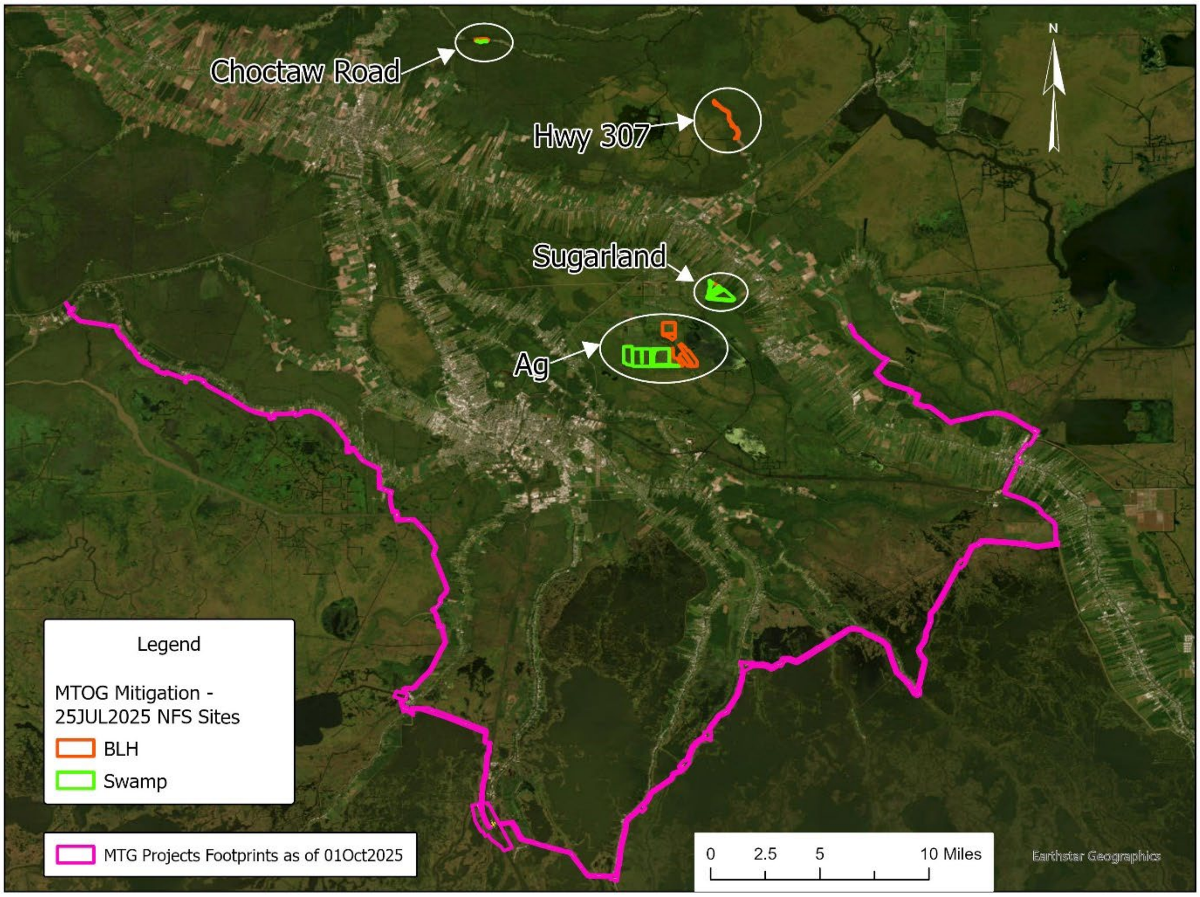

Figure C:2-5. NFS Proposed BLH and Swamp Sites

2.6.1 Common Elements in USACE-Constructed BLH & Swamp Mitigation Alternatives

Construction of BLH and swamp mitigation sites would include establishing staging areas, followed by site preparation and surveying. Grading and drainage modifications would be implemented based on topographic data to meet hydrologic goals, including creating swales to manage water flow. After grading, the sites would be surveyed to create a planting grid, and deep soil tillage (subsoiling) to promote seedling root development and infiltration would be conducted 6 months before planting, if necessary. Seedlings would be planted using approved tree species and spacing, and plant stakes and mowing poles would be inserted to guide maintenance.

Post-construction maintenance would occur over 2 to 3 years, with mowing and herbicide treatments conducted up to three times per year. Supplemental tree planting may occur 2 to 3 years after the initial planting to ensure success criteria are met. The overall timeline for both Napoleonville and Supreme BLH projects to meet initial success is approximately 5 years, including 2 years of construction and planting, and 3 years of maintenance and monitoring. See Attachment 7 for the Monitoring and Adaptive Management Plans for BLH and swamp mitigation, respectively.

2.6.2 BLH Mitigation Alternatives

2.6.2.1 Napoleonville BLH Project

This USACE-constructed mitigation site would be constructed on agricultural fields northwest of the town of Napoleonville in Assumption Parish, Louisiana. The site is located in the watershed of impact (in the coastal zone of ecoregions 73n and 73k; refer to Section 2.3.1.2.1). The site is currently an agricultural field that would be cleared of existing crops and leveled. The terrain is generally flat with an average elevation of 6.5 feet (NAVD88). Agricultural fields surround this site on all sides. Construction materials and equipment would be transported to the site via highways LA-70 to the North, LA-1 to the East, and LA-403 to the South.

This alternative consists of approximately 588 acres of BLH restoration/establishment. The proposed construction would begin with the entire project site being cleared of existing crops to facilitate leveling and grading activities. Following the leveling and clearing efforts, the soil preparation may begin. Subsoiling would occur uniformly over the plantable areas along identified planting rows as necessary. Of the 588 total acres of this project site, the total acreage of the plantable areas is 534 acres and 7 acres for miscellaneous features (staging areas, access routes, and/or minor real estate shifts). The seedling quantities are estimated using the following standard planting densities: 545 canopy seedlings and acre and 136 midstory seedlings an acre equaling approximately 287,400 - 291,300 canopy seedlings, and 72,000 – 73,000 midstory seedlings for this site. A 3-year monitoring and maintenance period would follow the completion of the plantings, resulting in a total estimated duration of 5 years to achieve initial success.

2.6.2.2 Supreme BLH Project

This USACE-constructed site is located in Assumption Parish, Louisiana west of the towns of Supreme and Labadieville in the same watershed in which MTG Project impacts would occur (in the coastal zone of ecoregions 73n and 73k; refer to Section 2.3.1.2.1). The site is currently an agricultural field that would be cleared of existing crops and leveled. Site elevations range from 3.5-feet to 9.0 feet, with an average elevation of 6.3 feet (NAVD88). Agricultural fields surround this site on the northern, eastern, and southern perimeter; forested wetlands occur to the west of the site. Construction materials and equipment would be transported to the site via highways LA-1010, LA-1, and LA-1011.

This alternative consists of approximately 616 acres of BLH restoration/establishment. The proposed construction would begin with the entire project site being cleared of existing vegetation to facilitate leveling and grading activities. Following the leveling and clearing efforts, the soil preparation may begin. Subsoiling would occur uniformly over all of the plantable areas along identified planting rows as necessary. Of the 616 total acres of this project site, the acreage of the plantable areas is 533 acres and 6 acres that would be used for miscellaneous features (staging areas, access routes, and/or minor real estate shifts). The seedling quantities are estimated using the following standard planting densities: 545 canopy seedlings and acre and 136 midstory seedlings an acre equaling approximately 287,400 - 291,300 canopy seedlings, and 72,000 – 73,000 midstory seedlings for this site. A 3-year monitoring and maintenance period will follow the completion of the plantings, resulting in a total estimated duration of 5 years to achieve initial success.

2.6.2.3 Mitigation Bank Credits

The PDT identified all USACE Regulatory approved mitigation banks with perpetual conservation servitudes within the same watershed as the impacts with available, in-kind credits for purchase. Because the availability of mitigation bank credits varies from year to year, the viability of satisfying all BLH mitigation requirements through the purchase of mitigation bank credits would be determined before construction of the project. Mitigation banks would be selected through a solicitation process, through which any mitigation bank meeting eligibility requirements could submit a proposal to sell credits. If appropriate and cost-effective, the USACE may choose to purchase mitigation bank credits from more than one bank to fulfill the compensatory mitigation requirements for a particular habitat type. Purchase of mitigation bank credits would be dependent on receipt of an acceptable proposal(s) and total purchase cost. No particular bank(s) is (are) proposed for use at this time. The bank(s) from which credits would be purchased would be selected through a solicitation process, through which any mitigation bank meeting eligibility requirements and having the appropriate resource type of credits could submit a proposal to sell credits.

Mitigation banks would be required to run the same version of the WVA model as was used to assess the impacts from constructing the MTG Project to ensure that the assessment of the functions and services provided by the mitigation bank match the assessment of the lost functions and services at the impacted site.

2.6.2.4 Combination Mitigation Bank Credits/USACE-Constructed Project

During the alternative evaluation process, mitigation banks with available BLH credits within the required watershed were identified (refer to Section 2.3.1.2.1 for a description of the watersheds). However, it is not known which banks would be available at the time of implementation; some banks may not have enough credits remaining, some may be closed, and additional mitigation banks may be approved. To account for the uncertainty surrounding the availability of future mitigation bank credits while maintaining the ability to satisfy as much of the mitigation need as quickly as possible, an alternative consisting of a combination of mitigation credit purchase and the highest-ranked USACE-constructed project was developed. In this way, if the mitigation bank measure becomes the tentatively selected plan (TSP) for a given habitat type, and during implementation of that TSP insufficient credits are available to mitigate the whole need, default to a combination measure could occur to ensure the timeliest satisfaction of 100 percent of the mitigation requirement while maximizing cost efficiencies. A range of 25, 50, and 75 percent mitigation credit/USACE-constructed project combinations were evaluated for cost effectiveness.

2.6.3 Swamp Alternatives

Site-specific information about both sites is provided in Section 2.3.7.1 and 2.3.7.2 below. Construction and maintenance of both sites would follow the same general order of work as described for BLH mitigation in Section 2.3.6.

2.6.3.1 Napoleonville Swamp Project

This USACE-constructed mitigation site would be constructed on agricultural fields northwest of the town of Napoleonville in Assumption Parish, Louisiana. The site is in the watershed of impact (in the coastal zone of ecoregions 73n and 73k; refer to Section 2.3.1.2.1). Site elevations range from 1.0 to 9.0-feet (NAVD88[1]), with an average elevation of 4.0 feet. Forested wetland fragments flank the western/southwestern edge of the agricultural fields, providing hydrologic connectivity and seed sources for restoration. Construction materials and equipment would be transported to the site via highways LA-70 to the North, LA-1 to the East, and LA-403 to the South.

This alternative consists of approximately 1,063 acres of swamp restoration/establishment including 962 acres for planting seedlings and 101 acres available for miscellaneous features (staging areas, access routes, utility buffers, and/or minor real estate shifts). The proposed construction would begin with the entire project site being cleared of existing crops to facilitate leveling and grading activities. Following the leveling and clearing efforts, the soil preparation may begin. The site would be divided into 3 separate restoration cells identified as: North Swamp, Central Swamp, and South Swamp. The three cells cover approximately 690 acres, 228 acres, and 145 acres, respectively. However, each cell has unique planting acreages: 632 acres, 197 acres, and 133 acres, respectively. Subsoiling would occur uniformly over all the plantable areas along identified planting rows as necessary. The seedling quantities are estimated using the following standard planting densities: 545 canopy seedlings and acre and 136 midstory seedlings an acre equaling approximately 517,400 - 524,600 canopy seedlings, and 129,300 – 131,000 midstory seedlings for this site. A 3-year monitoring and maintenance period would follow the completion of the plantings, resulting in a total estimated duration of 5 years to achieve initial success.

2.6.3.2 Supreme Swamp Project

This USACE-constructed site is located in Assumption Parish, Louisiana in agricultural fields west of the towns of Supreme and Labadieville in the same watershed in which MTG Project impacts would occur (in the coastal zone of ecoregions 73n and 73k; refer to Section 2.3.1.2.1). Site elevations range from 2.0 to 7.0-feet, with an average elevation of 4.0 feet. Agricultural fields surround this site on the northern, eastern, and southern perimeter, and

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[1] All elevations provided in this document are geo-referenced to NAVD 88.

forested wetland habitat occurs on the west. Construction materials and equipment would be transported to the site via highways LA-1010 to the North, LA-1 to the East, and LA-1011.

This alternative consists of approximately 1,105 acres of swamp restoration/establishment including 958 acres for planting seedlings and 147 acres available for miscellaneous features (staging areas, access routes, utility buffers, and/or minor real estate shifts). The proposed construction would begin with the entire project site being cleared of existing crops to facilitate leveling and grading activities. Following the leveling and clearing efforts, the soil preparation may begin. Subsoiling would occur uniformly over all the plantable areas along identified planting rows as necessary. The seedling quantities are estimated using the following standard planting densities: 545 canopy seedlings and acre and 136 midstory seedlings an acre equaling approximately 517,400 - 522,500 canopy seedlings, and 129,300 – 130,800 midstory seedlings for this site. A 3-year monitoring and maintenance period would follow the completion of the plantings, resulting in a total estimated duration of 5 years to achieve initial success.

2.6.3.3 Mitigation Bank Credits

The PDT identified all USACE Regulatory approved mitigation banks with perpetual conservation servitudes within the same watershed as the impacts with available, in-kind credits for purchase. Because the availability of mitigation bank credits varies from year to year, the viability of satisfying all swamp mitigation requirements through the purchase of mitigation bank credits would be determined before construction of the project. Mitigation banks would be selected through a solicitation process, through which any mitigation bank meeting eligibility requirements could submit a proposal to sell credits. If appropriate and cost-effective, the USACE may choose to purchase mitigation bank credits from more than one bank to fulfill the compensatory mitigation requirements for a particular habitat type. Purchase of mitigation bank credits would be dependent on receipt of an acceptable proposal(s) and total purchase cost. No particular bank(s) is (are) proposed for use at this time. The bank(s) from which credits would be purchased would be selected through a solicitation process, through which any mitigation bank meeting eligibility requirements and having the appropriate resource type of credits could submit a proposal to sell credits.

Mitigation banks would be required to run the same version of the WVA model as was used to assess the impacts from constructing the MTG Project to ensure that the assessment of the functions and services provided by the mitigation bank match the assessment of the lost functions and services at the impacted site.

2.6.3.4 Combination Mitigation Bank Credits/USACE-Constructed Project

During the alternative evaluation process, mitigation banks with available swamp credits within the required watershed were identified. However, it is not known which banks would be available at the time of implementation; some banks may not have enough credits remaining, some may be closed, and additional mitigation banks may be approved. To account for the uncertainty surrounding the availability of future mitigation bank credits while maintaining the ability to satisfy as much of the mitigation need as quickly as possible, an alternative consisting of a combination of mitigation credit purchase and the highest-ranked USACE-constructed project was developed. In this way, if the mitigation bank measure becomes the tentatively selected plan TSP for a given habitat type and during implementation of that TSP insufficient credits are available to mitigate the whole need, default to a combination measure could occur to ensure the timeliest satisfaction of 100 percent of the mitigation requirement while maximizing cost efficiencies. A range of 25, 50, and 75 percent mitigation credit/USACE-constructed project combinations were evaluated for cost effectiveness.

2.6.4 Fresh/Intermediate Marsh Alternatives

2.6.4.1 Avoca Island Cutoff Fresh/ Intermediate Marsh Project

This USACE-constructed site is located in open water north of Bayou Penchant within Terrebonne Parish, Louisiana in the same watershed in which MTG Project impacts would occur (in the coastal zone of the Deltaic Plain; refer to Section 2.3.1.2.2). Construction materials and equipment would be barged in using the Atchafalaya Navigation Canal. The water bottom elevation is assumed to be at -2.0-feet, with a typical water elevation range of +0.5 to +3.0-feet. It is assumed the required marsh elevation is approximately +1.0 to +1.5 feet.

This alternative consists of approximately 2,858 acres of fresh and intermediate marsh restoration/establishment. The proposed construction would consist of three sites: Site 1, Site 2, and Site 3. The footprints of these sites are 1,031 acres, 1,010 acres, and 817 acres respectively. To construct the marsh platforms, material from a borrow area adjacent to the Atchafalaya Navigation Channel, at Mile 150 to Mile 147.5, would be dredged mechanically and hauled to the project site via barge. Once the barged material reaches the project site, a hydraulic unloader would pump the material from the barges to the marsh creation sites. The overall process of construction would follow the following procedure: earthen perimeter containment dikes would be constructed to contain the pumped in dredge slurry, cross dikes would be built to split the sites into smaller cells, spill boxes would be used for each cell's effluent discharge locations, and then the first marsh platform lifts would begin. A year after the completion of the first marsh platform lift, a lift would be constructed for the perimeter and cross dikes in preparation for the second marsh platform lift. A year after the completion of the second marsh platform lift, the site would be dewatered via cuts through the containment dikes. The dikes would then be degraded down to elevation +1.0 feet. The site is anticipated to naturally vegetate following dewatering and dike degradation.

2.6.4.2 GIWW Fresh/Intermediate Marsh Project

This USACE-constructed site is located in open water north of the GIWW within Terrebonne Parish, Louisiana, within the same watershed in which MTG Project impacts would occur (in the coastal zone of the Deltaic Plain; refer to Section 2.3.1.2.2). To construct the marsh platform, material from a borrow area adjacent to the Atchafalaya Navigation Channel, at Mile 150 to Mile 147.5, would be dredged mechanically and hauled to the project site via barge. The water bottom elevation is assumed to be at -2.0-feet, with a typical water elevation range of +0.5 to +3.0-feet. It is assumed the required marsh elevation is approximately +1.0 to +1.5 feet.

This alternative consists of approximately 2,177 acres of fresh and intermediate marsh restoration/establishment. The proposed construction would consist of three sites: Site 1, Site 2, and Site 3. The footprints of these sites are 568 acres, 626 acres, and 983 acres respectively. To construct the marsh platforms, material from a borrow area adjacent to the Atchafalaya Navigation Channel, at Mile 150 to Mile 147.5, would be dredged mechanically at the borrow site and hauled to the project site via barge. Once the barged material reaches the project site, a hydraulic unloader would pump the material from the barges to the marsh creation sites. The overall process of construction would follow the following procedure: Earthen perimeter containment dikes would be constructed to contain the pumped in dredge slurry, cross dikes would be built to split the sites into smaller cells, spill boxes would be used for each cell's effluent discharge locations, and then the first marsh platform lifts would begin. A year after the completion of the first marsh platform lift, a lift would be constructed for the perimeter and cross dikes in preparation for the second marsh platform lift. A year after the completion of the second marsh platform lift, the site would be dewatered via cuts through the containment dikes. The dikes would then be degraded down to elevation +1.0 feet. The site is anticipated to naturally vegetate following dewatering and dike degradation.

2.6.4.3 Lake Salvador Fresh/Intermediate Marsh Project

This USACE-constructed site is located in open water along the southern edge of Lake Salvador and north of the GIWW, within Lafourche Parish, Louisiana, within the same watershed in which MTG Project impacts would occur (in the coastal zone of the Deltaic Plain; refer to Section 2.3.1.2.2. To construct the marsh platform, material from borrow areas within Lake Salvador be dredged via hydraulic cutterhead and dredge slurry would be pumped into the marsh creation area. The water bottom elevation is assumed to be at -2.0-feet, with a typical water elevation range of +0.5 to +3.0-feet. It is assumed the required marsh elevation is approximately +1.0 to +1.5 feet.

This alternative consists of approximately 2,380 acres of fresh and intermediate marsh restoration/establishment. The proposed construction would consist of five sites: Site 1, Site 2, Site 3, Site 4, and Site 5. The footprint of Site 1 and Site 2 would provide approximately 1,746 acres while Site 3 and Site 4 would provide approximately 331 acres, and Site 5 would provide approximately 303 acres. To construct the marsh platform, material from a 2 borrow areas within Lake Salvador, approximately 1,000-ft to 5,000-ft from the marsh creation sites, would be dredged via hydraulic cutterhead and dredge slurry would be pumped into the marsh creation area. The overall process of construction would follow the following procedure: Earthen perimeter containment dikes would be constructed to contain the pumped in dredge slurry, cross dikes would be built to split the sites into smaller cells, spill boxes would be used for each cell's effluent discharge locations, and then the first marsh platform lifts would begin. A year after the completion of the first marsh platform lift, a lift would be constructed for the perimeter and cross dikes in preparation for the second marsh platform lift. A year after the completion of the second marsh platform lift, a lift would be constructed for the perimeter and cross dikes in preparation for the third marsh platform lift. A year after the completion of the third marsh platform lift, the site would be dewatered via cuts through the containment dikes. The dikes would then be degraded down to elevation +1.0 feet. The site is anticipated to naturally vegetate following dewatering and dike degradation.

2.6.4.4 Delta Farms Fresh/Intermediate Marsh Project

This USACE-constructed site is located in open water northwest of Little Lake and northeast of the town Cutoff within Lafourche Parish, Louisiana, within the same watershed in which MTG Project impacts would occur (in the coastal zone of the Deltaic Plain; refer to Section 2.3.1.2.2). To construct the marsh platform, material from a borrow area adjacent to the Atchafalaya Navigation Channel, at Mile 150 to Mile 147.5, would be dredged mechanically at the borrow site and hauled to the project site via barge. The water bottom elevation is assumed to be at -2.0-feet, with a typical water elevation range of +0.5 to +3.0-feet. It is assumed the required marsh elevation is approximately +1.0 to +1.5 feet.

This alternative consists of approximately 2,895 acres of fresh and intermediate marsh restoration/establishment. The proposed construction would consist of four sites: Site 1, Site 2, Site 3, and Site 4. The footprints of these sites are 843 acres, 606 acres, 614, and 831 acres respectively. To construct the marsh platform, material from a borrow areas within Little Lake would be dredged via hydraulic cutterhead and dredge slurry would be pumped into the marsh creation area. Once the barged material reaches the project site, a hydraulic unloader would pump the material from the barges to the marsh creation sites. The overall process of construction would follow the following procedure: Earthen perimeter containment dikes would be constructed to contain the pumped in dredge slurry, cross dikes would be built to split the sites into smaller cells, spill boxes would be used for each cell's effluent discharge locations, and then the first marsh platform lifts would begin. A year after the completion of the first marsh platform lift, a lift would be constructed for the perimeter and cross dikes in preparation for the second marsh platform lift. A year after the completion of the second marsh platform lift, a lift would be constructed for the perimeter and cross dikes in preparation for the third marsh platform lift. A year after the completion of the third marsh platform lift, the site would be dewatered via cuts through the containment dikes. The dikes would then be degraded down to elevation +1.0 feet. The site is anticipated to naturally vegetate following dewatering and dike degradation.

2.6.4.5 Mitigation Bank Credits

The PDT identified all USACE Regulatory approved mitigation banks with perpetual conservation servitudes within the same watershed as the impacts with available, in-kind credits for purchase (refer to Section 2.3.1.2.2 for a description of the watersheds). Because the availability of mitigation bank credits varies from year to year, the viability of satisfying all fresh and intermediate marsh mitigation requirements through the purchase of mitigation bank credits would be determined before construction of the project. Mitigation banks would be selected through a solicitation process, through which any mitigation bank meeting eligibility requirements could submit a proposal to sell credits. If appropriate and cost-effective, the USACE may choose to purchase mitigation bank credits from more than one bank to fulfill the compensatory mitigation requirements for a particular habitat type. Purchase of mitigation bank credits would be dependent on receipt of an acceptable proposal(s) and total purchase cost. No particular bank(s) is (are) proposed for use at this time. The bank(s) from which credits would be purchased would be selected through a solicitation process, through which any mitigation bank meeting eligibility requirements and having the appropriate resource type of credits could submit a proposal to sell credits.

Mitigation banks would be required to run the same version of the WVA model as was used to assess the impacts from constructing the MTG Project to ensure that the assessment of the functions and services provided by the mitigation bank match the assessment of the lost functions and services at the impacted site.

2.6.4.6 Combination Mitigation Bank Credits/USACE-Constructed Project

During the alternative evaluation process, mitigation banks with available fresh and intermediate credits within the required watershed were identified. However, it is not known which banks would be available at the time of implementation; some banks may not have enough credits remaining, some may be closed, and additional mitigation banks may be approved. To account for the uncertainty surrounding the availability of future mitigation bank credits while maintaining the ability to satisfy as much of the mitigation need as quickly as possible, an alternative consisting of a combination of mitigation credit purchase and the highest ranked USACE constructed project was developed. In this way, if the mitigation bank measure becomes the TSP for a given habitat type and during implementation of that TSP insufficient credits are available to mitigate the whole need, default to a combination measure could occur to ensure the timeliest satisfaction of 100 percent of the mitigation requirement while maximizing cost efficiencies. A range of 25, 50, and 75 percent mitigation credit/USACE-constructed project combinations were evaluated for cost effectiveness.

2.6.5 Brackish/Saline Marsh Alternatives

2.6.5.1 Isle De Jean Charles Brackish and Saline Marsh Project

This USACE-constructed site is primarily located in Terrebonne Parish, with some portions extending into Lafourche Parish, within the same watershed in which MTG Project impacts would occur. The project site is divided into four distinct marsh creation areas (MCA) labeled as MCA-1, MCA-2, MCA-3, and MCA-4. The individual MCAs have the following acreages (from MCA-1 to MCA-4): 4,215 acres; 3,623 acres; 2,055 acres; and 6,816 acres. The assumed water bottom elevations at the sites are as follows (in order from MCA-1 to MCA-4): -2.90 feet, -3.50 feet, -3.30 feet, and -2.80 feet. The target elevation for the entire site (including all MCAs) is +1.25 feet.

To construct the marsh platform, material from 3 borrow areas near Wonder Lake, Lake Boudreaux, Lake Barre, and Lake Felicity would be dredged mechanically and pumped to the project site. The overall process of construction would follow the following procedure:

earthen perimeter containment dikes would be constructed to contain the pumped in dredge slurry, cross dikes would be built to split the sites into smaller cells, spill boxes would be used for each cell's effluent discharge locations, and then the first marsh platform lifts would begin. A year after the completion of the first marsh platform lift, the site would be dewatered via cuts through the containment dikes. The dikes would then be degraded down to elevation +1.25 feet. The site is anticipated to naturally vegetate following dewatering and dike degradation.

2.6.5.2 North Barataria Brackish and Saline Marsh Project

This USACE-constructed site is primarily located in Lafourche Parish near Galliano and Golden Meadow, LA, within the same watershed in which MTG Project impacts would occur. The project site is divided into two distinct marsh creation areas (MCA) labeled as MCA-1, and MCA-2. The individual MCAs have the following acreages (from MCA-1 to MCA-2): 3,973 acres; and 2,818 acres. The assumed water bottom elevations at the sites are as follows (in order from MCA-1 to MCA-2): -2.50 feet, and -3.80 feet. The target elevation for the entire site (including all MCAs) is +1.25 feet.

To construct the marsh platform, material from 2 borrow areas in Little Lake, Bay Dosgris, Round Lake, Bay L'Ours, and Cat Bay would be dredged mechanically and pumped to the project site. To avoid oyster seed grounds and nearby pipelines, the overall borrow areas have been divided into multiple cells. The overall process of construction of the marsh platforms would follow the following procedure: earthen perimeter containment dikes would be constructed to contain the pumped in dredge slurry, cross dikes would be built to split the sites into smaller cells, spill boxes would be used for each cell's effluent discharge locations, and then the first marsh platform lifts would begin. A year after the completion of the first marsh platform lift, the site would be dewatered via cuts through the containment dikes. The dikes would then be degraded down to elevation +1.25 feet. The site is anticipated to naturally vegetate following dewatering and dike degradation.

2.6.5.3 Three Mile Bay Brackish and Saline Marsh Project

This USACE-constructed site is situated in between Lake Borgne and Chandeleur Sound in the vicinity of the Biloxi State Wildlife Management Area, located in St. Berbard Parish near the Louisiana eastern state borderline. The project site is divided into two distinct marsh creation areas (MCA) labeled as MCA-1, and MCA-2. The individual MCAs have the following acreages (from MCA-1 to MCA-2): 7,153 acres; and 1,575 acres. The assumed water bottom elevations at the sites are as follows (in order from MCA-1 to MCA-4): -4.80 feet, and -5.70 feet. The target elevation for the entire site (including all MCAs) is +1.25 feet.

To construct the marsh platform, material from one large borrow area identified between Lake Borgne and the Mississippi Sound directly east of Grand Island would be dredged mechanically and pumped to the project site. The overall process of construction of the marsh platforms would follow the following procedure: earthen perimeter containment dikes would be constructed to contain the pumped in dredge slurry, cross dikes would be built to split the sites into smaller cells, spill boxes would be used for each cell's effluent discharge locations, and then the first marsh platform lifts would begin. A year after the completion of the first marsh platform lift, a lift would be constructed for the perimeter and cross dikes in preparation for the second marsh platform lift. A year after the completion of the second marsh platform lift, the site would be dewatered via cuts through the containment dikes. The dikes would then be degraded down to elevation +1.25 feet. The site is anticipated to naturally vegetate following dewatering and dike degradation.

2.6.5.4 West Terrebonne Brackish and Saline Marsh Project

This USACE-constructed site is located within Terrebonne Parish south of Theriot, Louisiana traveling down Bayou Dularge, within the same watershed in which MTG Project impacts would occur. The project site is divided into two distinct marsh creation areas (MCA) labeled as MCA-1, and MCA-2. The individual MCAs have the following acreages (from MCA-1 to MCA-2): 3,242 acres; and 3,188 acres. The assumed water bottom elevations at the sites are as follows (in order from MCA-1 to MCA-2): -2.80 feet, and -4.90 feet. The target elevation for the entire site (including all MCAs) is +1.25 feet.

To construct the marsh platform, material from two borrow areas located within Lake Merchant, Mud Lake, and Caillou Bay would be dredged mechanically and pumped to the project site. To avoid oyster seed grounds and nearby pipelines, the overall borrow areas have been divided into multiple cells. The overall process of construction of the marsh platforms would follow the following procedure: earthen perimeter containment dikes would be constructed to contain the pumped in dredge slurry, cross dikes would be built to split the sites into smaller cells, spill boxes would be used for each cell's effluent discharge locations, and then the first marsh platform lifts would begin. A year after the completion of the first marsh platform lift, the site would be dewatered via cuts through the containment dikes. The dikes would then be degraded down to elevation +1.25 feet. The site is anticipated to naturally vegetate following dewatering and dike degradation.

2.6.5.5 Mitigation Bank Credits

The PDT identified all USACE Regulatory approved mitigation banks with perpetual conservation servitudes within the same watershed as the impacts with available, in-kind credits for purchase (refer to Section 2.3.1.2.2 for a description of the watersheds). Because the availability of mitigation bank credits varies from year to year, the viability of satisfying all brackish and saline marsh mitigation requirements through the purchase of mitigation bank credits would be determined before construction of the project. Mitigation banks would be selected through a solicitation process, through which any mitigation bank meeting eligibility requirements could submit a proposal to sell credits. If appropriate and cost-effective, the USACE may choose to purchase mitigation bank credits from more than one bank to fulfill the compensatory mitigation requirements for a particular habitat type. Purchase of mitigation bank credits would be dependent on receipt of an acceptable proposal(s) and total purchase cost. No particular bank(s) is (are) proposed for use at this time. The bank(s) from which credits would be purchased would be selected through a solicitation process, through which any mitigation bank meeting eligibility requirements and having the appropriate resource type of credits could submit a proposal to sell credits.

Mitigation banks would be required to run the same version of the WVA model as was used to assess the impacts from constructing the MTG Project to ensure that the assessment of the functions and services provided by the mitigation bank match the assessment of the lost functions and services at the impacted site.

2.6.5.6 Combination Mitigation Bank Credits/USACE-Constructed Project

During the alternative evaluation process, mitigation banks with available brackish and saline credits within the required watershed were identified. However, it is not known which banks would be available at the time of implementation; some banks may not have enough credits remaining, some may be closed, and additional mitigation banks may be approved. To account for the uncertainty surrounding the availability of future mitigation bank credits while maintaining the ability to satisfy as much of the mitigation need as quickly as possible, an alternative consisting of a combination of mitigation credit purchase and the highest-ranked USACE-constructed project was developed. In this way, if the mitigation bank measure becomes the tentatively selected plan (TSP) for a given habitat type and during implementation of that TSP insufficient credits are available to mitigate the whole need, default to a combination measure could occur to ensure the timeliest satisfaction of 100 percent of the mitigation requirement while maximizing cost efficiencies. A range of 25, 50, and 75 percent mitigation credit/USACE-constructed project combinations were evaluated for cost effectiveness.

2.7 ALTERNATIVE EVALUATION & SELECTION OF TENTATIVELY SELECTED PLAN

2.7.1 Mitigation Alternatives Evaluation Process

The MTG Project PDT implemented an alternatives evaluation process to rank the projects in the final array by habitat type and identify the number one ranked alternative as the TSP for each habitat type using the evaluation criteria below (see Attachment 2 for details about each of these evaluation criteria). The TSP for each habitat type, when combined together, constituted the Tentatively Selected Mitigation Plan for MTG. The evaluation criteria included:

- Cost Effectiveness/Incremental Cost Analysis –This analysis evaluated the average annual cost per average annual habitat unit to rank the projects in order of cost effectiveness and to identify the least cost alternative for implementation.
- Risk and Reliability – This criterion considers issues such as a proposed projects' susceptibility and resiliency to stressors, long-term sustainability, uncertainty relative to the USACE ability to implement the project, and uncertainty relative to project success.
- Environmental – This criterion evaluates a proposed project's adverse and beneficial impacts to human and natural resources.
- Time - Time evaluates the duration to contract award and to completion of construction or Notice of Construction Complete (NCC) and real estate acquisition timeline.

- Watershed and Ecological Site Considerations – This criterion evaluates the proposed project site characteristics such as whether the project is consistent with watershed plans such as CPRA's 2023 Coastal Master Plan, CWPPRA, and the Louisiana Coastal Area Plan and the role that a potential project would play in terms of creating habitat linkages or wildlife corridors. This criterion also examines whether the proposed project is located within the impacted Parish or is contiguous with or located within a resource managed area. There are also ecological considerations that are not captured in the WVA analysis, such as fragmentation of the proposed project site or the proposed project's habitat connectivity or future land use trends in the surrounding area.
- Completeness – A determination of whether or not the plan includes all elements necessary to achieve the objectives. It is an indication of the degree to which the outputs of the plan are dependent upon the actions of others. Compliance with this criterion is ensured by implementation of the screening criteria "Must have independent utility" and "Can be easily scaled to meet changing mitigation acreage requirements". No alternatives without independent utility or the flexibility to meet changing mitigation acreage requirements should have been carried forward into alternative comparison.
- Effectiveness – The extent to which an alternative plan alleviates the specified problems and achieves the specified opportunities (P&G Section VI.1.6.2(c)(2)). Alternative plans that do not contribute or minimally contribute to the planning objectives should be dropped from consideration. Compliance with this criterion is ensured by implementation of the screening criteria "Technical Viability". All alternatives should have developed to ensure their technical viability or effectiveness before being carried forward into alternative comparison.
- Efficiency – The extent to which an alternative plan is the most cost-effective means of alleviating the specified problems and realizing the specified opportunities, consistent with protecting the Nation's environment (P&G Section VI.1.6.2(c)(3)). Benefits can be both monetary and non-monetary. Alternative plans that provided little benefits relative to the cost should be dropped from further consideration. This criterion is evaluated through completion of CE/ICA, CE in particular.
- Acceptability – The workability and viability of the alternative plan with respect to acceptance by State and local entities and the public and compatibility with existing laws, regulations, and public policies (P&G Section VI.1.6.2(c)(4). Acceptability means a measure or alternative plan is technically, environmentally, economically, and socially feasible. Alternative plans that are clearly not feasible should be dropped from further consideration. This criterion is evaluated under all alternative comparison criteria, especially Risk and Reliability, Watershed Considerations/Significance in Watershed, and Environmental.

For environmental planning, where traditional benefit-cost analysis is not possible because costs and benefits are expressed in different units, two analytical methods are used to assist in the decision process, cost effectiveness (CE) analysis and incremental cost analysis (ICA). The team ran Cost-Effectiveness and Incremental Cost Analysis (CE/ICA) to show variations in costs of alternative plans with the intent to identify and describe the least cost plan. The Institute for Water Resources (IWR) provides methodologies for how CE/ICA is used as a planning tool by USACE to evaluate and compare alternative plans for environmental restoration. First, cost effectiveness (CE) analysis is conducted to ensure that the least cost solution is identified for each possible level of environmental output. Subsequent incremental cost analysis (ICA) of the cost-effective solutions is conducted to reveal changes in costs for increasing levels of environmental outputs. Since mitigation is required to replace the lost functions and services of the impacted habitats only, and each alternative site in the final array was scaled to meet the mitigation requirement by habitat type, the environmental output of each alternative site by habitat type was the same and the analysis was reduced to just CE.

After the team ran CE/ICA and understood the projects ranking in relation to cost, an evaluation of the projects under other criteria was completed to see if any important factor could be identified that would justify a deviation from the results of CE/ICA. The relative scoring of each project under each criterion for each habitat type produced an overall score for each project. A ranking was then established for the projects under each habitat type based on each project's overall score. Although the ranking under the other criteria were somewhat different than the ranking determined under CE/ICA, no particular factor was identified that would result in a departure from the ranking under CE/ICA. As such, the highest ranked project under CE/ICA for that habitat type was selected as the TSP for that habitat type. CE/ICA results and the tables used during the evaluation process that show how each alternative was scored are provided in Attachments 5 and 6.

2.7.2 Tentatively Selected Mitigation Plan (TSMP)

The alternative selected as the TSP for each habitat type is shown in Table C:2-5. Project descriptions of these alternatives are summarized in Sections 2.2.6 – 2.2.9 and detailed in Attachment 4. Scores for each of the alternatives for each of the evaluation criteria are provided in Attachment 5. The TSP for each habitat type together makes up the TSMP. The TSMP satisfies all habitat mitigation requirements for the entire MTG Project.

Table C:2-5. Tentatively Selected Mitigation Plan

Habitat Type	TSP	Acres
BLH	Combo Mitigation Bank/Napoleonville	588

Habitat Type	TSP	Acres
Swamp	Combo Mitigation Bank/Napoleonville	1,063
Fresh/Intermediate Marsh**	Combo Mitigation Bank/Delta	2,895
Brackish/Saline Marsh	Combo Mitigation Bank/West Terrebonne	6,431

**Lake Salvador was originally identified as the TSMP for F/I marsh but was replaced by Delta (see section 2.4.2.3 for details).

2.7.2.1 BLH

The TSP for MTG BLH Mitigation is the combination of mitigation bank credits/Napoleonville alternative (described in Section 2.2.6.1). No particular bank(s) is (are) proposed for use at this time. The amount of in-kind mitigation bank credits available would depend on the availability of eligible banks at the time of implementation. If this alternative is ultimately not able to complete satisfaction of the required mitigation need for this habitat type, the successive alternatives would be implemented in order of ranking to the extent needed to ensure full satisfaction of the mitigation requirement. The next ranked alternative for this habitat type was the combination of mitigation bank/Supreme alternative. The full project descriptions can be found in Attachment 4.

Table C:2-6. BLH Alternative Rankings

Mitigation Site	**Ranking**
Mitigation Banks	1
Napoleonville	2
Supreme	3

2.7.2.2 Swamp

The TSP for MTG Swamp Mitigation is the combination mitigation bank credits/Napoleonville alternative (described in Section 2.3.7). No particular bank(s) is (are) proposed for use at this time. The amount of in-kind mitigation bank credits available would depend on the availability of eligible banks at the time of implementation. If this alternative is ultimately not able to complete satisfaction of the required mitigation need for this habitat type, the successive alternatives would be implemented in order of ranking to the extent needed to ensure full satisfaction of the mitigation requirement. The next ranked alternative for this habitat type was the combination of mitigation bank/Supreme alternative. The full project description can be found in Attachment 4.

Table C:2-7. Swamp Alternative Rankings

Mitigation Site	Ranking
Mitigation Banks	1
Napoleonville	2
Supreme	3

2.7.2.3 Fresh and Intermediate Marsh

The TSP for MTG Project impacts on fresh and intermediate marsh was identified as the combination mitigation bank credits/Lake Salvador alternative (described in Section 2.3.8.3). Results of recently completed Engineering investigative surveys caused USACE to determine that construction of Lake Salvador may involve unacceptable risks and defaulted to the next ranked alternative, mitigation bank/Delta Farms for implementation (described in Section 2.3.8.4). No particular bank(s) is (are) proposed for use at this time. The amount of in-kind mitigation bank credits available would depend on the availability of eligible banks in the Deltaic Plain at the time of implementation. If this alternative is ultimately not able to complete satisfaction of the required mitigation need for this habitat type, the successive alternatives would be implemented in order of ranking to the extent needed to ensure full satisfaction of the mitigation requirement. The next ranked alternative for this habitat type was the construction of the Delta Farms alternative. The full project description can be found in Attachment 4.

Table C:2-8. F/I Marsh Alternative Rankings

Mitigation Site	Ranking
Lake Salvador **	1
Delta Farms	2
GIWW	3
Avoca	4

** The PDT defaulted to the next ranked alternative (Delta Farms) due to unacceptable risks.

2.7.2.4 Brackish and Saline Marsh

The TSMP for MTG Project impacts on brackish and saline marsh is the combination mitigation bank credits/West Terrebonne alternative (described in Section 2.3.9.4). No particular bank(s) is (are) proposed for use at this time. The amount of mitigation bank credits available would depend on the availability of eligible banks in the Deltaic Plain at the time of implementation. If this alternative is ultimately not able to complete satisfaction of the required mitigation need for this habitat type, the successive alternatives would be implemented in order of ranking to the extent needed to ensure full satisfaction of the mitigation requirement. The next ranked alternative for this habitat type was the construction of the West Terrebonne alternative. The full project description can be found in Attachment 4.

Table C:2-9. B/S Marsh Alternative Rankings

Mitigation Site	Ranking
West Terrebonne	1
Isle de Jean Charles	2
North Barataria	3
Three Mile Bay	4

SECTION 3 WVAS FOR MITIGATION ALTERNATIVES

3.1 WETLAND VALUE ASSESSMENT

The Wetland Value Assessment (WVA) model was used to assess future benefits to be obtained through the compensatory mitigation projects. For each habitat type, the same version of the WVA model was used to calculate both the impacts from construction of the MTG Project (as described in Section 6 of the SEIS) and future benefits to be obtained through the implementation of the mitigation project.

The WVA methodology operates under the assumption that optimal conditions for general fish and wildlife habitat within a given coastal wetland type can be characterized, and that existing or predicted conditions can be compared to that optimum level to provide an index of habitat quality. Habitat quality is estimated or expressed through the use of a mathematical model developed specifically for each wetland type. Each model consists of: 1) a list of variables that are considered important in characterizing fish and wildlife habitat; 2) a Suitability Index graph for each variable assumed relationship between habitat quality (Suitability Index) and different variable values; and 3) a mathematical formula that combines the Suitability Index for each variable into a single value for wetland habitat quality. That single value is referred to as the Habitat Suitability Index, or HSI.

In accordance with EC 1105-2-412, the following versions of the certified WVA models were used for the MTG mitigation effort: 1) WVA Bottomland Hardwoods Community Model for Civil Works Version 1.2 (BLH WVA) 2) WVA Swamp Community Model for Civil Works (Version 2.0)(Swamp WVA) 3) Fresh/Intermediate, Brackish, and Saline Marsh Wetland Value Assessment Marsh Community Models for Civil works (Version 2.1) (Fresh/Intermediate Marsh WVA, Brackish Marsh WVA, Saline Marsh WVA).

The WVA models assess the suitability of each habitat type for providing resting, foraging, breeding, and nursery habitat to a diverse assemblage of fish and wildlife species. This standardized, multispecies, habitat-based methodology facilitates the assessment of project-induced impacts on fish and wildlife resources. The bottomland hardwood (BLH) WVA models consist of 7 variables: 1) Tree Species Composition, 2) Stand maturity, 3) Understory/Midstory, 4) Hydrology, 5) Size of Contiguous Forested Area, 6) Suitability and Traversability of Surrounding Land Uses, 7) Disturbance. The swamp WVA models consist of 7 variables: 1) Stand structure, 2) Stand maturity, 3) Water regime, 4) Mean high salinity during the growing season, 5) Size of Contiguous Forested Area, 6) Suitability and Traversability of Surrounding Land Uses, 7) Disturbance. The Marsh WVA models consist of 6 variables: 1) Percent of wetland area covered by emergent vegetation, 2) Percent of open water area covered by aquatic vegetation, 3) Marsh edge and interspersion, 4) Percent of open water area ≤ 1.5 feet deep in relation to marsh surface, 5) Salinity, 6) Aquatic organism access.

Values for variables used in the models are derived for existing conditions and are estimated for conditions projected into the future if no mitigation efforts are applied (i.e., FWOP), and for conditions projected into the future if the proposed mitigation project is implemented (i.e., FWP), providing an index of habitat quality, or habitat suitability, for the period of analysis. The HSI is combined with the acres of habitat to generate a number that is referred to as "habitat units." Expected project impacts/benefits are estimated as the difference in habitat units between the FWP scenario and the FWOP scenario. To allow comparison of WVA benefits to costs for overall project evaluation, total benefits are averaged over a 50-year period, with the result reported as AAHUs. Assumptions used for the MTG mitigation WVAs are found in Attachment 10.

3.2 SEA LEVEL CHANGE

The intent of compensatory mitigation is to offset unavoidable habitat losses by replacing those impacted habitats by restoring (re-establishment or rehabilitation), establishing (creation), or enhancing a naturally functioning system. Once the project meets its long-term success criteria, it will experience natural successional phases common to that habitat type. Once the functions and services of the affected habitat have been replaced (over the 50-yr period of analysis) and the mitigation project becomes a naturally functioning, self-sustaining system whose habitat is protected in perpetuity, the compensatory mitigation obligation is satisfied.

The performance of all the mitigation projects over the 50-yr period of analysis were evaluated considering future sea level change to support selection of the TSMPs. Potential increases in SLR could affect the performance and therefore ability of a mitigation project to achieve replacement of the services and functions of the impacted habitat types. Because all of the mitigation projects were designed based on the intermediate SLR scenario to account for potential uncertainties in future SLR impacts, the risk of the proposed projects not successfully meeting the mitigation requirement due to SLR has been minimized. Additionally, since all projects within the same habitat type are similarly located within the coastal zone, effects on these projects from future SLR increases would be similar across the projects and not affect the selection/ranking of the projects.

SECTION 4 DATA GAPS AND UNCERTAINTIES

4.1 IMPLEMENTATION RISKS

4.1.1 Impact Assessment

The MTG project mitigation requirement has been determined based on initial engineering designs of the alignment and estimated indirect impacts. As final designs are completed, a reassessment of the mitigation requirement would be completed to ensure all impacts from construction of the MTG are fully mitigated. If additional impacts are identified beyond what can be mitigated under the TSMP, then additional NEPA documentation would be prepared analyzing options to complete the outstanding mitigation. This document would be available for public review and comment.

4.1.2 Tropical Storms

Tropical storm events can directly and indirectly contribute to coastal land loss through erosion from increased wave energies, removal and/or scouring of vegetation from storm surge and saltwater intrusion into estuaries and interior wetlands. Wetland loss and degradation of large areas can occur over a short period of time as a result of storms.

Approximately 52,480 acres of marsh were permanently or temporarily converted to open water in the Pontchartrain Basin following Hurricane Katrina, (Barras, 2009). There is a risk that a single storm event, or multiple storms over a short period time, could significantly reduce or eliminate anticipated benefits of mitigation plans in the areas susceptible to storms surge and shearing. All of the features of the TSMP (and the associated cost and benefits) are at some risk from storm damage. The extent of potential damage is dependent upon several unknown variables. Including: the track and intensity of the storm, the development stage of the project, changes in the future conditions in the study area, and variability of project performance from forecast conditions due to other factors of risk and uncertainty.

The benefits of shoreline protection features could also be reduced by a storm through the displacement of rocks and damage to the structures. Repair of storm damage to these features could necessitate maintenance of the shoreline protection features in order to secure anticipated erosion reduction benefits, reducing the cost-effectiveness of these features.

4.1.3 Increased Sea Leve Rise

Increased sea level rise could convert emergent wetlands to shallow open water to deeper water habitat, reducing or eliminating the effectiveness of mitigation plans.

4.1.4 Climate Change

Extreme changes in climate (Temperature, rain, evaporation, wind) could result in conditions that cannot support the types of habitats restored, reducing the effectiveness of the mitigation plan. Extreme climate change could essentially eliminate the benefits of vegetative plantings, if the change results in plant mortality. The monitoring plan for all USACE constructed projects would monitor the success of any vegetative plantings and includes provisions for replanting if mortalities become such that meeting the required success criteria is in jeopardy.

4.1.5 Timing

The timing for implementation is an uncertainty that must be considered. If the plan is not implemented in the near future, the conditions in the study area would continue to degrade. The impact of the uncertainties associated with the future condition of the stud area could increase mitigation cost, decrease mitigation benefits, or both.

If a proposed project becomes infeasible due to difficulties in implementation or changed conditions, the USACE will take appropriate action to ensure satisfaction of its mitigation requirement.

4.2 ERRORS IN ANALYSIS

Future conditions are inherently uncertain. The forecast of future conditions is limited by existing science and technology. Future conditions described in this study are based on an analysis of historic trends and the best available information. Some variation between forecast conditions and reality is certain. Mitigation features were developed in a risk-aware framework to minimize the degree to which these variations would affect planning decision. However, errors in analysis or discrepancies between forecast and actual conditions could affect plan effectiveness.

All of the models used in this study are abstract mathematical representations of reality. Models simulate complex systems by simplifying real processes into expressions of their most basic variables. These tools assist with finding optimal solutions to problems, testing hypothetical situations, and forecasting future conditions based on observed data. No model can account for all relevant variables in the system. The interpretation of model outputs must consider the limitations, strengths, weaknesses, and assumptions inherent in model inputs and framework. Inaccurate assumptions or input errors could change benefits predicted by models used in this study. The potential for significant changes due to errors has been reduced through technical review, sensitivity analyses, and quality assurance procedures. However, there is inherent risk in reducing complex natural systems into the results of mathematic expressions driven by the simplified interaction of key variables.

4.3 WVA MODEL UNCERTAINTIES

WVAs models were run on the final array of mitigation projects using site-specific data collected at or near the project sites. Though data obtained make confidence high that this data is representative of current site conditions, a delay in implementation may result in a change in existing conditions that could influence WVA results. During advanced design, additional field work would be conducted as necessary to ensure WVA outputs reflect a true understanding of site conditions, and the benefits project construction would realize.

4.4 MITIGATION FOR COASTAL ZONE IMPACTS

Depending on the projects implemented, LDNR may determine that, in its view, such projects do not mitigate for coastal zone impacts. If deemed necessary, additional mitigation for coastal zone impacts may be required.

4.5 OTHER DATA GAPS

4.5.1 Pipelines

At this stage of design, an in-depth pipeline locations/identification was not available. Initial design used pipeline data on the internal USACE New Orleans District (USACE) GIS database, Strategic Online Natural Resources Information System (SONRIS) Public Viewer, National Pipeline Mapping System (NPMS) Public Viewer. As design proceeds, the proposed access corridors, borrow areas and marsh creation areas may encounter wells and flowlines that would have to be avoided. Prior to any formal design or construction, the proposed project site and borrow area would require an in-depth pipeline, well, and flowline review and identification. At this stage of design, 500-foot buffer zone was established around all known pipeline locations.

4.5.2 Engineering Surveys

As of the date of this report submission, borings and surveys have only been completed for Lake Salvador by the USACE Engineering Division (ED) Team. Survey data and geotechnical borings/data were not available and/or conducted for the other mitigation projects. For engineering design to proceed, much more site-specific information would be required, including topographic/bathymetric and magnetometer surveys, as well as boring data collection with a full geotechnical analysis, that would influence final design.

SECTION 5 MONITORING AND ADAPTIVE MANAGEMENT

An effective monitoring program is required (WRDA 2007, Section 2036) to determine if the project outcomes are consistent with the identified success criteria. The elements of the monitoring plans are designed to measure the attainment of ecological success criteria at key points over the course of the mitigation construction and operation periods.

Adaptive management (AM) establishes a framework for decision making that utilizes monitoring results and other information, as they become available, to update project knowledge and adjust management/mitigation actions to ensure attainment of ecological success criteria. The AM plan outlines a range of corrective actions in cases where monitoring demonstrates that mitigation features are not achieving ecological success goals.

A Monitoring and Adaptive Management (MAM) Plan has been developed for each habitat type TSP within the TSMP (see Attachments 7-9). Following completion of the design of the TSPs, a more detailed monitoring plan including transects, sampling plots and gage locations, and monitoring frequency would be developed for the TSPs in coordination with the local sponsor and the Interagency Environmental Team. Reports documenting the monitoring activities, and the results would be prepared after each monitoring event and shared with the IET/USACE. Follow-up discussions on the monitoring results would be completed as necessary with the IET/USACE, especially in instances where AM may be needed to ensure ecological success is achieved.

For the habitat type TSPs where credits would be purchased from a mitigation bank, the mitigation bank must be complaint with the requirements of the USACE Regulatory Program and its Mitigation Banking Instrument (MBI), which specifies the management, monitoring, and reporting required to be performed by the bank. In addition, the bank is responsible for any contingency plans (adaptive management) for taking corrective actions in cases where monitoring demonstrates that the bank is not achieving the ecological success criteria specified in the MBI. Purchase of mitigation bank credits relieves the USACE and NFS of the responsibility for monitoring and of demonstrating mitigation success.

SECTION 6 LIST OF ACRONYMS AND ABBREVIATIONS

AAHU	Average Annual Habitat Unit
BLH	Bottomland Hardwood
USACE	USACE New Orleans District
CIMS	Coastal Information Management System
CPRAB	Coastal Protection and Restoration Board
CRMS	Coastwide Reference Monitoring System
CWPPRA	Coastal Wetlands Planning, Protection, and Restoration Act
ED	Engineering Division
ENV	Environmental Division
EPA	Environmental Protection Agency
GIS	Geographic Information System
GIWW	Gulf Intercoastal Waterway
HET	Habitat Evaluation Team
LDENR	Louisiana Department of Energy and Natural Resources
LDWF	Louisiana Department of Wildlife and Fisheries
LiDAR	Light Detection and Ranging
MCA	Marsh Creation Area
MTG	Morganza to the Gulf
NAVD	North American Vertical Datum
NCC	Notice of Construction Complete
NEPA	National Environmental Policy Act
NFS	non-Federal Sponsor
NMPS	National Marine Fisheries Service
NPMS	National Pipeline Mapping System

OMRR&R	Operation, Maintenance, Repair, Replace, and Restore
PED	Preconstruction Engineering and Design
PDT	Project Delivery Team
Ppt	Parts Per Thousand
RIBITS	Regulatory In-Lue of feed and Bank Information Tracking System
RSLR	Relative Sea Level Rise
SEIS	Supplemental Environmental Impact Statement
TSMP	Tentatively Selected Mitigation Plan
TSP	Tentatively Selected Plan
USACE	U.S. Army Corps of Engineers
USFWS	U.S Fish and Wildlife Services
USGS	U.S. Geological Survey
WRDA	Water Resource Development Act
WVA	Wetland Value Assessment

SECTION 7 REFERENCES

33 CFR Part 332. “Compensatory Mitigation for Losses of Aquatic Resources”.

33 USC 2283. “Fish and Wildlife Mitigation”.

40 CFR 230.92 “Procedures for Implementing NEPA”.

40 CFR 1508.5. “Protection of Environment. Chapter V – Council on Environmental Quality. Part 1508 – Terminology and Index. Sec 1508.5 – Cooperating Agency.”

Chapman, S.S., Kleiss, B.A., Omernik, J.M., Foti, T.L., and Murray, E.O. 2004. Ecoregions of the Mississippi Alluvial Plain (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,150,000). Accessed online in July 2025 at https://www.epa.gov/eco-research/ecoregion-download-files-state-region-6#pane-16.

Chiavacci, S.J., Pindilli, E.J. U.S. Geologic Survey. 2022. Database of Biodiversity, Habitat, and Aquatic Resource Quantification Tools Used for Markey-based Conversation in the United States Washington D.C.

Coastal Protection and Restoration Authority. (2007, 2012, 2017, and 2023). 2023 Coastal Master Plan: (pp. 1-18). Baton Rouge, Louisiana.

Coastal Protection and Restoration Authority. 2020. Bayou Terrebonne Increment (TE-0139) Baton Rouge, LA.

Conner, W.H., T.W. Doyle & K.W. Krauss, Eds., 2007. Ecology of Tidal Freshwater Forested Wetlands of the Southeastern United States. Springer. 505 pCouvillion, B.R., Beck, Holly, Schoolmaster, Donald, and Fischer, Michelle, 2017, Land area change in coastal Louisiana 1932 to 2016: U.S. Geological Survey Scientific Investigations Map 3381, 16 p. pamphlet, https://doi.org/10.3133/sim3381.

Daigle, J.J., G.E. Griffith, J.M. Omernik, P.L. Faulkner, R.P. McCulloh, L.R. Handley, L.M. Smith, and S.S. Chapman. 2006. Ecoregions of Louisiana (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,000,000).

Engineering Regulation (ER) 1105-2-100 “Planning Guidance Notebook.”

Engineering Regulation (ER) 1105-2-101 “Risk Analysis for Flood Damage Reduction Studies.”

Fischenich, J. C., & Barnes, T. K. (n.d.). ERDC knowledge core: Case study : Southwest Coastal Louisiana ... - HPC. https://erdc-library.erdc.dren.mil/jspui/handle/11681/3964

Hodges, C.C., Diplas, P., & Younos, T. 1997. Resistance to Flow Through Riparian Wetlands.

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

Kentucky Energy and Environment Cabinet. 2022. Wetlands Environmental Protection. Frankfort, KY. Wetlands - Kentucky Energy and Environment Cabinet Accessed January,17, 2024

King, S.L., & Keim, R.F. (2019). Hydrologic Modifications Challenge Bottomland Hardwood Forest Management. Journal of Forestry.

Louisiana Department of Wildlife and Fisheries. 2014. Natural Communities of Louisiana: Freshwater Marsh. Baton Rouge, LA. 2pp.

Louisiana Department of Wildlife and Fisheries. 2020. Rare Natural Communities Tracking List. Baton Rouge, LA. Rare Species and Natural Communities by Parish | Louisiana Department of Wildlife and Fisheries Accessed January,17, 2024

Mcbride, Randolph & Byrnes, Mark & Britsch, Louis. (2011). Subsidence-Corrected Elevations of Paleoshorelines (Chenier Ridges) of the Mississippi River chenier Plain, USA: Implications of Forcing Mechanisms. 176-187.

Restore the Mississippi River Delta. 2025. Anatomy of a Delta: The Foundation of New Land. Available online: https://mississippiriverdelta.org/learning/anatomy-of-a-delta-the-foundation-of-new-land/. Accessed July 2025.

Shaffer, G.P., Perkins, T.E., Hoeppner, S., Howell, S., Benard, H., and Parsons, A.C. 2003. Ecosystem Health of the Maurepas Swamp: Feasibility and Projected Benefits of a Freshwater Diversion. U.S. Environmental Protection Agency, Region 6, Dallas, TX, USA

U.S. Army Corps of Engineers. 2000. Planning Guidance Notebook. Engineer Regulation 1105-2-100.

U.S. Army Corps of Engineers. 2005. Engineer Research and Development Center. Louisiana Coastal Area (LCA), Louisiana, Ecosystem Restoration Study, Volume 4: Appendices. Washington, D.C.

U.S. Army Corps of Engineers. 2010 Comprehensive Evaluation of Projects with Respect to Sea Level Change

U.S. Army Corps of Engineers. 2011. Engineer Circular 1105-2-412 Assuring Quality of Planning Models. Washington, D.C. 32pp.

U.S. Army Corps of Engineers. 2013. Final Post Authorization Change Report and Revised Programmatic Environmental Impact Statement for the Morganza to the Gulf of Mexico, Louisiana. New Orleans District.

U.S. Army Corps of Engineers. 2014. West Shore Lake Pontchartrain Hurricane and Storm Damage Risk Reduction Study Final Integrated Feasibility Report and Environmental Impact Statement Appendix E- Plan Formulation. Washington, D.C.

U.S. Army Corps of Engineers. 2021. Lake Pontchartrain & Vicinity GRR Appendix K-Mitigation Plan. Washington, D.C.

U.S. Environmental Protection Agency. 2017. Washington, D.C. Bottomland Hardwoods | Wetlands Protection and Restoration | US EPA Accessed January,17, 2024

U.S. Fish and Wildlife Service and U.S. Army Corps of Engineers. 1984. The Ecology of Delta Marshes of Coastal Louisiana. Performed for Division of Biological Services. Washington, D.C. 159pp.

U.S. Fish and Wildlife Service. 2011. Report to Congress: Status and Trends of Wetlands in the Conterminous United States 2004 – 2009. T.E. Dahl (ed). Washington, D.C. 112pp.

U.S. Geologic Survey. 2011. Completion of the 2006 National Land Cover Database for the Conterminous United States. Washington D.C.

U.S. Geologic Survey. 2017. Primary Causes of Wetland Loss at Madison Bay, Terrebonne Parish, Louisiana - USGS Open File Report 03-060. USGS Coastal & Marine Geology Program.

Mississippi Valley Division,
Regional Planning and Environment Division South

Morganza to the Gulf of Mexico, Louisiana, Hurricane and Storm Damage Risk Reduction Project

Appendix C – Attachment 1 – Screening Criteria

October 2025

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SECTION 1
Introduction

The Mitigation Project Delivery Team (PDT) used the following screening criteria to identify suitable sites to mitigate the Morganza to the Gulf (MTG) impacts to multiple habitat types and ensure in-kind replacement of these habitat type's functions and values as required by law. Since efforts to avoid and minimize impacts have occurred and unavoidable impacts have still been incurred, mitigation of these impacts is warranted. Screening criteria were developed by the Mitigation PDT and are described in detail below. Screening criteria respond to Congressional authority and other laws, policies and guidance, and include, but are not limited to, constraints. Proposed projects that did not meet any one of the screening criteria were discarded without further investigation.

1.1 DEFINITION/APPLICATION

A given mitigation alternative must be compliant with all federal laws and policies. In application, laws such as 33 U.S.C. 2283 served as a framework from which to develop additional screening criteria, rather than a screening criterion in and of itself. Other laws were applied directly as screening criteria. One example is the application of 31 U.S.C. 1301, under which projects authorized under other authorities were screened out.

1.2 JUSTIFICATIONS, AND LEGAL AND POLICY REFERENCES

The following Engineering Regulations require that project alternatives comply with applicable laws and policies:

- The objectives and requirements of applicable laws and executive orders are considered throughout the planning process in order to meet the federal objective. USACE ER 1105-2-100, 2-2.
- Each alternative plan shall be formulated in consideration of four criteria described in the [Principles & Guidelines]: completeness, efficiency, effectiveness, and acceptability… Acceptability is the extent to which the alternative plans are acceptable in terms of applicable laws, regulations and public policies. USACE ER 1105-2-100, 2-3.
- Civil Works studies and projects should be in compliance with all applicable Federal environmental statutes and regulations and with applicable State laws and regulations where the Federal government has clearly waived sovereign immunity. USACE ER 1105-2-100, 2-7.

Additionally, two principles of fiscal law prohibit the use of funds appropriated under one authority from being expended on actions pursuant to a different authority. First, 31 U.S.C.

1301(a) posits that appropriations may be used only for their intended purposes. Second, as a general principle, when both specific and general authorizations/ appropriations exist, the specific always rules over the general such that agencies do not have an option. For example, if a specific appropriation exists for a particular item, then that appropriation must be used, and it is improper to "charge" the more general appropriation or any other appropriation. These principles were used to screen out projects that were authorized and recommended under authorities other than the MTG authority.

SECTION 2
Within Impacted Watershed

2.1 DEFINITION AND APPLICATION

As required by 33 U.S.C. 2283 d3 complies with, at a minimum, the mitigation standards and policies established pursuant to the regulatory programs". Mitigation projects for impacts to tidal marsh habitat in the Deltaic Plain would be identified within the Deltaic Plain. Mitigation projects for impacts to BLH and swamp would, at a minimum, be mitigated within the river basin watershed that was impacted (Terrebonne and Barataria), but could be situated within the Level 4 EPA designated ecoregion where the impacts occurred (73n and 73k) to take advantage of cost efficiencies and greater ecological output achieved through mitigating impacts together with larger projects since impacts to these habitat types in Barataria are small. Please refer to figures C1:2-1 and C1:2-2 below for maps.

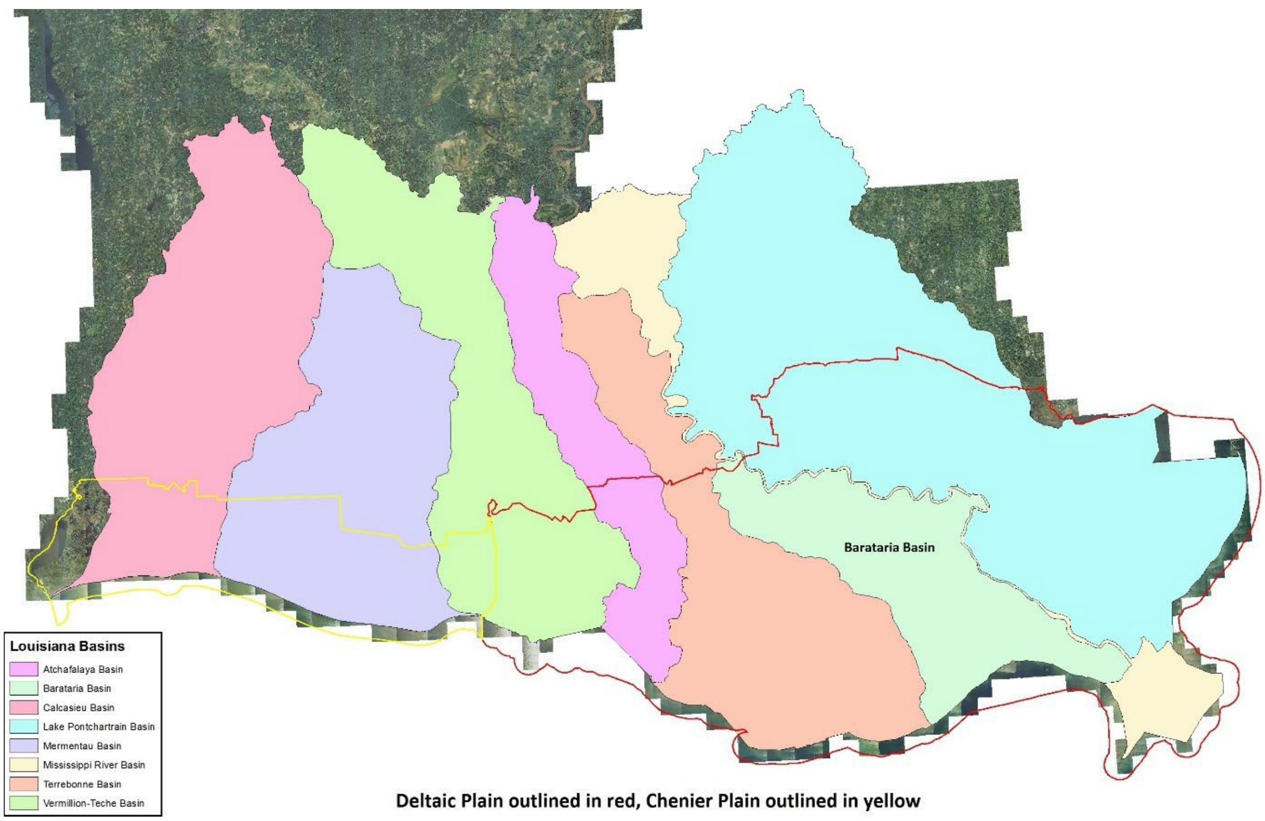

Figure C1:2-1. River Basins and Deltaic Plains

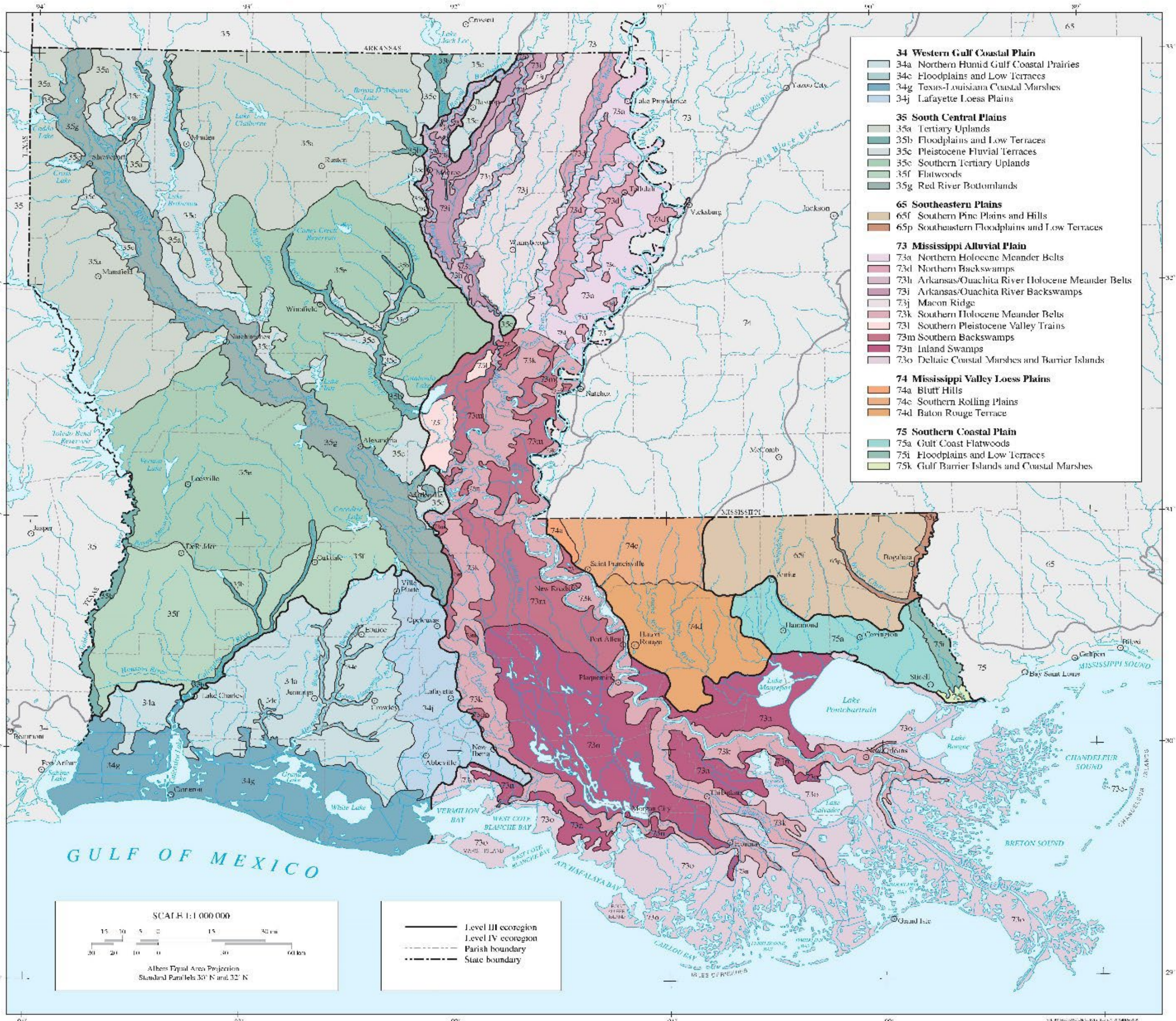

Figure C1:2-2. EPA Level 4 Ecoregions

During the screening process, potential mitigation sites were excluded from further consideration in cases where the mitigation site was located outside of the applicable watershed.

2.2 JUSTIFICATION, AND LEGAL AND POLICY REFERENCES

- To mitigate losses to flood damage reduction capabilities and fish and wildlife resulting from a water resources project, the Secretary shall ensure that the mitigation plan for each water resources project complies with, at a minimum, the mitigation standards and policies established pursuant to the regulatory programs administered by the Secretary. 33 U.S.C. 2283

- The mitigation plans are to set forth the mitigation activities that are to be undertaken within the watershed in which the losses occur or in any case in which the mitigation will occur outside the watershed, the mitigation plan shall set forth a detailed explanation for undertaking the mitigation outside the watershed. 33 U.S.C. 2283.
- In general, the required compensatory mitigation should be located within the same watershed as the impact site, and should be located where it is most likely to successfully replace lost functions and services, taking into account such watershed scale features as aquatic habitat diversity, habitat connectivity, relationships to hydrologic sources (including the availability of water rights), trends in land use, ecological benefits, and compatibility with adjacent land uses. 33 CFR Part 332, Section 332.3(b)(1), and; 40 CFR Part 230, Section 230.93(b)(1).

Where permitted impacts are not in the service area of an approved mitigation bank or in-lieu fee program that has the appropriate number and resource type of credits available, permittee-responsible mitigation is the only option. Where practicable and likely to be successful and sustainable, the resource type and location for the required permittee-responsible compensatory mitigation should be determined using the principles of a watershed approach as outlined in paragraph (c) of this section. 33 CFR Part 332, Section 332.3(b)(4), and; 40 CFR Part 230, Section 230.93(b)(4).

SECTION 3
HTRW Risk

3.1 DEFINITION AND APPLICATION

Hazardous, toxic, and radioactive waste (HTRW) includes various materials defined in Section 4.a.(1) of Engineering Regulation 1165-2-132 (USACE, 1992). Examples of such materials include, but are not limited to, any material listed as a "hazardous substance" under the Comprehensive Environmental Response, Compensation and Liability Act (42 U.S.C. 9601 et seq.).

In screening potential mitigation sites, USACE reviewed various information sources to determine if there could be Recognized Environmental Conditions (REC) present within a particular site. The term "REC" is defined in Section 1.1.1 of ASTM Standard Practice E 1527-05 (ASTM, 2005). This term basically refers to the presence or likely presence of HTRW on a property under conditions which indicate an existing or past release, or a material threat of a release of HTRW into structures on the property or into the ground, ground water, or surface water of the property. It does not include *de minimis* conditions that commonly do not present a threat to human health or the environment.

The following information sources (databases) were consulted and searched as part of the review process: (a) Federal records - United States Environmental Protection Agency's (USEPA) National Priorities List; USEPA Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS); USEPA No Further Remedial Action Planned Sites (NFRAP); USEPA Resource Conservation and Recovery Information System (RCRIS-LG); USEPA Emergency Response Notification System (ERNS); USEPA Corrective Action Report (CORRACTS); USEPA Biennial Reporting System (BRS); USEPA Superfund (CERCLA) Consent Decrees (CONSENT); USEPA Facility Index System/Facility Identification Initiative Program Summary Report (FINDS); USDOT Hazardous Materials Information Reporting System (HMIRS); USNRC Material Licensing Tracking System (MLTS); USEPA Federal Superfund Liens (NPL LIENS); USEPA PCB Activity Database System (PADS); USEPA RECRA Administrative Action Tracking System (RAATS); USNTIS Records of Decision (ROD); USEPA Toxic Chemical Release Inventory System (TRIS); USEPA Toxic Substances Control Act (TSCA); (b) State and local records - Solid and Hazardous Waste Sites (SHWS); Solid Waste Facilities/Landfill Sites (SWF/LF); LDEQ Approved Debris Sites (DEBRIS); Recycling Sites (SWRCY); Leaking Underground Storage Tanks (LUST); Historic Leaking Underground Storage Tanks (HIST LUST); Louisiana Underground Storage Tank Database (UST); Environmental Liens (LIENS); Spills and Releases (SPILLS); Listing of institutional and/or engineering controls (AUL); Voluntary Remediation Program Sites (VCP); Drycleaner Facility Listing (DRYCLEANERS); LPDES Permits Database (NPDES).

If a potential mitigation site was determined to have the risk for REC (risk for HTRW), then the site was further evaluated to determine whether the boundaries of the site could be adjusted to exclude the area(s) posing a risk for REC. If the boundaries could be adjusted to exclude the problem area(s) and still satisfy other applicable screening criteria, then the boundaries were adjusted accordingly, and the resultant site was retained as a potential location for mitigation measures. If the boundaries could not be adjusted in this manner, then the site was excluded from further consideration.

3.2 JUSTIFICATION, AND LEGAL AND POLICY REFERENCES

- Construction of Civil Works projects in HTRW-contaminated areas should be avoided where practicable. USACE ER 1165-2-132, 6.b.
- Alternative project plans may consider avoidance of HTRW as well as possible responses. At least one alternative plan should be formulated to avoid HTRW sites to the maximum extent possible, consistent with project objectives. USACE ER 1165-2-132, 8.a.
- Civil Works plan formulation and plan selection may be substantially influenced by the presence of HTRW in the project area. HTRW sites will be avoided whenever practicable. USACE ER 1165-2-132, 8.d.
- The development of a response plan for dealing with HTRW, as well as response measures to relocate HTRW or to treat the HTRW in place is 100% Non-Federal cost. USACE ER 1165-2-132, Table 1.

SECTION 4

In kind replacement of impact AAHUs by habitat type (exception: BLH-Dry can be mitigated as BLH-Wet)

4.1 DEFINITION AND APPLICATION

This criterion specifies that impacts must be mitigated by replacing the same habitat type as was originally impacted. In kind is defined as a resource of a similar structural and functional type to the impacted resource (40 CFR 230.92). Functions mean the physical, chemical and biological processes that occur in ecosystems (40 CFR 230.92). The application of this criterion eliminated projects that attempted to mitigate fresh/intermediate marsh impacts with anything other than a fresh/intermediate project, brackish/saline marsh impacts with anything other than a brackish/saline marsh project, swamp impacts with anything other than a swamp project, BLH-dry impacts with anything other than a BLH project, and BLH-wet impacts with anything other than a BLH-wet project. In addition, protected side projects for flood side impacts were eliminated since a loss of functions and values inherent in flood side habitats would occur resulting in out of kind mitigation. These definitions of in-kind for the purposes of MTG mitigation were developed in coordination with Federal and state resource agencies.

4.2 JUSTIFICATION, AND LEGAL AND POLICY REVIEW

- Comply with the Fish and Wildlife Coordination Act by giving full consideration to reports and recommendations furnished by the Secretary of the Interior (U. S. Fish and Wildlife Service), the Secretary of Commerce (National Marine Fisheries Service), and the appropriate head of the State agency exercising administration over the fish and wildlife resources. ER 1105-2-100, Section d(3)(b).
- Mitigation plans shall ensure that impacts to bottomland hardwood forests are mitigated in kind, to the extent possible. 33 U.S.C. 2283(d)(1).
- Other habitat types are mitigated to not less than in kind condition to the extent possible. 33 U.S.C. 2283(d)(1).
- The Secretary of Commerce is required to obtain the views of Federal agencies affected by the program, including the Department of the Interior, and to ensure that these views have been given adequate consideration before approval of Coastal Zone Management Plans. 16 U.S.C. 1451-1464.
- Mitigation plans shall ensure that adverse impacts to bottomland hardwood forests are mitigated in-kind, to the extent possible. The intent is that the bottomland hardwood forest as an ecological system be mitigated rather than mitigating for

faunal species in an upland hardwood forest habitat type. In this instance "to the extent possible" shall take into consideration the availability of manageable units of existing or restorable bottomland hardwood forests and the practicability and feasibility of implementing management measures to accomplish in-kind mitigation. In-kind mitigation means providing replacement resources of the same type and value as those being impacted. It is not necessarily acre-for-acre but replacement of similar habitat quality or functions and values. Consultation with appropriate Federal and non-Federal agencies is required in complying with this requirement. ER 1105-2-100, C4 h(2).

The justification for eliminating the use of protected side projects for flood-side impacts stems from the notion that aquatic ecosystems lose habitat value when the natural hydrology of the ecosystem is altered by impoundment. This notion is supported by the metrics used in the Wetland Value Assessment Methodology Community Models used to quantify impacts and benefits for the MTG system.

- Coastal Wetlands Planning, Protection and Restoration Act, Wetland Value Assessment Methodology, Bottomland Hardwood Community Model - Variable V4, Hydrology: Bottomland hardwood stands in the Louisiana Coastal Zone generally occur in one of four basic hydrology classes or water regimes: 1) efficient forced drainage system, 2) irregular periods of inundation due to an artificially lowered water table, 3) extended inundation or impoundment because of artificially raised water table, and 4) essentially unaltered. The optimum bottomland hardwood hydrology (SI= 1.0) is one that is essentially unaltered, allowing natural wetting and drying cycles which are beneficial to vegetation and associated fish and wildlife species. When a bottomland hardwood stand is part of an efficient forced drainage system, the vegetative component provides some habitat value, but wildlife species which are dependent on water would essentially be excluded year-round, and the area would not in any way serve to promote fish production (SI = 0.1). With a moderately lowered water table, the vegetative component of the site could provide excellent habitat for many wildlife species and temporary habitat for wildlife species which are dependent on water, but fish would generally be excluded (SI = 0.5). With a raised water table, fish habitat and habitat for water-dependent wildlife could be equivalent to an unaltered system; however, other wildlife species could be adversely affected because of water-related impacts to the vegetative components of the stand (SI = 0.5).
- Coastal Wetlands Planning, Protection and Restoration Act, Wetland Value Assessment Methodology, Swamp Community Model - Variable V3, Water regime: This variable considers the duration and amount of water flow/exchange. Four flow/exchange and four flooding duration categories are described to characterize the water regime. The optimal water regime is assumed to be seasonal flooding with abundant and consistent riverine/tidal input and water flow-through (SI=1.0). Seasonal flooding with periodic drying cycles is assumed to contribute to increased nutrient cycling (primarily through oxidation and decomposition of accumulated detritus), increased vertical structure complexity

(due to growth of other plants on the swamp floor), and increased recruitment of dominant overstory trees. In addition, abundant and consistent input and water flow-through is optimal, because under that regime the full functions and values of a swamp in providing fish and wildlife habitat are assumed to be maximized. Temporary flooding is also assumed to be desirable. Habitat suitability is assumed to decrease as water exchange between the swamp and adjacent systems is reduced. The combination of permanently flooded conditions and no water exchange (e.g., an impounded swamp where the only water input is through rainfall and the only water loss is through evapotranspiration and ground seepage) is assumed to be the least desirable (SI=0.1).

- Coastal Wetlands Planning, Protection and Restoration Act, Wetland Value Assessment Methodology, Coastal Marsh Community Models for Brackish and Intermediate Marsh - Variable V6, Aquatic Organism Access: Access by estuarine aquatic organisms (i.e., transient and resident species), is considered to be a critical component in assessing the quality of a given marsh system. Additionally, a marsh with a relatively high degree of access by default also exhibits a relatively high degree of hydrologic connectivity with adjacent systems, and therefore may be considered to contribute more to nutrient exchange than would a marsh exhibiting a lesser degree of access. Optimal conditions are assumed to exist when all of the study area is accessible and the access points are entirely open and unobstructed.

SECTION 5
Technical Viability

5.1 DEFINITION AND APPLICATION

As applied to MTG Mitigation, technically viable means capable of achieving ecological functionality from a scientific or engineering standpoint. As specifically applied during screening, alternatives were only screened under this criterion if the conditions in the vicinity of the proposed alternative were not supportive of a target habitat type. In addition, projects that did not produce positive mitigation benefits were not considered further.

5.2 JUSTIFICATION, AND LEGAL AND POLICY REFERENCES

WRDA 2007 requires that mitigation for water resources projects achieve ecological success. Additionally, USACE regulations specify that civil works projects must be implementable, feasible, constructible, reliable, and functional. Specific excerpts of WRDA 2007 and these regulations are provided below:

- MITIGATION REQUIREMENTS…INCLUSIONS.—A specific mitigation plan for a water resources project … shall include, at a minimum—(i) a plan for monitoring the implementation and ecological success of each mitigation measure, including the cost and duration of any monitoring, and, to the extent practicable, a designation of the entities that will be responsible for the monitoring; (ii) the criteria for ecological success by which the mitigation will be evaluated and determined to be successful based on replacement of lost functions and values of the habitat, including hydrologic and vegetative characteristics; … and (v) a contingency plan for taking corrective actions in cases in which monitoring demonstrates that mitigation measures are not achieving ecological success in accordance with criteria under clause (ii)… DETERMINATION OF SUCCESS…CONSULTATION.—In determining whether a mitigation plan is successful under subparagraph (A), the Secretary shall consult annually with appropriate Federal agencies and each State in which the applicable project is located on at least the following: (i) The ecological success of the mitigation as of the date on which the report is submitted. (ii) The likelihood that the mitigation will achieve ecological success, as defined in the mitigation plan. (iii) The projected timeline for achieving that success. (iv) Any recommendations for improving the likelihood of success. 33 U.S.C. 2283.
- [Principles and Guidelines] Evaluation Criteria: (1)… Two primary dimensions to acceptability are implementability and satisfaction. Implementability means that the alternative is feasible from technical, environmental, economic, financial,

political, legal, institutional, and social perspectives. If it is not feasible due to any of these factors, then it cannot be implemented, and therefore is not acceptable. An infeasible plan should not be carried forward for further consideration. USACE ER 1105-2-100, E-3. General Policies a. The Planning Process, (4) Step 4-Evaluate alternative plans.

- …habitat-based evaluation methodologies, supplemented with production, user-day, population census, and/or other appropriate information, shall be used to the extent possible to describe and evaluate ecological resources and impacts associated with alternative plans. ER 1105-2-100, Section C-4 f.
- Mitigation plan components include documentation of the functions and values that will result from the mitigation. 33 U.S.C. 2283.

SECTION 6

Measures That are in the Future Without Project Condition

6.1 DEFINITION AND APPLICATION

The Future Without Project Condition for MTG Mitigation is defined in part by the measures (projects) that would likely exist in the absence of the implementation of the MTG Mitigation.

6.2 JUSTIFICATION, AND LEGAL AND POLICY REFERENCES

Establishment of the Future Without Project Condition is required for alternative plan evaluation in USACE civil works planning, as described in the below bullets. The impacts of alternatives, including benefits, are qualitatively or quantitatively described as the different between the Future Without and Future With Project Condition. Specific excerpts of these regulations are provided below:

- The second step of the planning process is to develop an inventory and forecast of critical resources (physical, demographic, economic, social, etc.) relevant to the problems and opportunities under consideration in the planning area. This information is used to further define and characterize the problems and opportunities. A quantitative and qualitative description of these resources is made, for both current and future conditions, and is used to define existing and future without-project conditions. Existing conditions are those at the time the study is conducted. The forecast of the future without-project condition reflects the conditions expected during the period of analysis…The future without-project condition provides the basis from which alternative plans are formulated and impacts are assessed. Since impact assessment is the basis for plan evaluation, comparison and selection, clear definition and full documentation of the without-project condition are essential. Gathering information about historic and existing conditions requires an inventory. Gathering information about potential future conditions requires forecasts, which should be made for selected years over the period of analysis to indicate how changes in economic and other conditions are likely to have an impact on problems and opportunities. Information gathering and forecasts will most likely continue throughout the planning process. USACE ER 1105-2-100, Section 2-3 b.
- The without-project condition is the most likely condition expected to exist in the future in the absence of a proposed water resources project. Proper definition and forecast of the future without-project condition are critical to the success of the planning process. The future without-project condition constitutes the benchmark against which plans are evaluated. Forecasts of future without-project conditions

shall consider all other actions, plans and programs that would be implemented in the future to address the problems and opportunities in the study area in the absence of a Corps project. Forecasts should extend from the base year (the year when the proposed project is expected to be operational) to the end of the period of analysis. ER 1105-2-100, Section 2-4 b (1).

SECTION 7
Independent Utility

7.1 DEFINITION AND APPLICATION

The project would not be dependent on implementation of or modification to other projects for ecological success and fulfillment of Average Annual Habitat Unit (AAHU) requirement. If the sustainability or technical viability would be reliant upon another project, the net benefits of the project could not be guaranteed such that mitigation credit could be secured.

7.2 JUSTIFICATION, AND LEGAL AND POLICY REFERENCES

- The least cost mitigation plan that provides full mitigation of losses specified in mitigation planning objectives, and which is unconstrained except for required legal and technical constraints, shall always be identified and displayed. ER 1105-2-100, Section C-4 f (1).

A project without independent utility may not meet the P&G "completeness" criteria. Completeness is the extent to which a given alternative plan provides and accounts for all necessary investments or other actions to ensure the realization of the planned effects. If the success of a project depends upon factors beyond the control of the planning team that are required to make the plan's effects (benefits) a reality, it would not meet the completeness criteria. ER 1105-2-100, Section 2-3 c (2).

- …mitigation, including acquisition of the lands or interests – (A) shall be undertaken or acquired before any construction of the project …, or (B) shall be undertaken or acquired concurrently with lands and interests in lands for project purposes (other than mitigation of fish and wildlife losses)… WRDA 1986, 33 U.S.C.. 2283(a).

If a project's ecological success relies upon the implementation or modification of another project, there is increased risk in delay of mitigation implementation.

- Temporal loss is the time lag between the loss of aquatic resource functions caused by the permitted impacts and the replacement of aquatic resource functions at the compensatory mitigation site. Higher compensation ratios may be required to compensate for temporal loss. When the compensatory mitigation project is initiated prior to, or concurrent with, the permitted impacts, the district engineer may determine that compensation for temporal loss is not necessary, unless the resource has a long development time. 33 CFR Part 332.2.

The potential time lag in implementation of mitigation for such projects could reduce their cost effectiveness due to higher compensation ratios and thus increased required acreage.

SECTION 8
Scalability

8.1 DEFINITION AND APPLICATION

The size of a given alternative must have the ability to increase or decrease the number of AAHUs it would provide over the 50-year period of analysis in a practical, logical and technically feasible manner. For example, the PDT used aerial photography and GIS capabilities to determine whether adequate acreage was available to increase a particular project polygon in case mitigation requirements were increased.

8.2 JUSTIFICATION, AND LEGAL AND POLICY REFERENCES

Under the premise laid forth in the Antideficiency Act, 31 U.S.C. 1341 et seq., the USACE’s ability to expend funds to produce AAHUs is limited to the mitigation requirement for MTG impacts. Funds expended for AAHUs above those required for MTG mitigation could be viewed as a violation of this fiscal law.

The exact MTG mitigation requirement will not be determined until all as-builts become available for MTG projects and final AAHUs of impact are determined. Early estimates of acreages needed are based on MTG designs rather than as-builts, as well as previous WVAs conducted for similar projects. The number of acres needed to mitigate for MTG unavoidable losses will continue to evolve throughout the planning and design phases, as impact acreage are revised. The selected projects must be scalable such that the mitigation designs can be adjusted to produce only the required AAHUs.

SECTION 9
Site Must Meet 100% of Mitigation Need

9.1 DEFINITION AND APPLICATION

This criterion specifies that the MTG mitigation projects must address the entire mitigation requirement for the habitat type being restored at that site.

9.2 JUSTIFICATION, AND LEGAL AND POLICY REVIEW

These criteria limit alternative plan combinations and work toward identifying projects that will result in large contiguous tracts of land for the purposes of greater ecological output within the watershed. In addition, the consolidation of mitigation projects produces cost efficiencies experienced during construction and O&M phases. Mitigation for protected side impacts with flood side mitigation projects was based on additional functions and values assessed for providing a restored hydrology and connectivity with other wetland habitats. The BLH WVA assigns increasing benefits as the acres of contiguous forested land increase (Variable V5), and assesses benefits for surrounding land use with contiguity with other forested and marsh areas that allow for wildlife movement receiving the greatest credit (Variable V6).

- Variable V5 – Size of Contiguous Forested Area.

Although edge and diversity, which are dominant features of small forested tracts, are important for certain wildlife species, it is important to understand four concepts: 1) species which thrive in edge habitat are highly mobile and presently occur in substantial numbers, 2) because of forest fragmentation and ongoing timber harvesting by man, edge and diversity are quite available, 3) most species found in "edge" habitat are "generalists" in habitat use and are quite capable of existing in larger tracts, and 4) those species in greatest need of conservation are "specialists" in habitat use and require large forested tracts. Therefore, the basic assumption for this variable is that larger forested tracts are less common and offer higher quality habitat than smaller tracts. For this model, tracts greater than 500 acres in size are considered large enough to warrant being considered optimal and receive a suitability index of 1. Tracts up to 5 acres receive a SI of 0.2, tracts from 5.1 to 20 acres receive a SI of .4, tracts from 21.1 to 100 receive a SI of .4, and tracts from 100.1 to 500 acres receive a SI of .8.

- Variable V6– Suitability and Traversability of Surrounding Land Uses

Many wildlife species commonly associated with bottomland hardwoods will often use adjacent areas as temporary escape or resting cover and seasonal or diurnal food sources. Surrounding land uses which meet specific needs can render a given area of bottomland hardwoods more valuable to a cadre of wildlife species. Additionally, the type of surrounding land use may encourage, allow, or discourage wildlife movement between two or more desirable habitats. Land uses which allow such movement essentially increase the amount of habitat available to wildlife populations. The weighting factor assigned to various land uses reflects their estimated potential to meet specific needs and allow movement between more desirable habitats. For this model, contiguity with other forested areas and marsh receive the greatest suitability (1.0) because of the ability for contiguous habitats to allow wildlife movement.

SECTION 10

List of Acronyms and Abbreviations

AAHU	Average Annual Habitat Unit
ASTM	American Society for Testing and Materials
BRS	Biennial Reporting System
BLH	Bottomland Hardwood
CERCLIS	Comprehensive Environmental Response, Compensation and Liability Information System
CORRACTS	Corrective Action Report
EPA	Environmental Protection Agency
ER	Engineering Regulation
ERNS	Emergency Response Notification System
FINDS	Facility Index System/Facility Identification Initiative Program Summary Report
HIST LUST	Historic Leaking Underground Storage Tanks
HMIRS	Hazardous Materials Information Reporting System
HTRW	Hazardous, Toxic, and Radioactive Waste
LUST	Leaking Underground Storage Tanks
MLTS	Material Licensing Tracking System
MTG	Morganza to the Gulf
NFRAP	No Further Remedial Action Planned Sites
PADS	PCB Activity Database System
PCB	Polychlorinated Biphenyl Activities
O&M	Operation & Maintenance
PDT	Project Delivery Team
P&G	Principles & Guidelines
RAATS	RCRA Administrative Action Tracking System
RCRIS	Resource Conservation and Recovery Information System
REC	Recognized Environmental Conditions
RECRA	Resource Conservation and Recovery Act

ROD	Records of Decision
SHWS	Solid and Hazardous Waste Sites
SI	Suitability Index
SWF/LF	Solid Waste Facilities/Landfill Sites
TRIS	Toxic Chemical Release Inventory System
TSCA	Toxic Substances Control Act
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank Database
WRDA	Water Resources Development Act
WVA	Wetland Value Assessment

Mississippi Valley Division,
Regional Planning and Environment Division South

Morganza to the Gulf of Mexico, Louisiana, Hurricane and Storm Damage Risk Reduction Project

Appendix C – Attachment 2 – Evaluation Criteria

October 2025

CONTENTS

LIST OF TABLES

LIST OF FIGURES

No table of figures entries found.

SECTION 1
Introduction

In brief, plan selection criteria reflect project goals. For instance, if the mission is to buy a car, goals may be to have a low start-up and operating cost. This scenario would have the criteria of retail cost and gas mileage. Note that constraints are not considered criteria (i.e. the retail cost of the car must be under $20K) because alternatives cannot be compared based on this information. Selection criteria vary widely depending on the problem and can even vary within the umbrella of Civil Works. But for the purposes of MTG Environmental Mitigation, the Project Delivery Team (PDT) has identified the following plan selection criteria:

- Cost Effectiveness
- Risk & Reliability
- Environmental Impacts
- Watershed & Ecological Site Considerations
- Time Considerations

1.1 COST EFFECTIVENESS

Cost analysis plays a central role in virtually every management decision, including decision making in environmental planning. In environmental planning, the cost of plans and the output provided by those plans are examined to determine their relative production efficiency. Also, cost variations are examined as output levels increase to facilitate the selection of a desirable scale of output.

Implementation Costs are what economists might refer to as “explicit costs”; they are the out-of-pocket, cash outlays for the production of environmental outputs. Examples of implementation costs might include outlays for preconstruction engineering and design, real estate, construction, OMRR&R (operation, maintenance, repair, replacement and rehabilitation), and monitoring.

For the purposes of cost effectiveness and incremental cost analyses, the total cost of an environmental restoration or mitigation plan equals the sum of all implementation costs and opportunity costs of foregone national economic development benefits. The total cost of each alternative plan under study, together with its associated level of output, can be used as the inputs to cost effectiveness analysis to identify all cost-effective production alternatives.

Incremental cost is the change in cost that results from a decision. It is for this reason that incremental cost is the most important cost concept for most production decisions. In the context of environmental planning, incremental cost is the additional cost incurred by choosing to select one plan instead of another plan. Incremental cost is computed by subtracting the cost of the last alternative under consideration from the cost of the alternative currently under consideration. It's the difference in cost between one alternative and the next.

In cost effectiveness analysis, the plans that produce the same output level as another plan but cost more; or cost either the same amount or more than another plan, but produces less output are filtered out.

1.2 RISK AND RELIABILITY

One of the Chief's 4 priorities is to "employ risk-based concepts in planning, design, construction, operations, and major maintenance." Analysis of alternatives regarding their risk and reliability is a paradigm shift from deterministic methodologies (e.g. National Economic Development, Benefit/Cost ratios, etc.) to more statistical, probabilistic terms. Though the policy and even the science is still in its nascent stages, enough is usually known to begin making risk-informed decisions, at least qualitatively.

1.2.1 Risk

This criterion is defined as probability multiplied by consequences. An example of risk would be a calculation of the relative chance of saltwater intrusion during the 50-year period of analysis multiplied by magnitude of anticipated plant mortality. Actions can be implemented to reduce risk, but because risk can never be completely eliminated, *residual risk* will remain.

1.2.2 Reliability

This criterion refers to the chance that a component of the system will fail to perform its intended purpose as a function of the forces placed upon it. Reliability is often displayed using a fragility curve which describes the probability of failure as a function of an applied force. Many separate system components can be combined in an event tree to represent the reliability of a system.

Since these two factors are similar, it is best to consider them as one criterion: Risk & Reliability. Moreover, PDTs are only expected to perform Risk & Reliability analysis qualitatively. It is unlikely that PDTs will have fragility curves or event trees when analyzing alternatives. Instead, PDTs should analyze alternatives comparatively. For example,

"Alternative 1 is much more reliable than Alternative 2, but only slightly more reliable than Alternative 3."

The below risk and reliability sub-criteria (see Table C2:1-1) were applied to each mitigation alternative.

Table C2:1-1. Risk and Reliability

Issue	Explanation
Uncertainty Relative to Achieving Ecological Success/Potential Need for Adaptive Management (Contingency) Actions	Sources of uncertainty relative to achieving ecological success include: 1. incomplete understanding of the system (environmental or engineering) to be managed or restored (e.g. hydroperiod, water depth, water supply, substrate, nutrient levels, toxic compounds) 2. imprecise estimates of the outcomes of alternative management actions (e.g. proven methodology, project complexity). *Evaluation of Potential Need for Adaptive Management (Contingency) Actions:* 1. Is there sufficient flexibility within project design and operation to permit adjustments to management actions? 2. Is the system (or components) to be restored or managed well understood (e.g. hydrology and ecology) and are management outcomes accurately predictable? 3. Do participants generally agree on the most effective design and operation to achieve project goals and objectives? 4. Are the goals and objectives for restoration understood and agreed upon by all parties?
Uncertainty Relative to Implementability	Includes implementability issues that are not captured under other selection criteria. Implementability means that the alternative is feasible from technical, environmental, economic, financial, political, legal, institutional, and social perspectives. If it is not feasible due to any of these factors, then it cannot be implemented, and therefore is not acceptable. An infeasible plan should not be carried forward for further consideration. However, just because a plan is not the preferred plan of a non-Federal sponsor does not make it infeasible or unacceptable.
Long-Term Sustainability of Project Benefits	Degree to which the proposed project is affected by water surface elevation changes.

Implementation before or concurrent with construction	Can the project be implemented before or concurrent with the parent project's construction (that incurred the impacts).
Self-Sustainability of Project Once Ecological Success Criteria Linked to NCC are Achieved	1. Anticipated OMRR&R Activities 2. Relative difficulty of OMRR&R
Risk of Exposure to Stressors/ Reliability & Resiliency of Design	1. To what stressors will a given alternative be exposed (e.g. sea level rise, subsidence, saltwater intrusion during storm or drought, long-term salinity shift, herbivory, invasive species, inundation from storm surge, damage from storm-induced wave action, runoff from adjacent property which could alter chemical or nutrient balance of soils, altered hydrologic regime which could change habitat type or stress vegetation, non-storm wave energy)? 2. How is the project, as designed, likely to perform relative to stressors and/or how well is the project expected to return to functionality after exposure to stressors?

1.3 ENVIRONMENTAL

The National Environmental Policy Act (NEPA) and other environmental laws require federal agencies to consider the environmental impacts in their decision-making, identify unavoidable environmental impacts and make this information available to the public. All evaluated alternatives should be investigated with respect to environmental consequences. The NEPA document records this investigation. However, since a recommended alternative needs to be selected prior to the NEPA document being released for public review and comment, the PDT must attempt to analyze the impacts qualitatively using preliminary information, for those resources which could be impacted to differing degrees by each of the alternatives, focusing only on noteworthy differences between the alternatives.

1.4 WATERSHED AND ECOLOGICAL SITE CONSIDERATIONS

The PDT has added this selection criterion to address unique factors that apply to environmental mitigation projects that were not addressed in the previously listed selection criteria. Guidance from 40 CFR Part 230 discusses consideration of a mitigation site's role in the larger landscape and other ecological conditions. The first two headings below aim to capture this guidance.

1.4.1 Watershed Considerations/Significance within the Watershed:

Consistency with watershed plans includes guidance regarding the siting of mitigation projects. This guidance directs that mitigation should consider existing watershed plans within the project area. Therefore, the selection criteria consider how a given alternative relates to existing watershed plans within the project area. Consistency with the following watershed plans/programs were considered:

- 2023 Louisiana State Master Plan
- Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) program projects

Other important watershed considerations used to evaluate the alternatives included:

- Contiguous with or within resource managed area (i.e. Federal, state, private mitigation bank or other restoration projects considered under Future Without Project condition)
- Located in parish of impact by habitat-type

Ecological Site Considerations not captured in WVA:

- Fragmentation within site boundary
- Site habitat connectivity to larger surrounding project area considering future land use trends

1.5 TIME CONSIDERATIONS

The PDT must analyze the likely implementation schedules for mitigation alternatives. Time metrics account for engineering and design, real estate acquisition, construction, and period to project turn-over. Time metrics include:

- Estimated time to acquire necessary RE.
- Time to construction complete.

1.6 PRINICPLES AND GUIDELINES (P&G)

These P&G defined below were considered and captured under the screening criteria or the comparison criteria above.

Completeness

This criterion is a determination of whether or not the plan includes all elements necessary to achieve the objectives. It is an indication of the degree to which the outputs of the plan are dependent upon the actions of others. Compliance with this criterion is ensured by implementation of the screening criteria “Must have independent utility” and “Can be easily scaled to meet changing mitigation acreage requirements”. No alternatives without independent utility or the flexibility to meet changing mitigation acreage requirements should have been carried forward into alternative comparison.

Effectiveness

This criterion is the extent to which an alternative plan alleviates the specified problems and achieves the specified opportunities (P&G Section VI.1.6.2(c)(2)). Alternative plans that do not contribute or minimally contribute to the planning objectives should be dropped from consideration. Compliance with this criterion is ensured by implementation of the screening criteria “Technical Viability”. All alternatives should have developed to ensure their technical viability or effectiveness before being carried forward into alternative comparison.

Efficiency

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

Acceptability

This criterion is the workability and viability of the alternative plan with respect to acceptance by State and local entities and the public and compatibility with existing laws, regulations, and public policies (P&G Section VI.1.6.2(c)(4). Acceptability means a measure or alternative plan is technically, environmentally, economically, and socially feasible. Alternative plans that are clearly not feasible should be dropped from further consideration. This criterion is evaluated under all alternative comparison criteria, especially Risk and Reliability, Watershed Considerations/Significance in Watershed, and Environmental.

SECTION 2
List of Acronyms and Abbreviations

CE	Cost Effectiveness
CEICA	Cost Effectiveness/Incremental Cost Analysis
CWPPRA	Coastal Wetland Planning, Protection and Restoration Act
ER	Engineering Regulation
MTG	Morganza to the Gulf
NCC	National Coordination Center
NEPA	National Environmental Policy Act
OMRR&R	Operation, Maintenance, Repair, Replacement, & Rehabilitation
PDT	Project Delivery Team
P&G	Principles and Guidelines
RE	Real Estate
WVA	Wetland Value Assessment

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Appendix C – Attachment 3 – Project Maps

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Bottomland Hardwood Forest and Swamp Project Maps

1.1 NAPOLEONVILLE

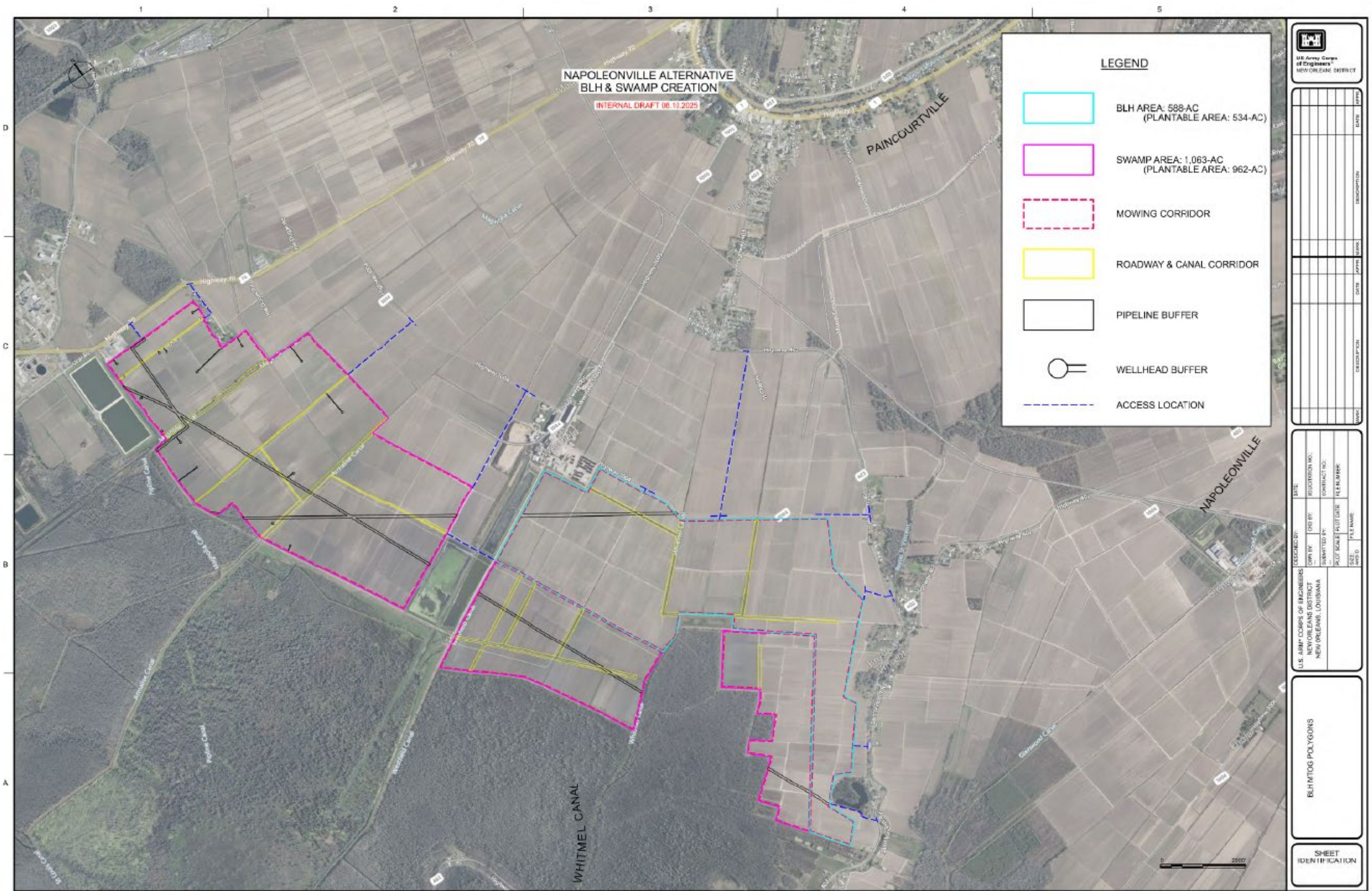

Figure C3:1-1 Napoleonville BLH and Swamp Project Map

1.2 SUPREME

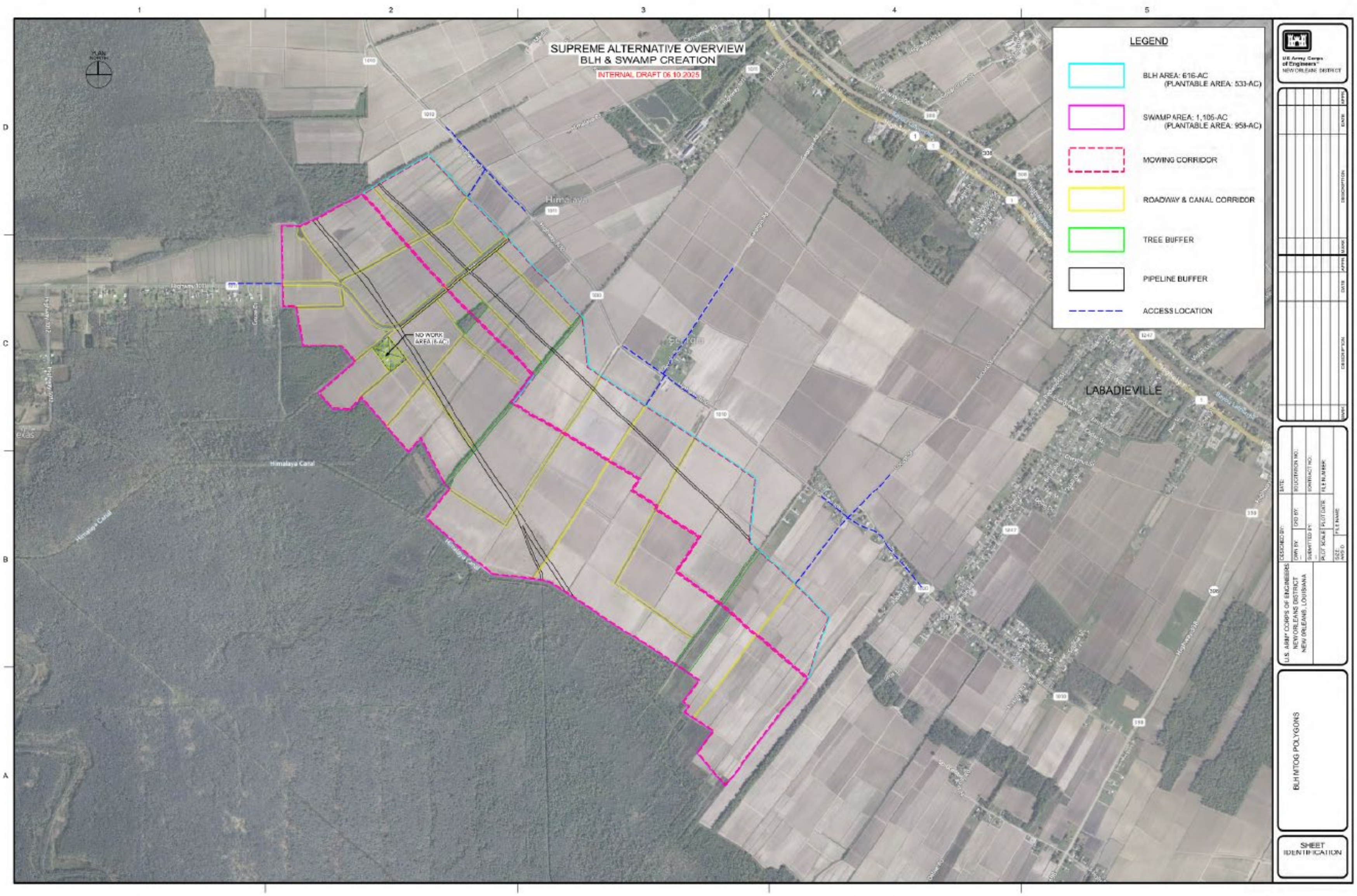

Figure C3:2-1. Supreme BLH and Swamp Project Map

SECTION 2

Brackish and Saline Marsh Project Maps

2.1 WEST TERREBONNE

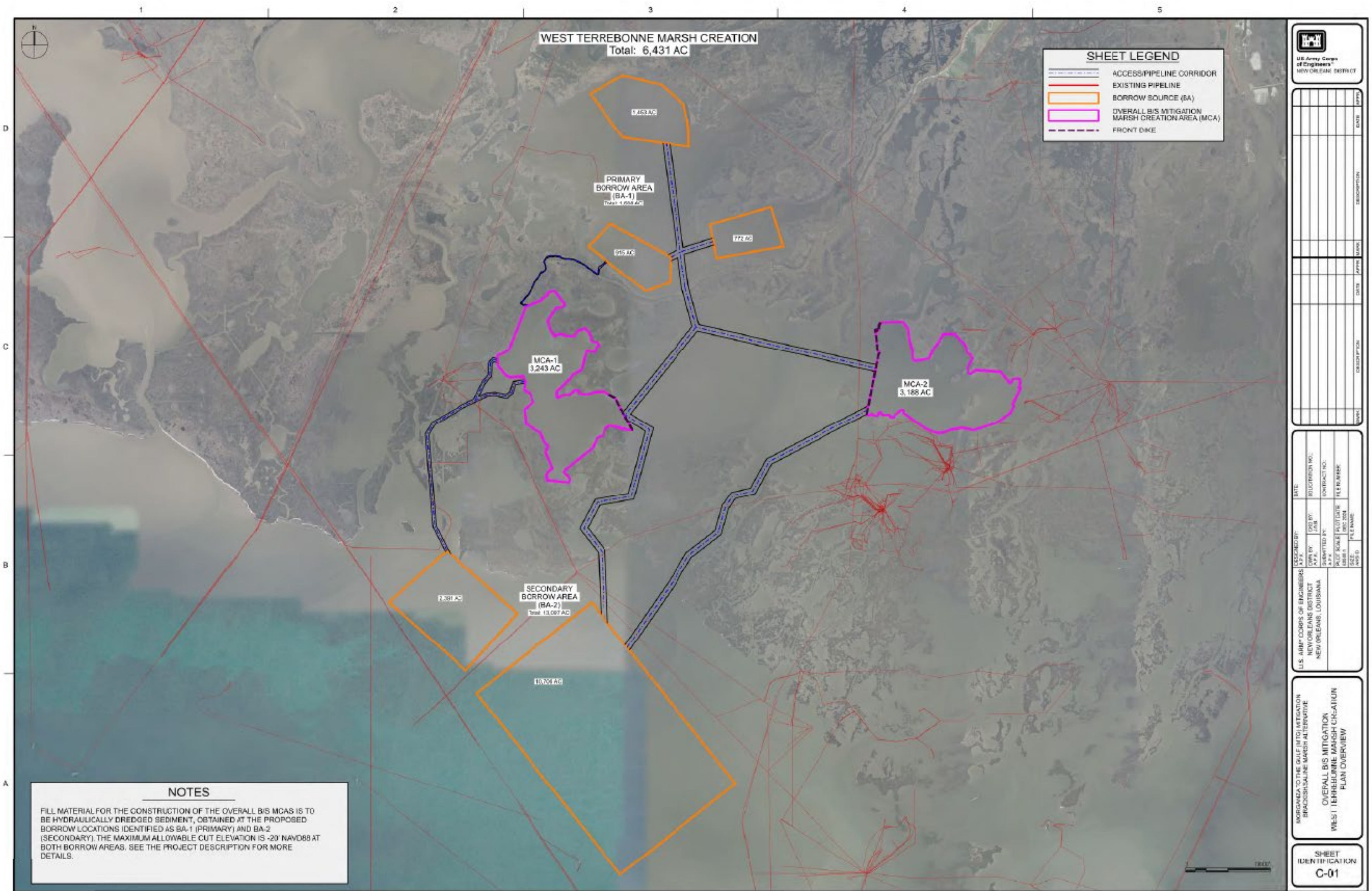

Figure C3:1-1a. West Terrebonne Project Map.

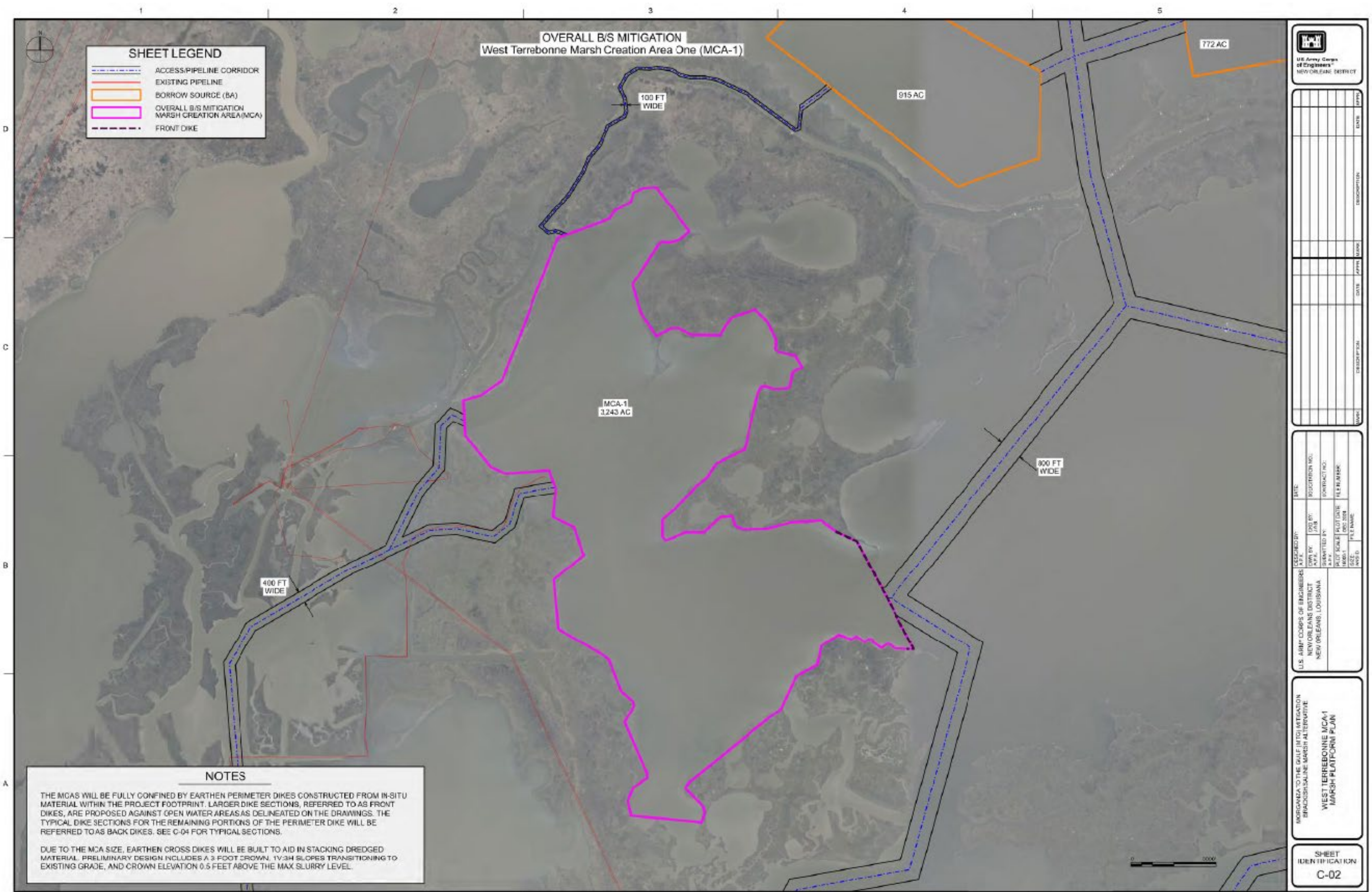

Figure C3:1-1b. West Terrebonne Project Map.

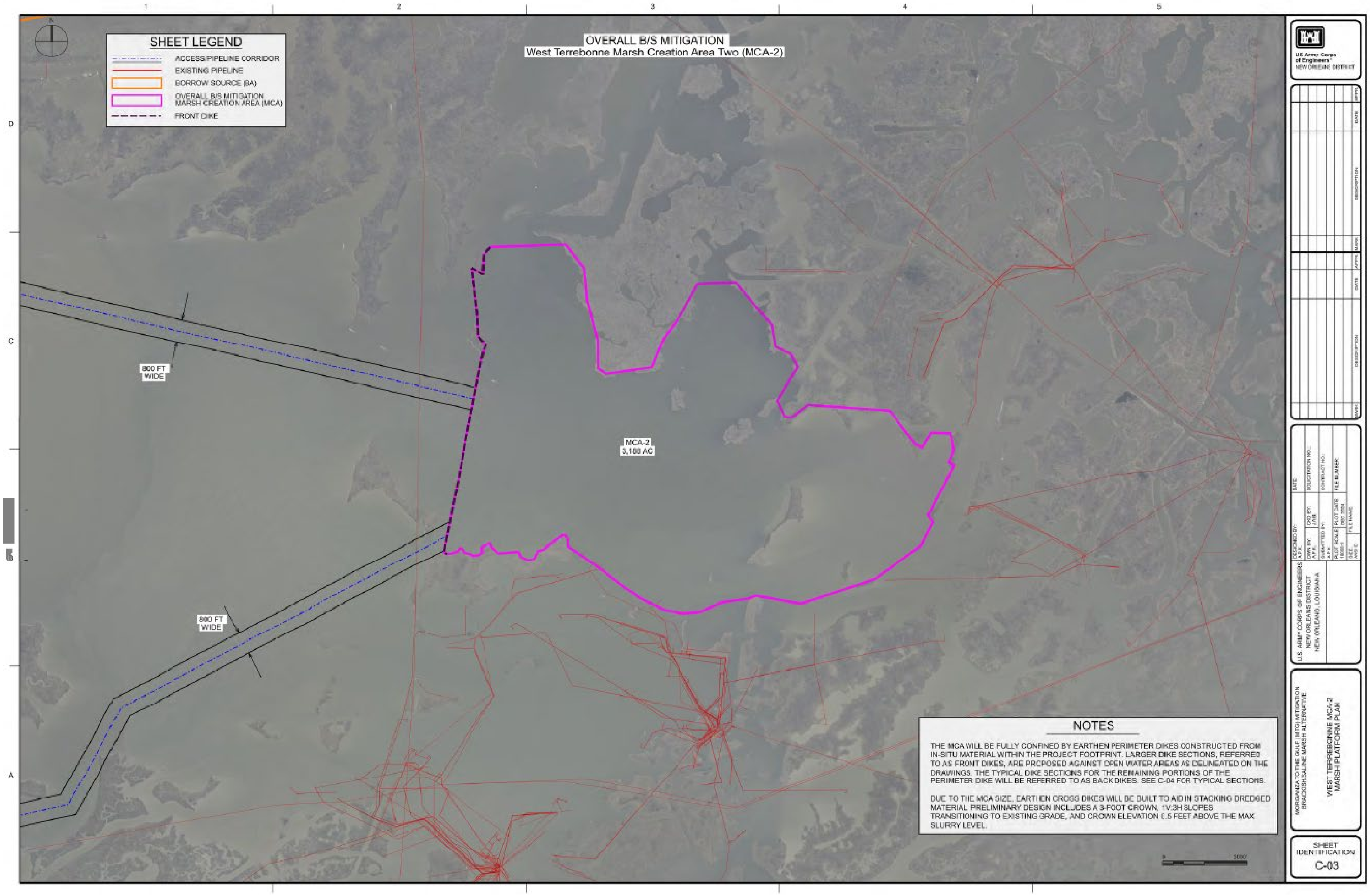

Figure C3:1-1c. West Terrebonne Project Map.

2.2 NORTH BARATARIA BAY

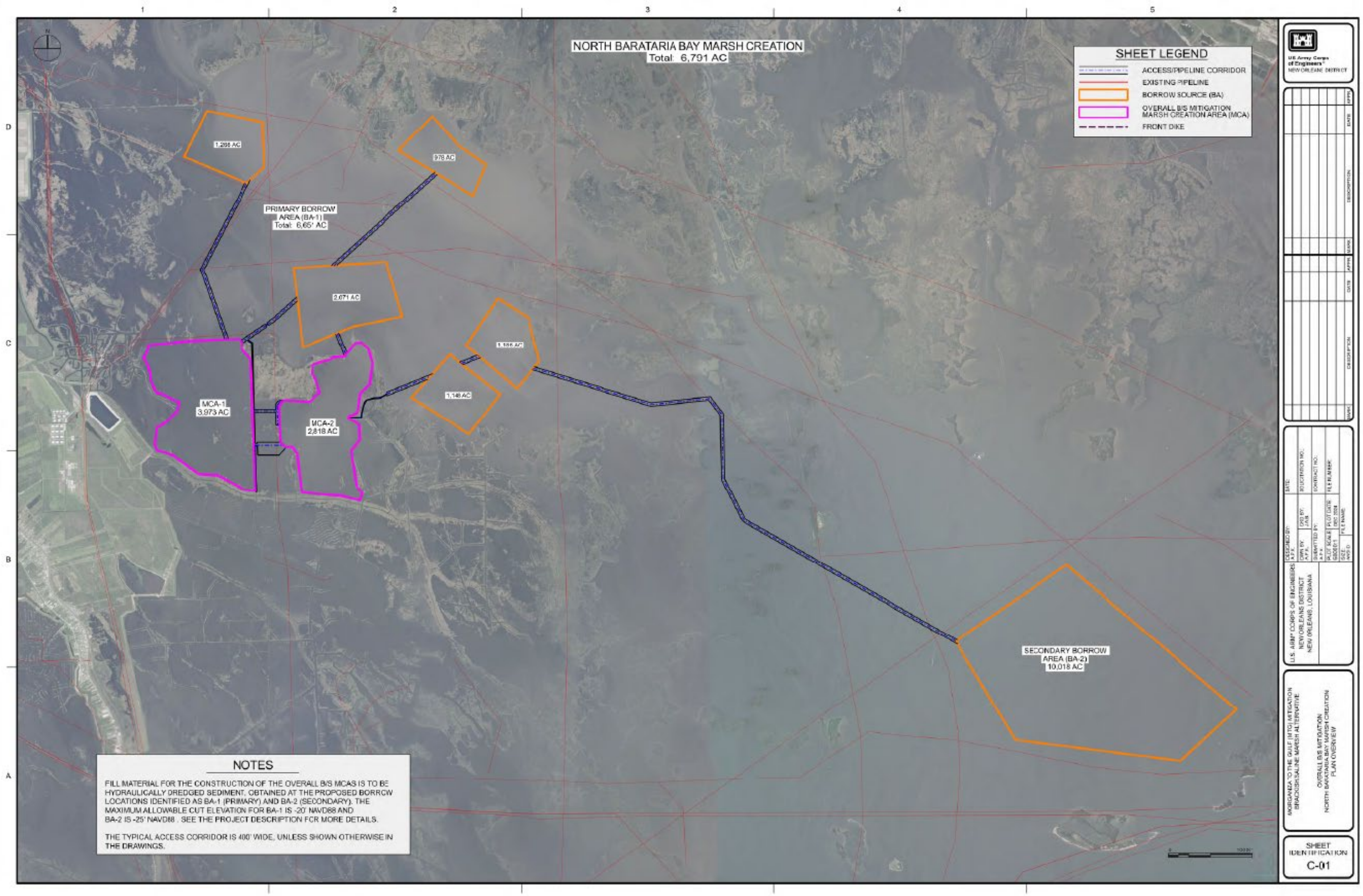

Figure C3:2-1a. North Barataria Bay Project Map.

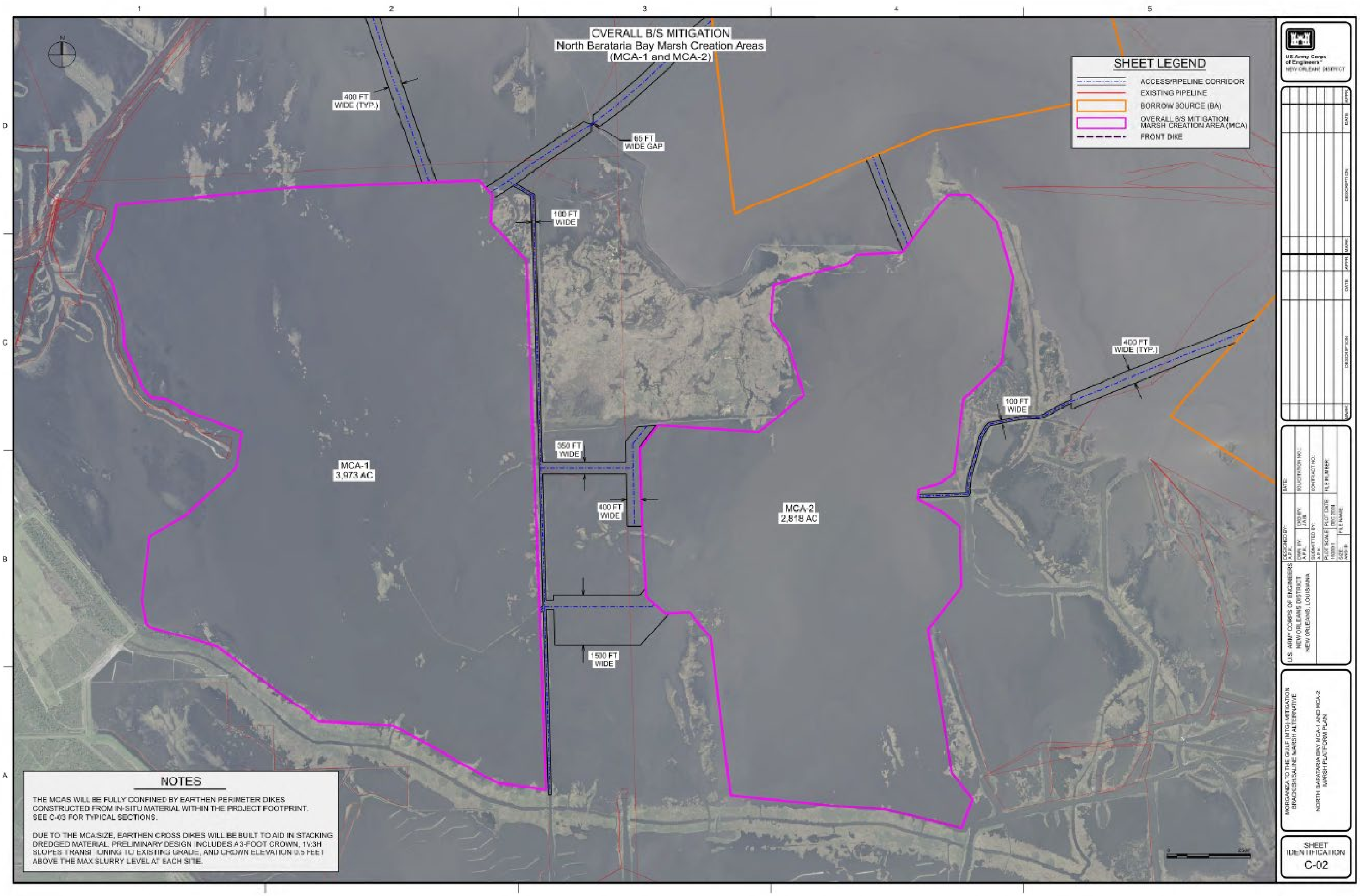

Figure C3:2-1b. North Barataria Bay Project Map.

2.3 ISLE DE JEAN CHARLES

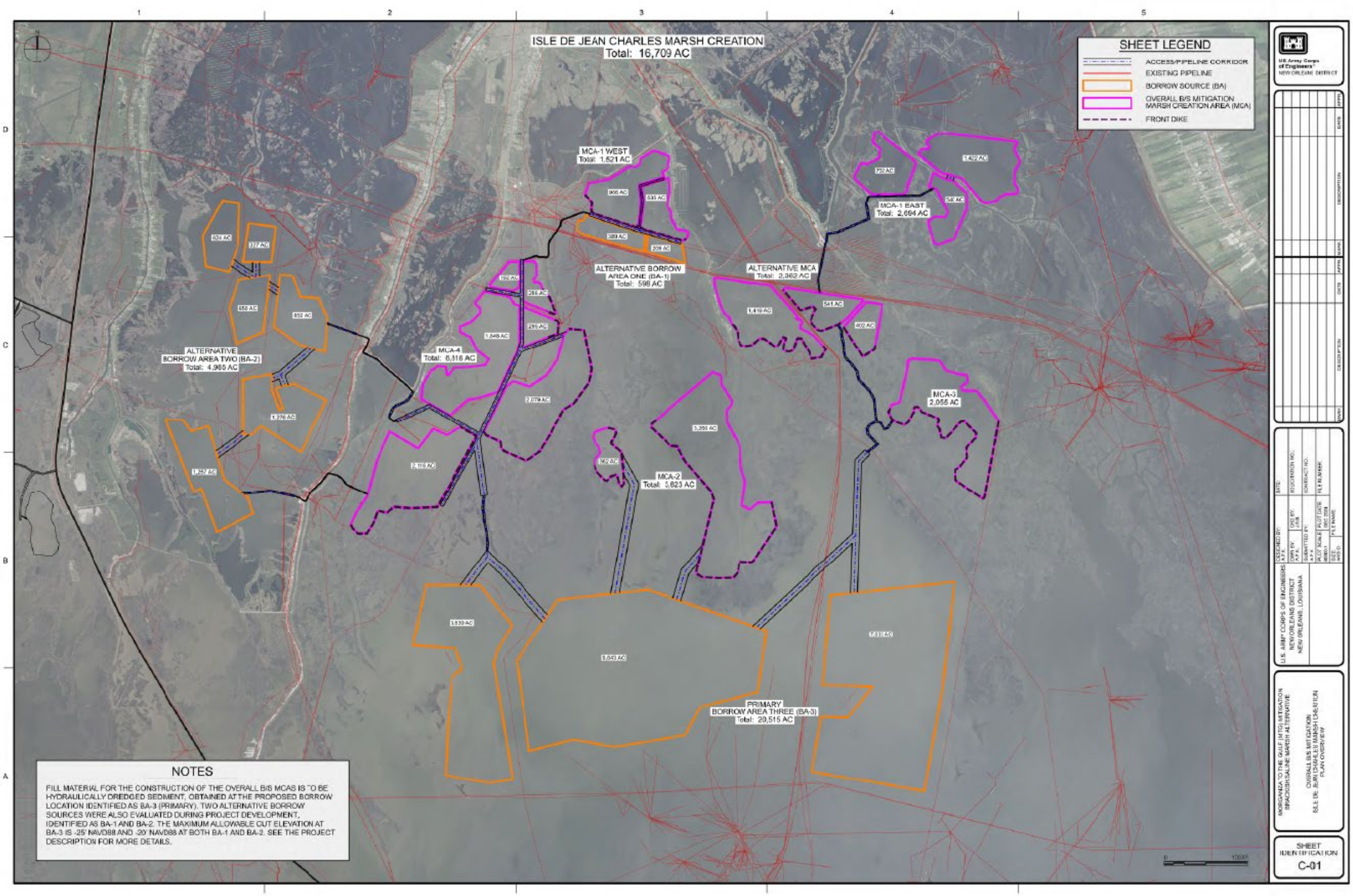

Figure C3:3-1a. Isle De Jean Charles Project Map.

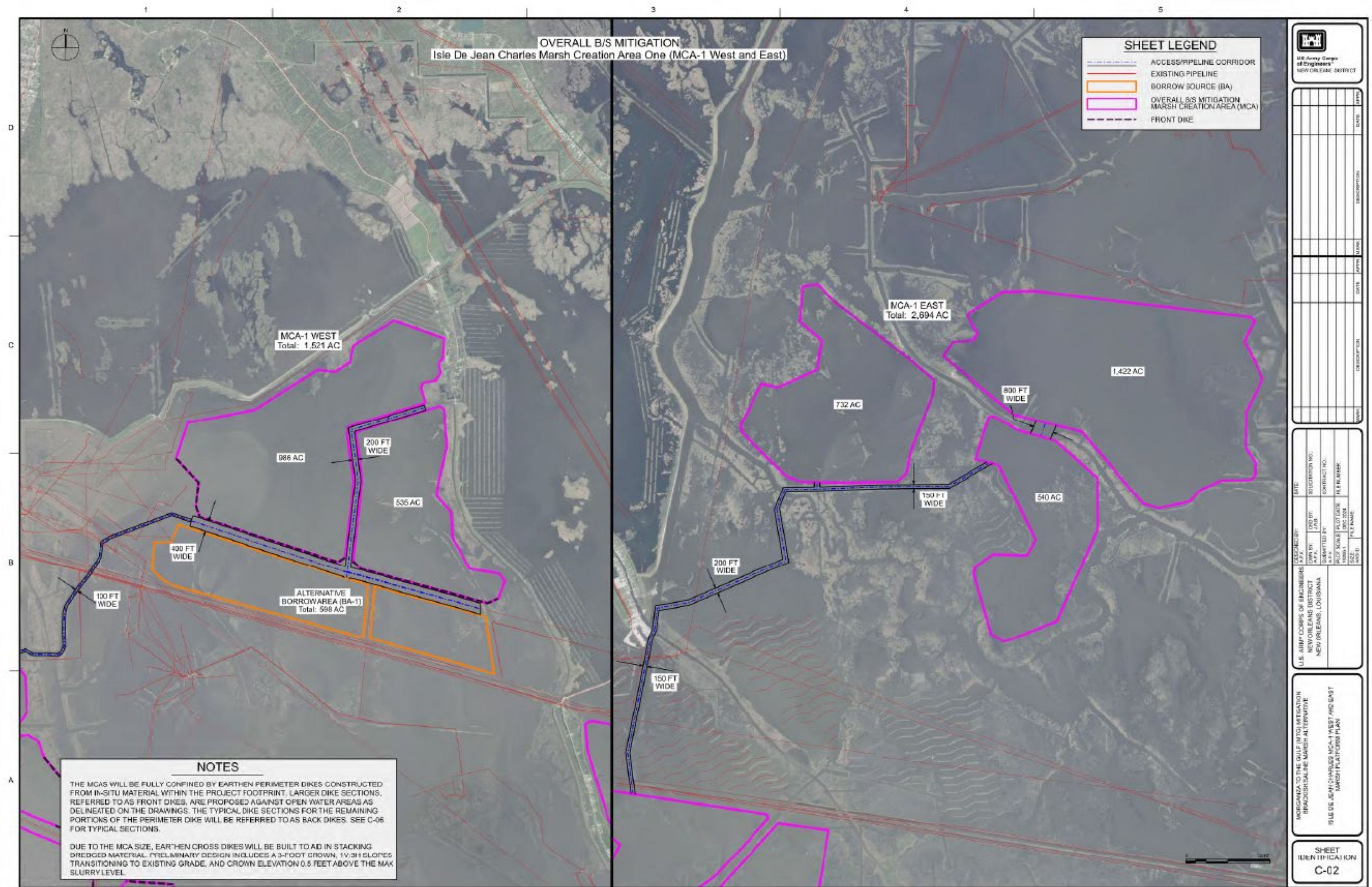

Figure C3:3-1b. Isle de Jean Charles Project Map.

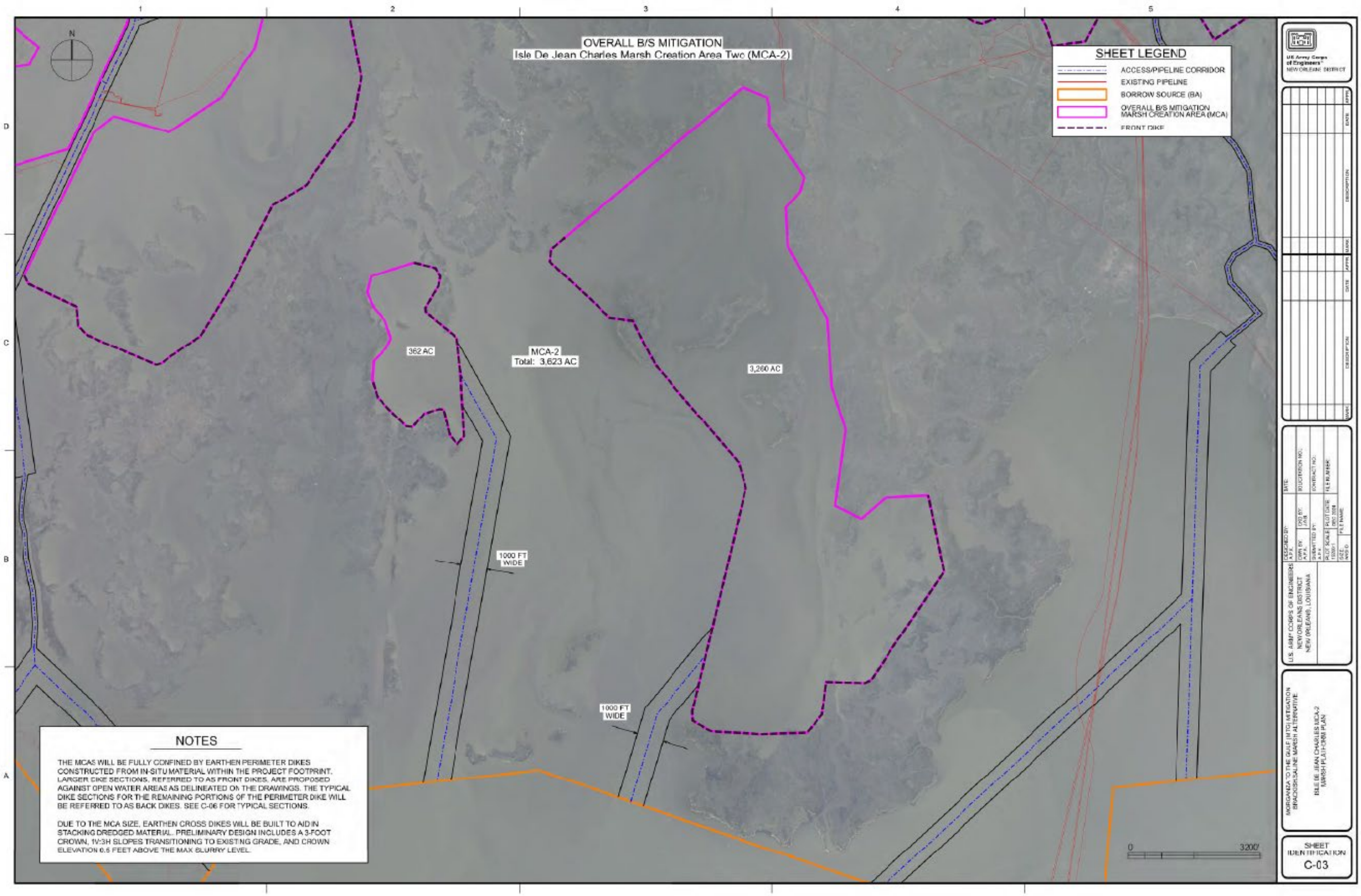

Figure C3:3-1c. Isle de Jean Charles Project Map.

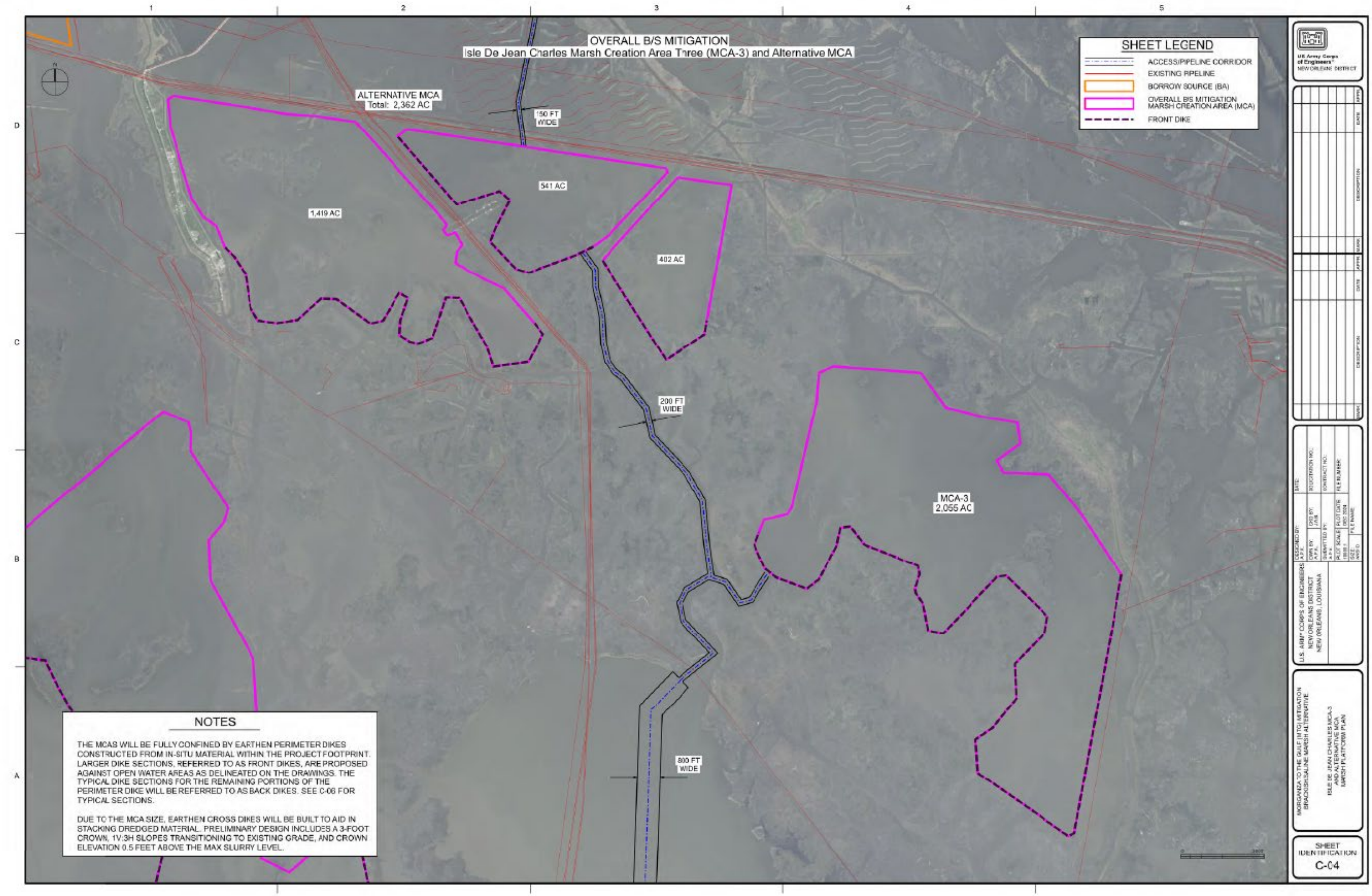

Figure C3:3-1c. Isle de Jean Charles Project Map.

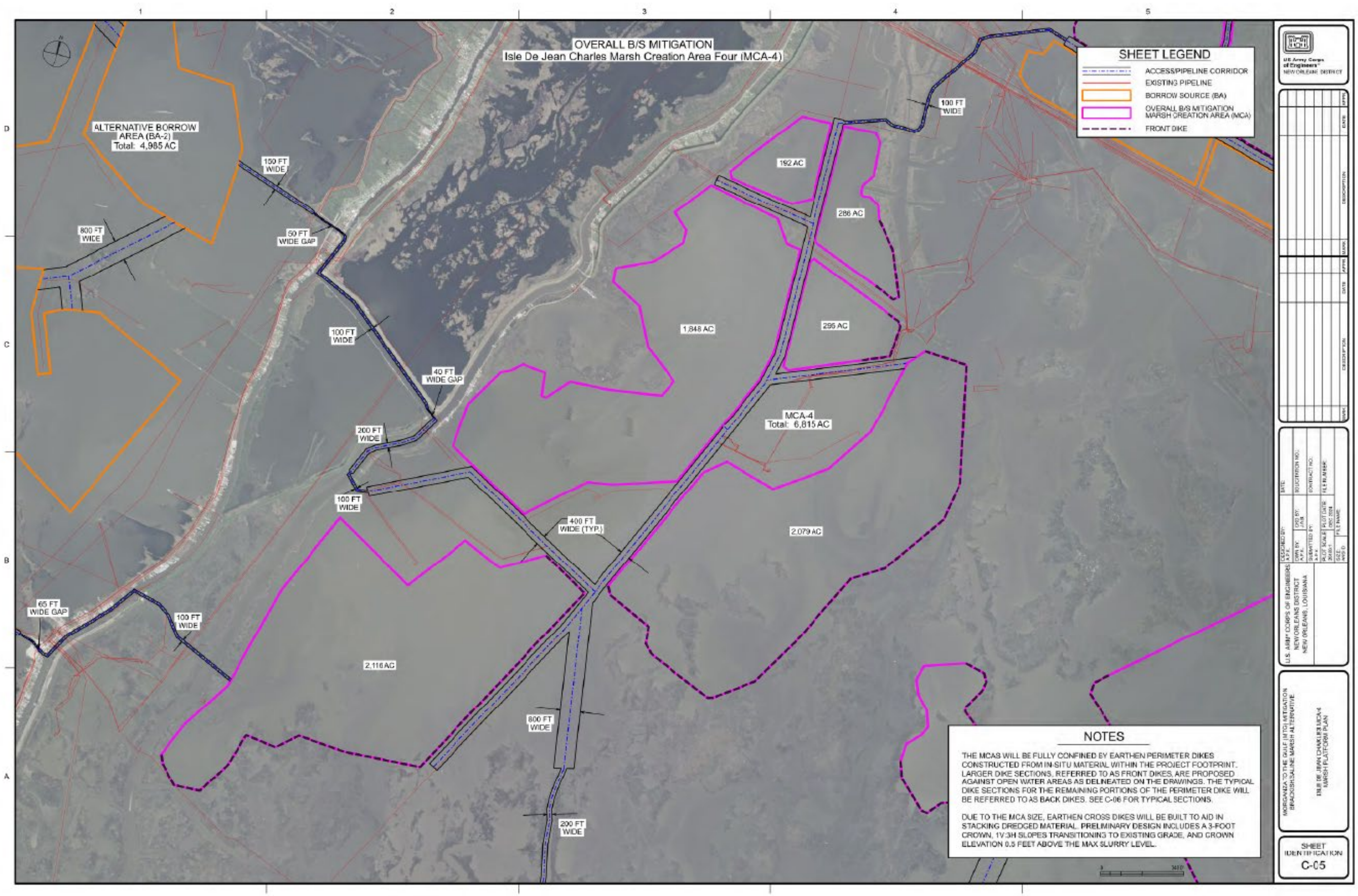

Figure C3:3-1d. Isle de Jean Charles Project Map.

2.4 THREE MILE BAY

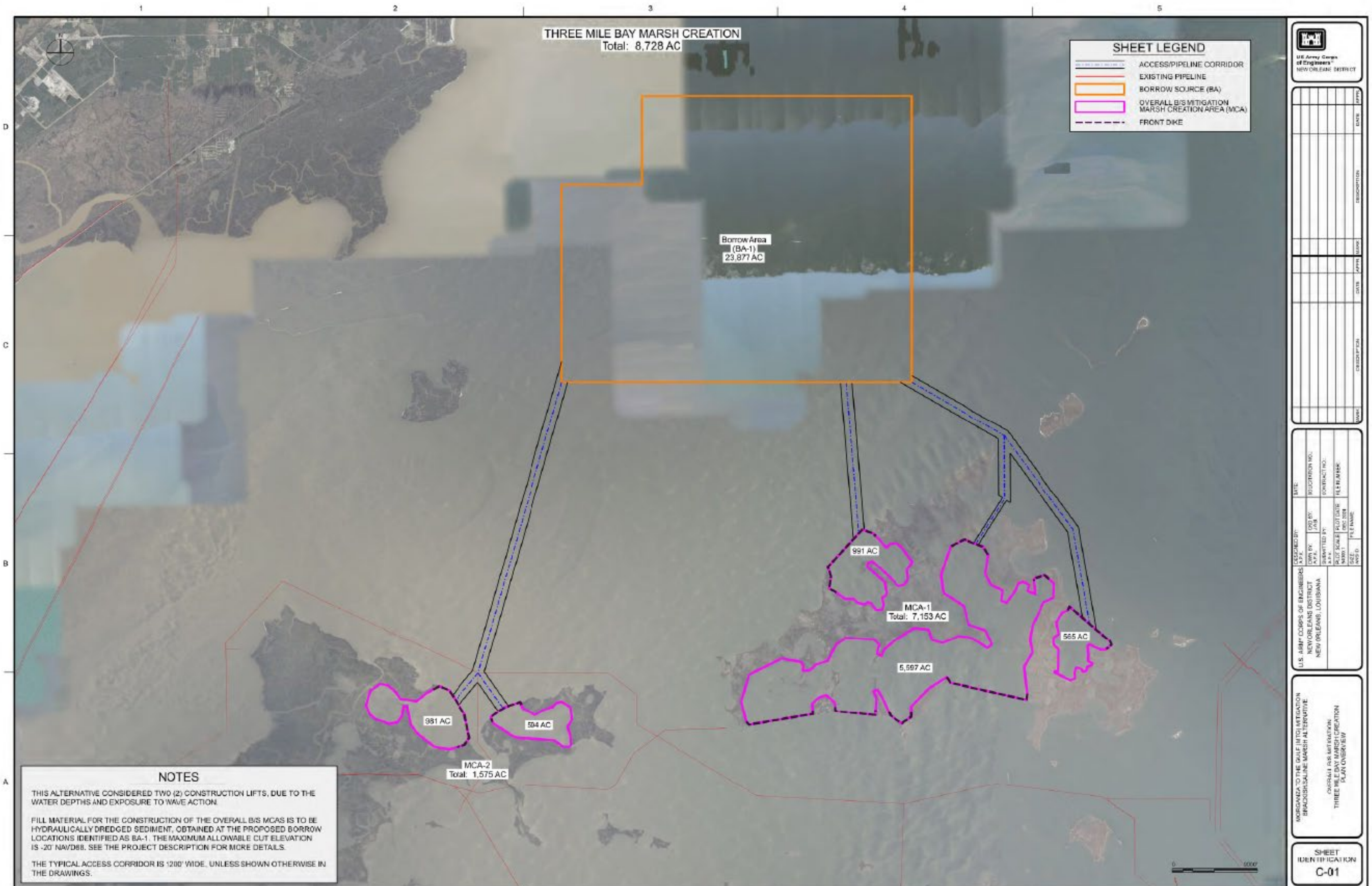

Figure C3:4-1a.Three Mile Bay Project Map.

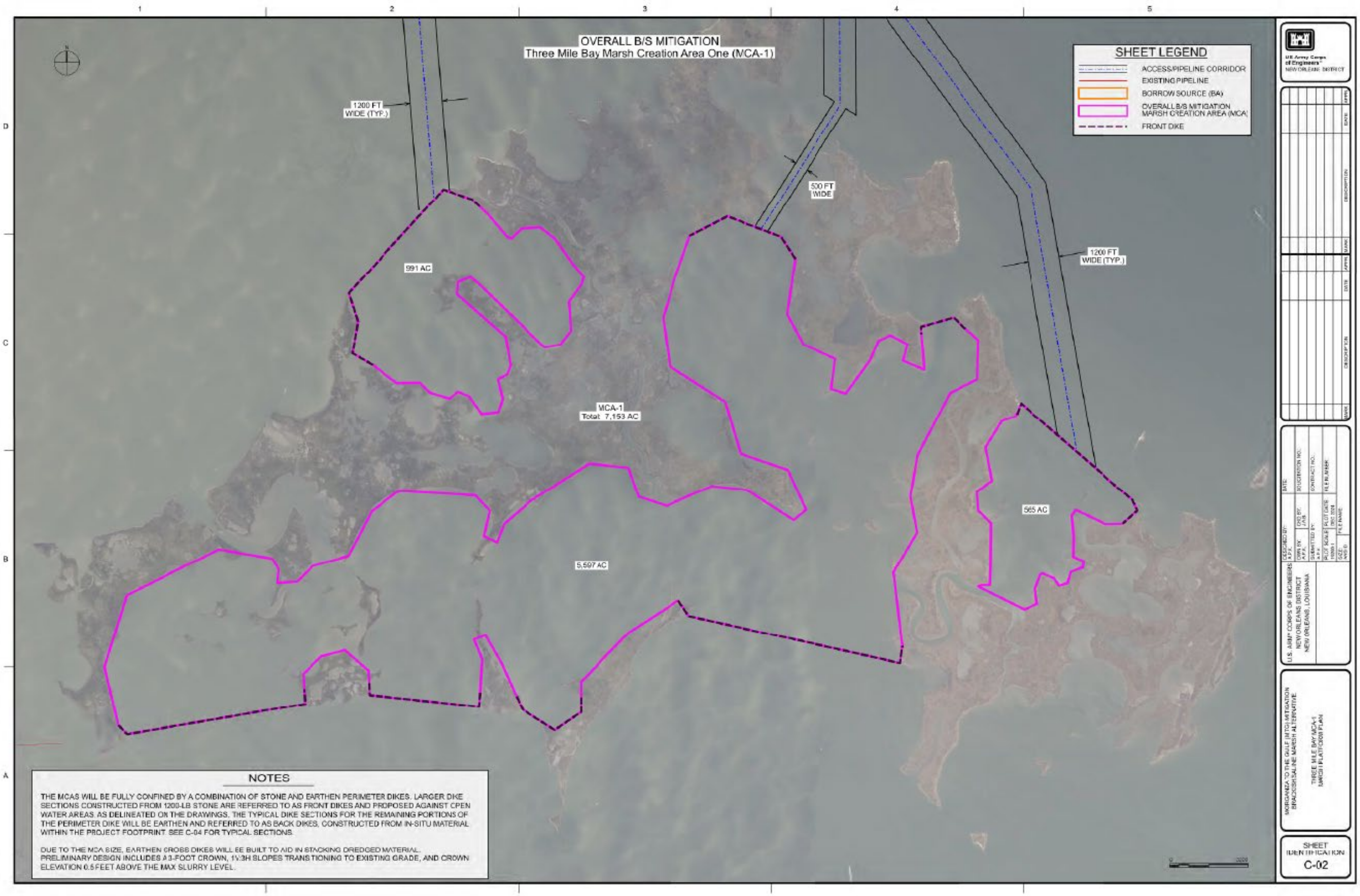

Figure C3:4-1b. Three Mile Bay Project Map.

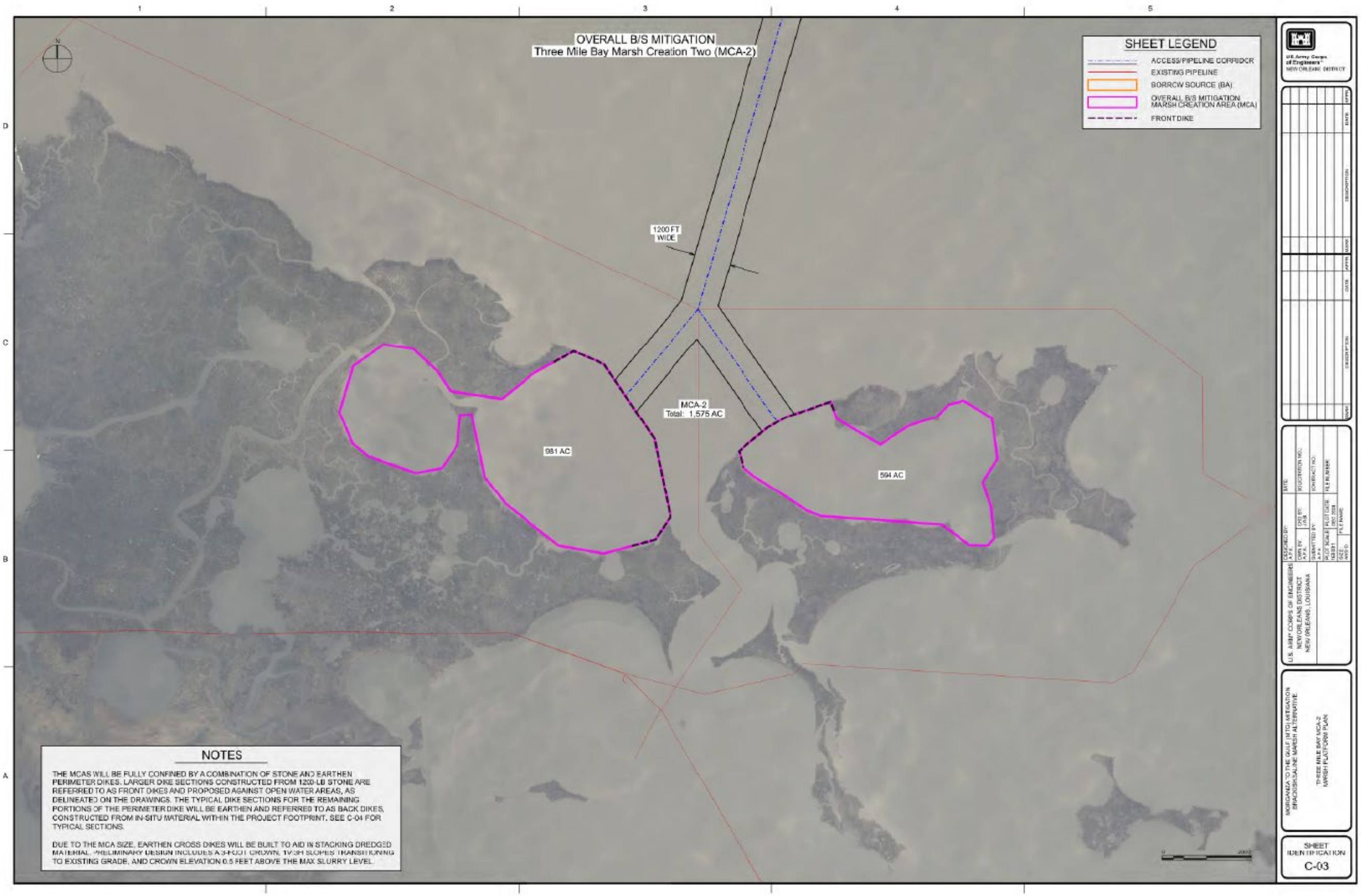

Figure C3:4-1c. Three Mile Bay Project Map

SECTION 3

Fresh and Intermediate Marsh Project Maps

3.1 LAKE SALVADOR

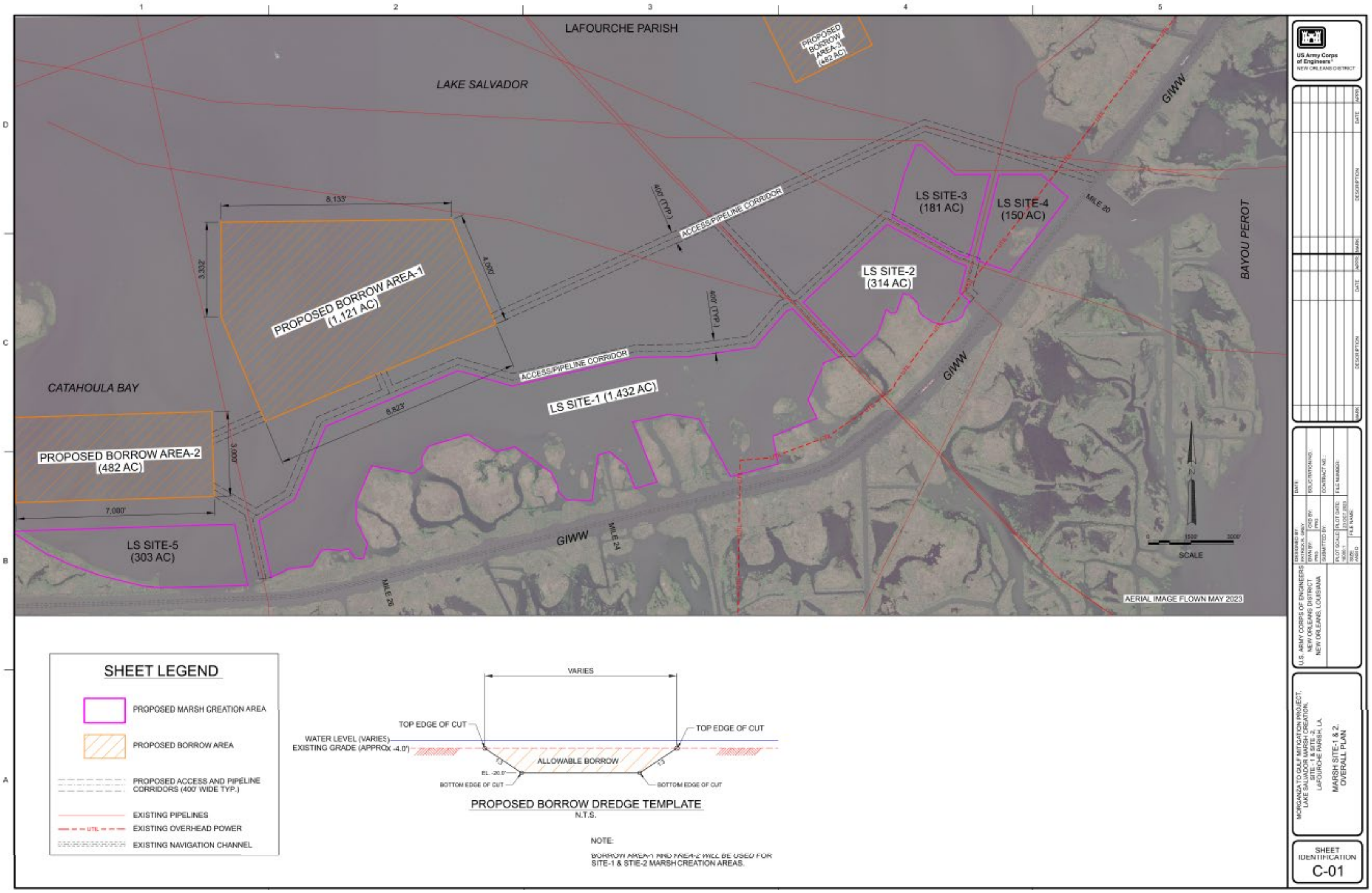

Figure C3:1-1a. Lake Salvador Project Map

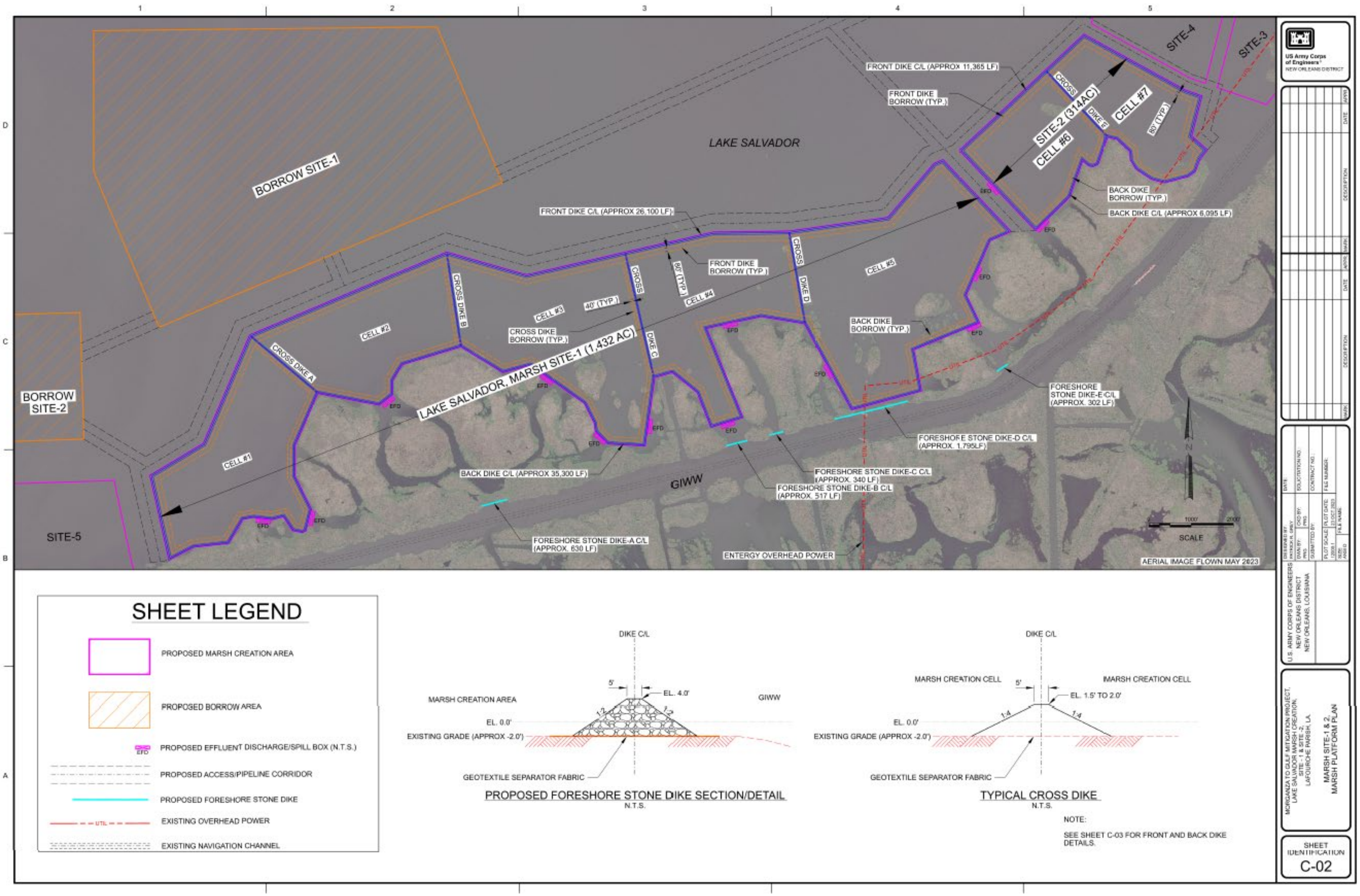

Figure C3:1-1b. Lake Salvador Project Map

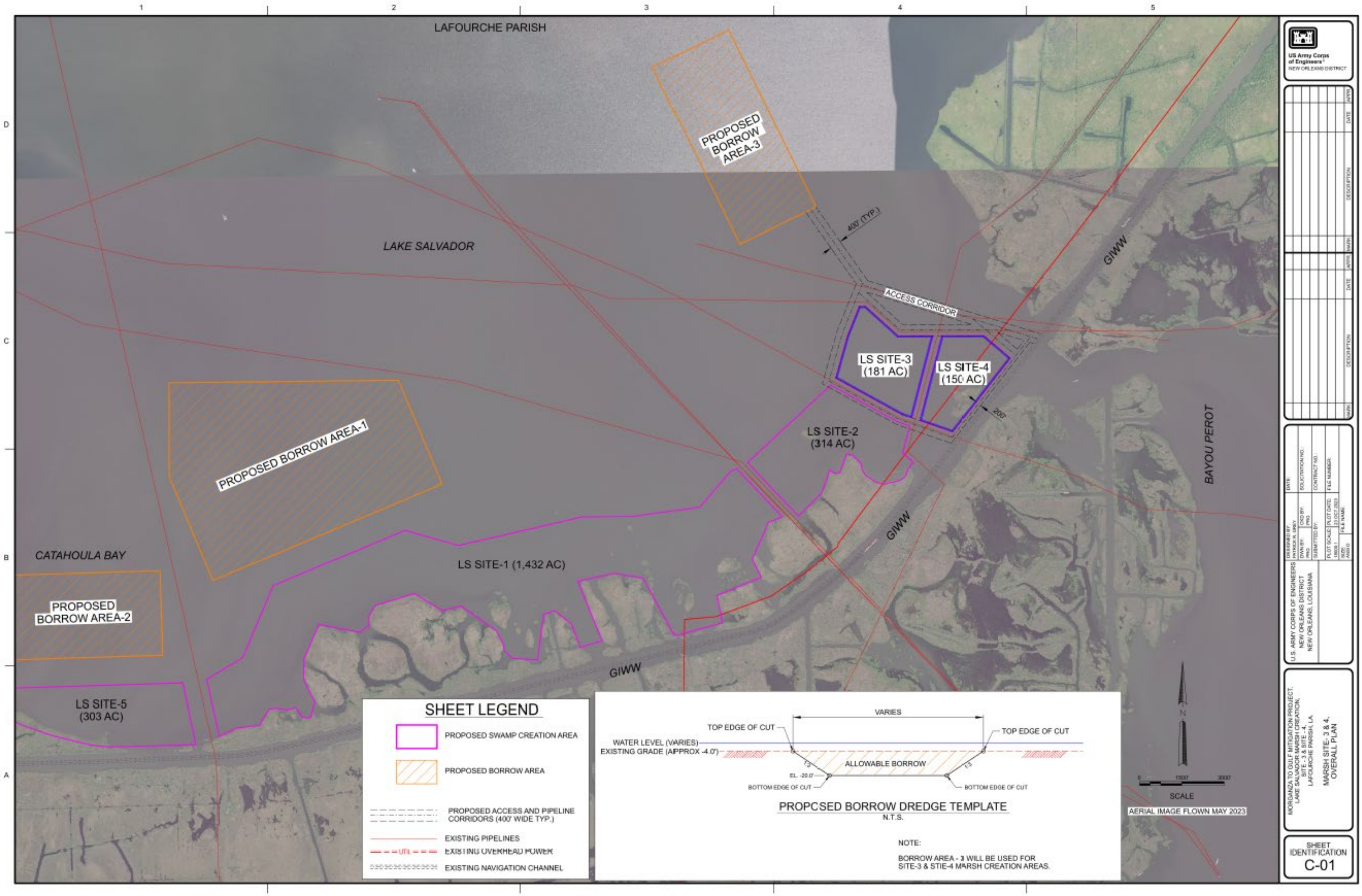

Figure C3:1-1c. Lake Salvador Project Map

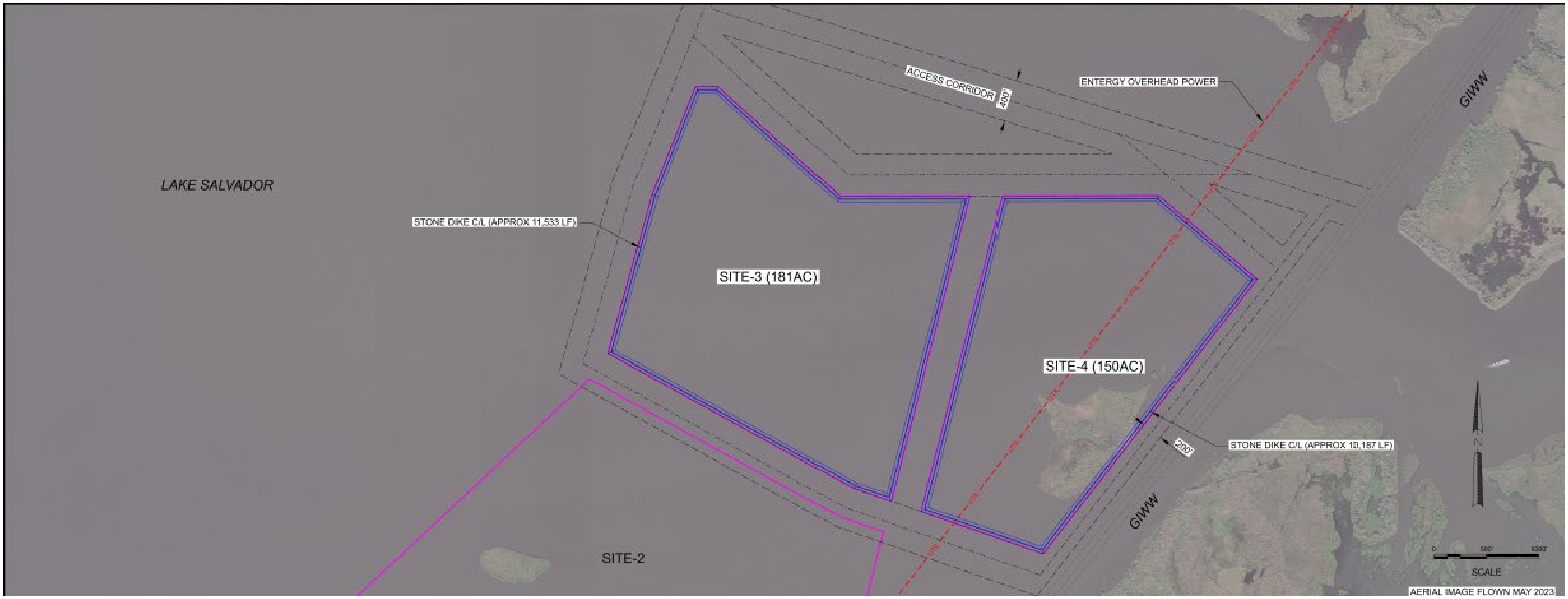

Figure C3:1-1d. Lake Salvador Project Map

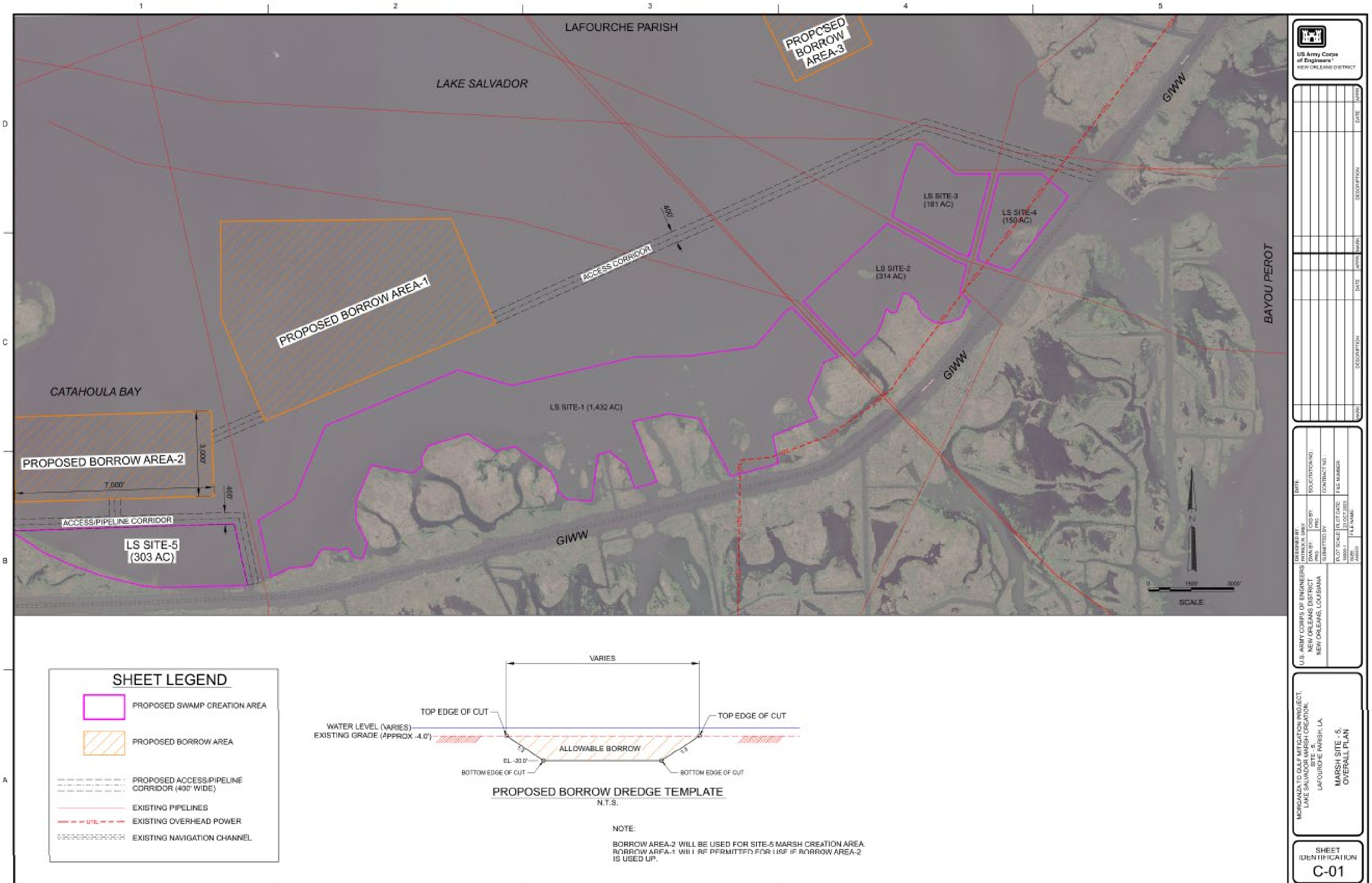

Figure C3:1-1e. Lake Salvador Project Map

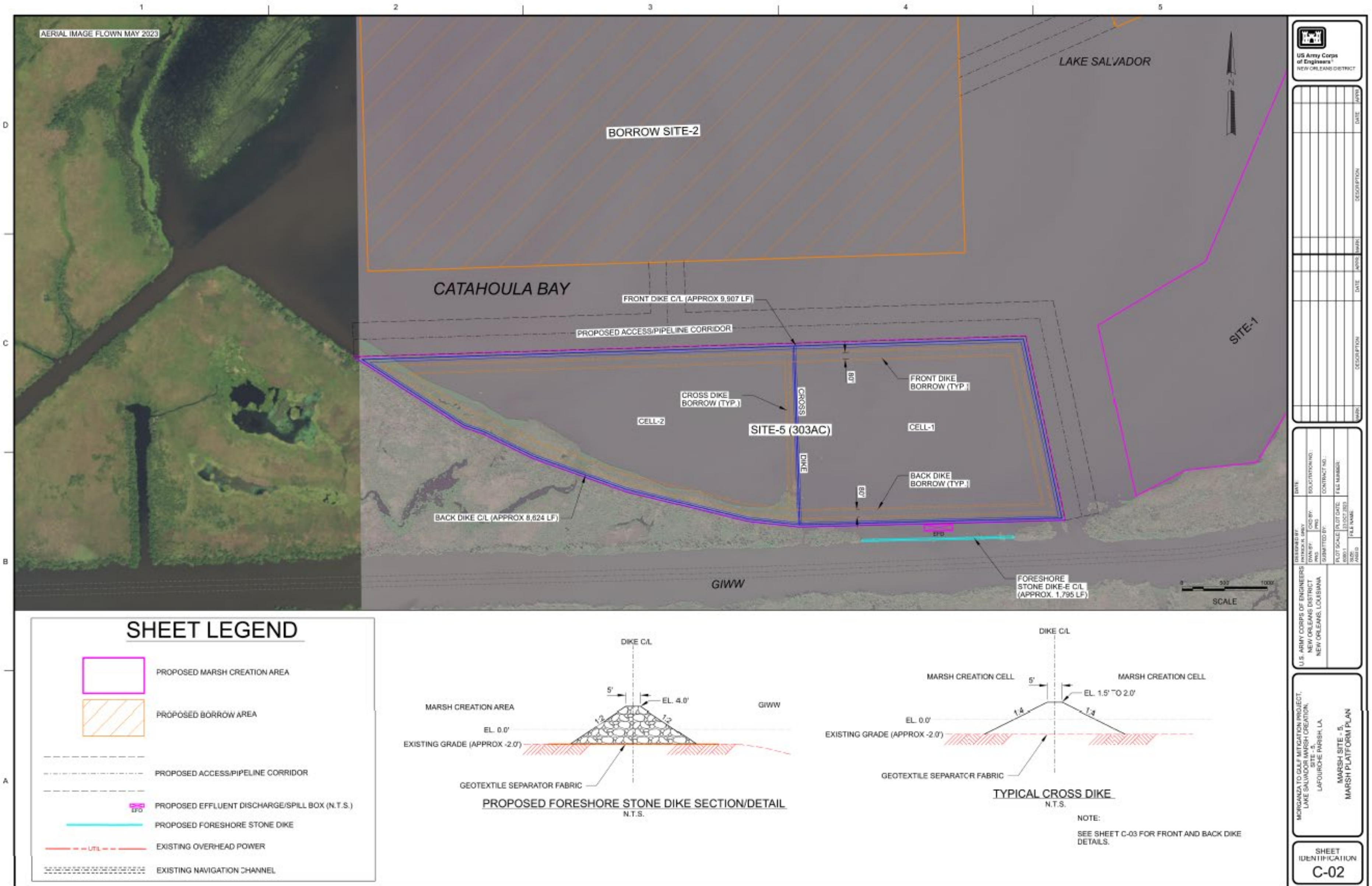

Figure C3:1-1f. Lake Salvador Project Map

3.2 GIWW

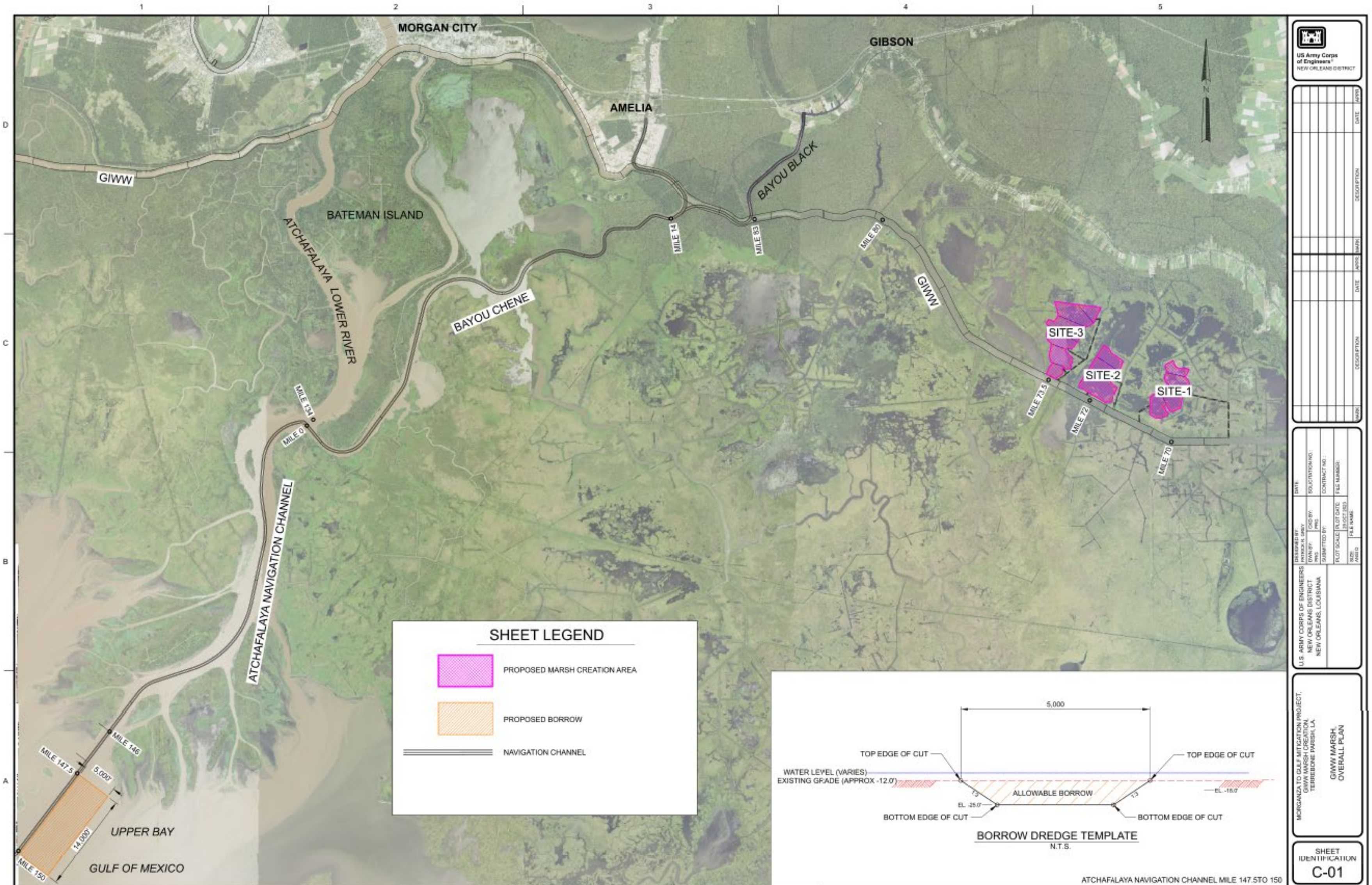

Figure C3:2-1a. GIWW Project Map

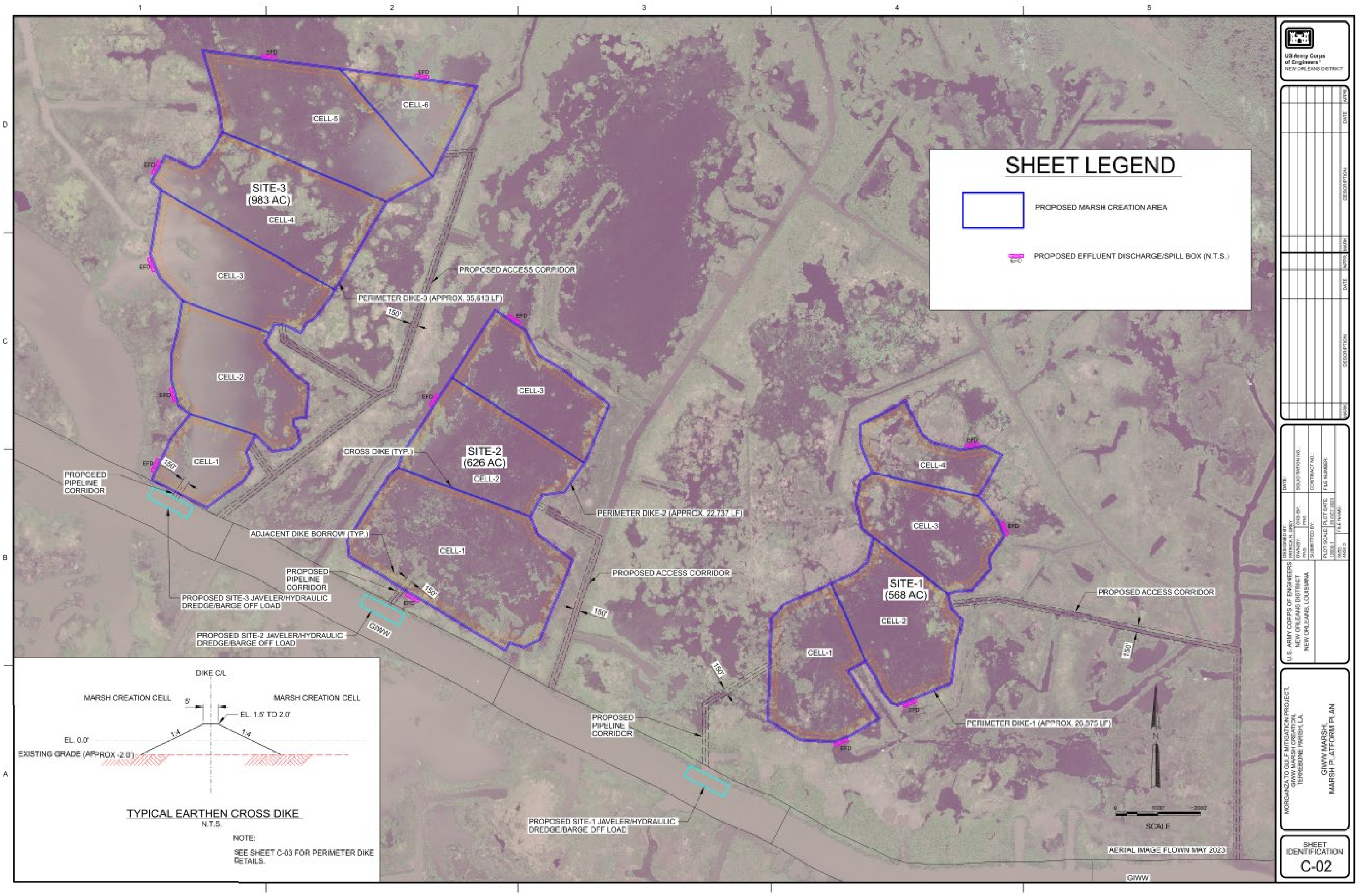

Figure C3:2-1b. GIWW Project Map

3.3 DELTA FARMS

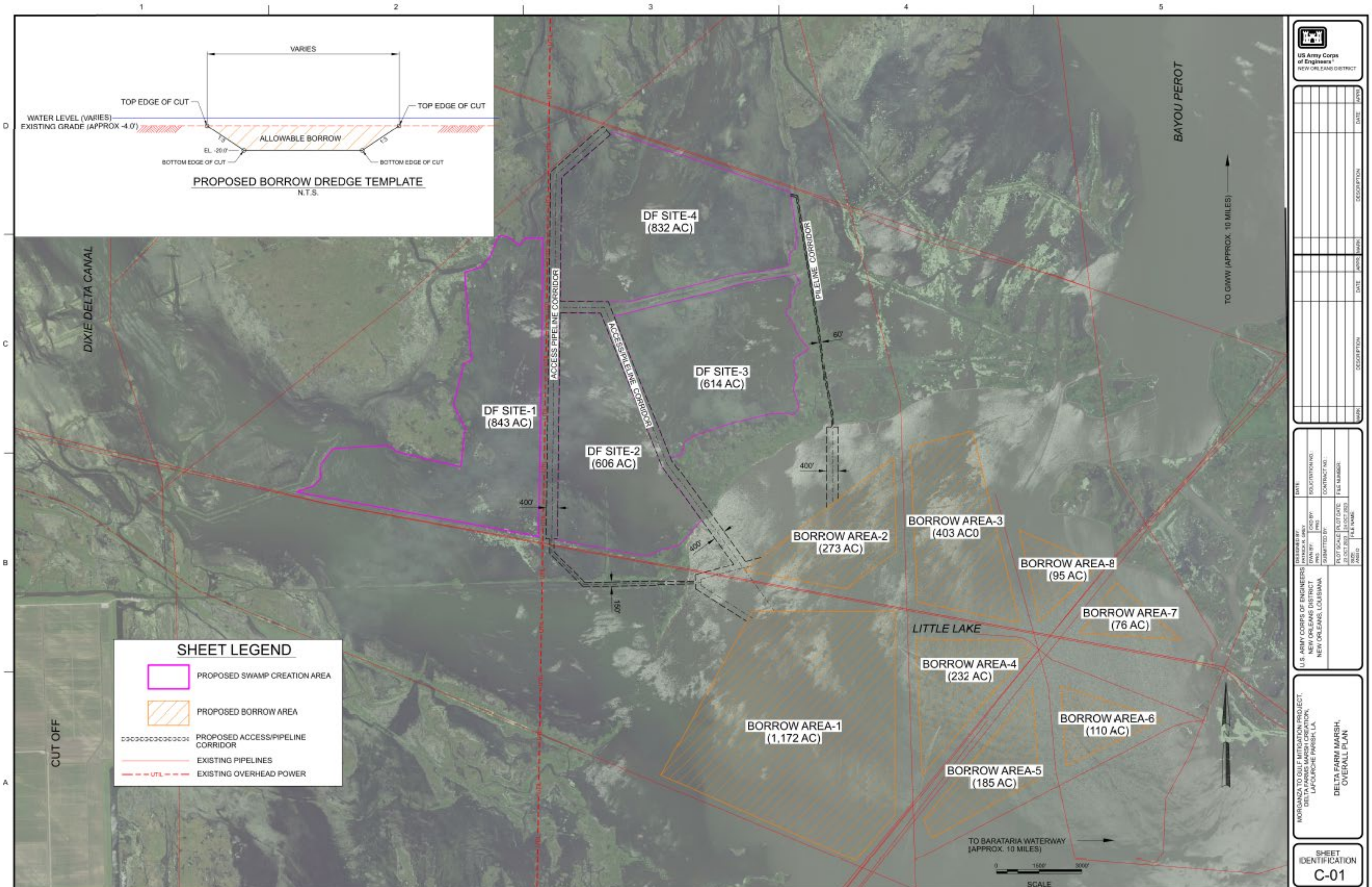

Figure C3:3-1a. Delta Farms Project Map

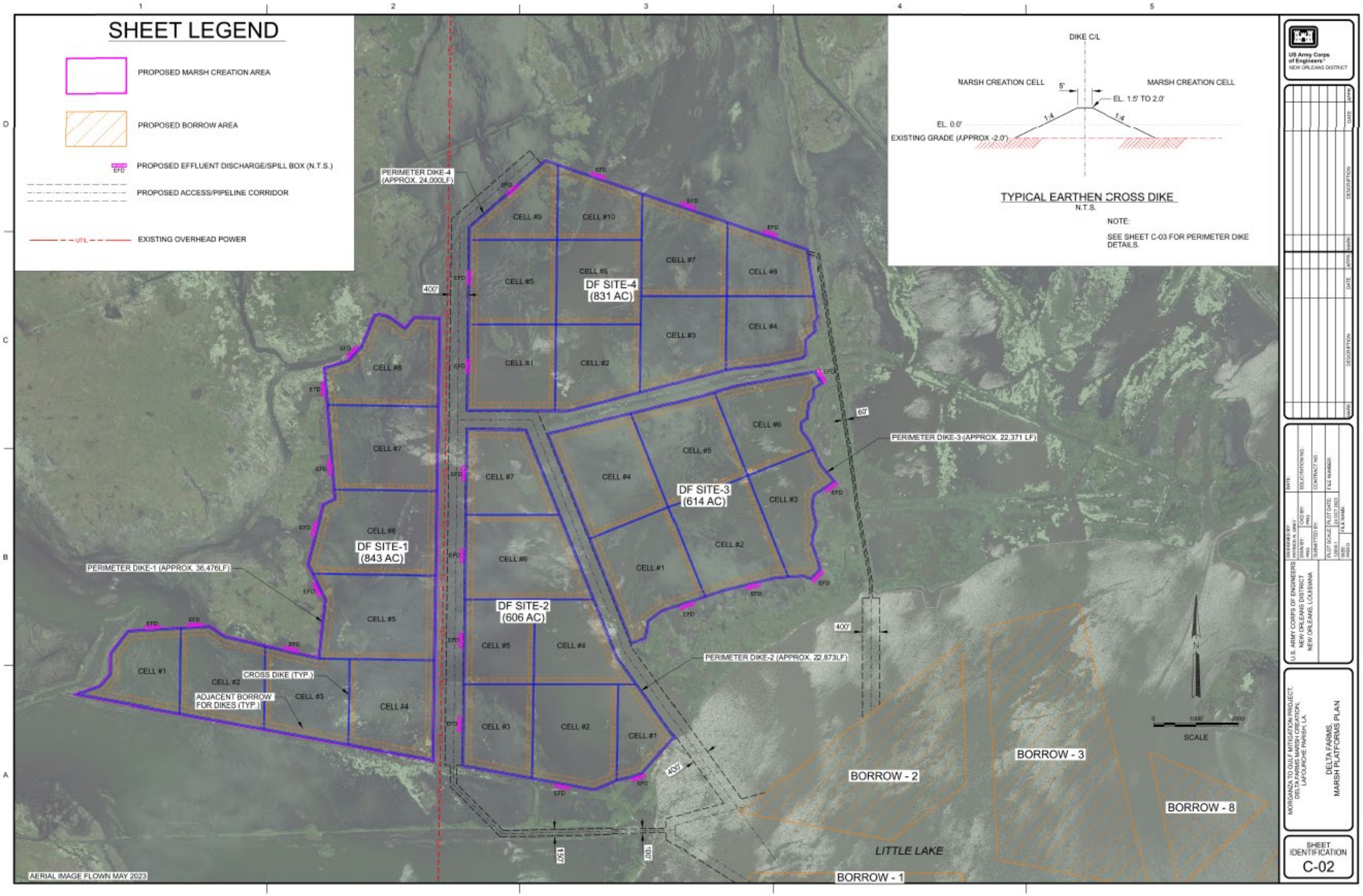

Figure C3:2-1b. Delta Farms Project Map

3.4 AVOCA ISLAND CUTOFF

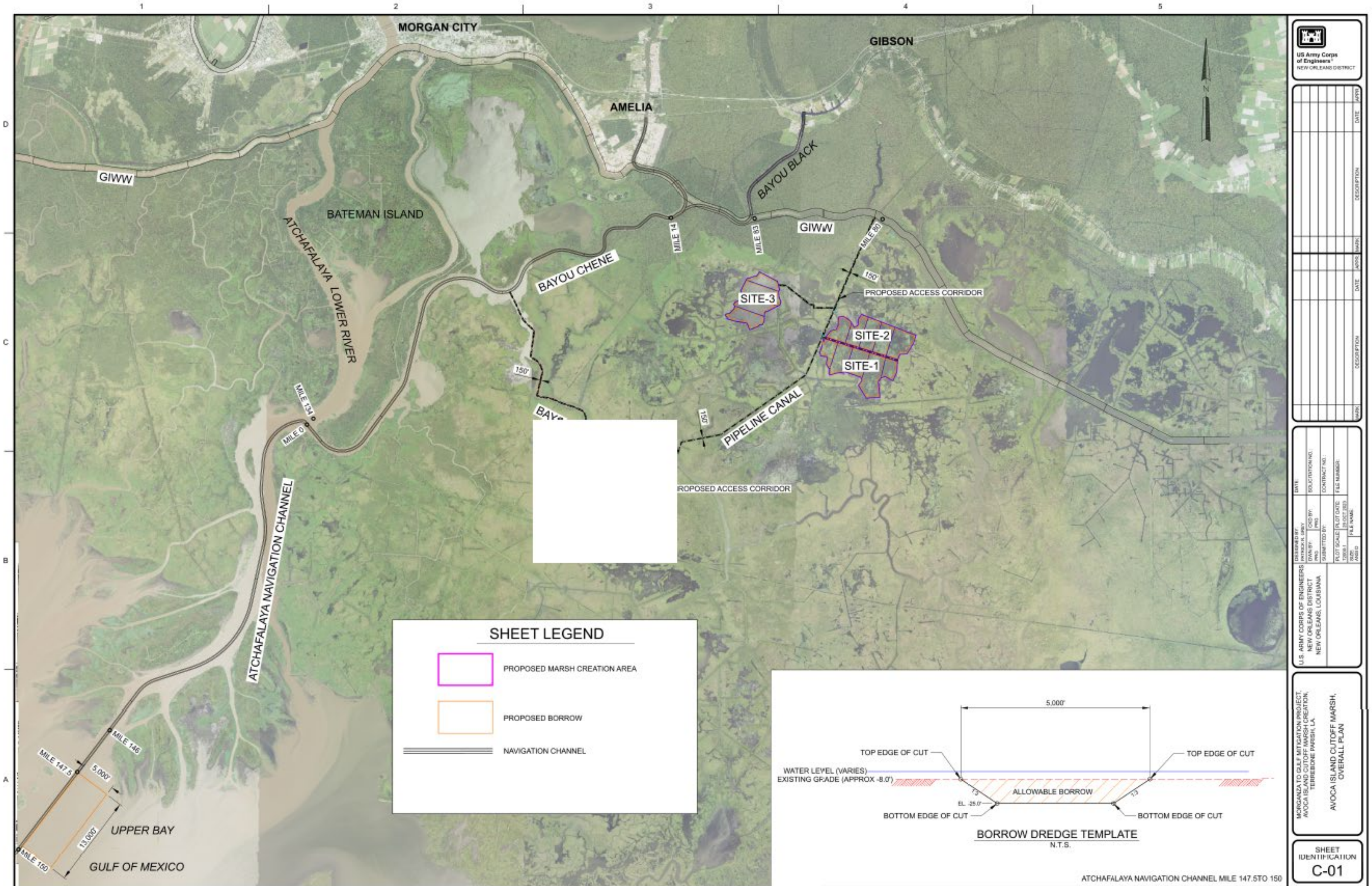

Figure C3:4-1a. Avoca Island Cutoff Project Map

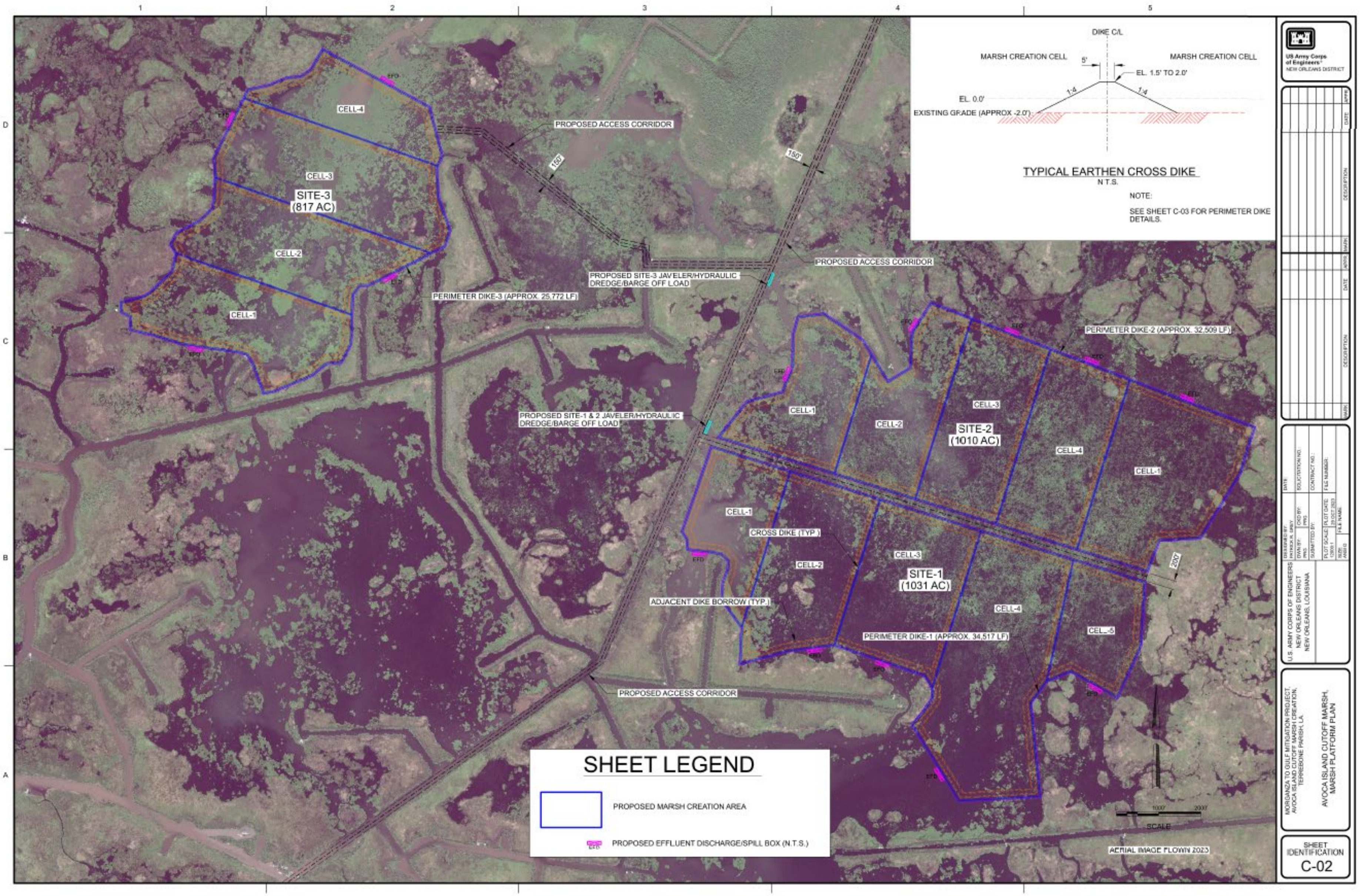

Figure C3:4-1b. Avoca Island Cutoff Project Map

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Appendix C – Attachment 4 – Napoleonville BLH Project Description

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1.1 PROJECT AREA AND ACCESS OVERVIEW

Located in an agricultural area northwest of Napoleonville in Assumption Parish, The Napoleonville BLH project footprint encompasses approximately 588 acres, of which 534 acres are estimated to be plantable BLH zones.

A total of four (4) potential access routes have been identified across these areas:

- First and Second Routes: Two (2) unmarked dirt/gravel roadway running east-west between HWY-1004 and the eastern project boundary.
- Third and Fourth Routes: Two (2) unmarked dirt/gravel roadways running north-south between HWY-402 and the southern project boundary.

1.2 SITE PREPARATION AND EARTHWORK ASSUMPTIONS

Prior to any earthwork, the entire project footprint will be cleared of existing vegetation to facilitate leveling and/or grading activities, access establishment, and site preparation for planting.

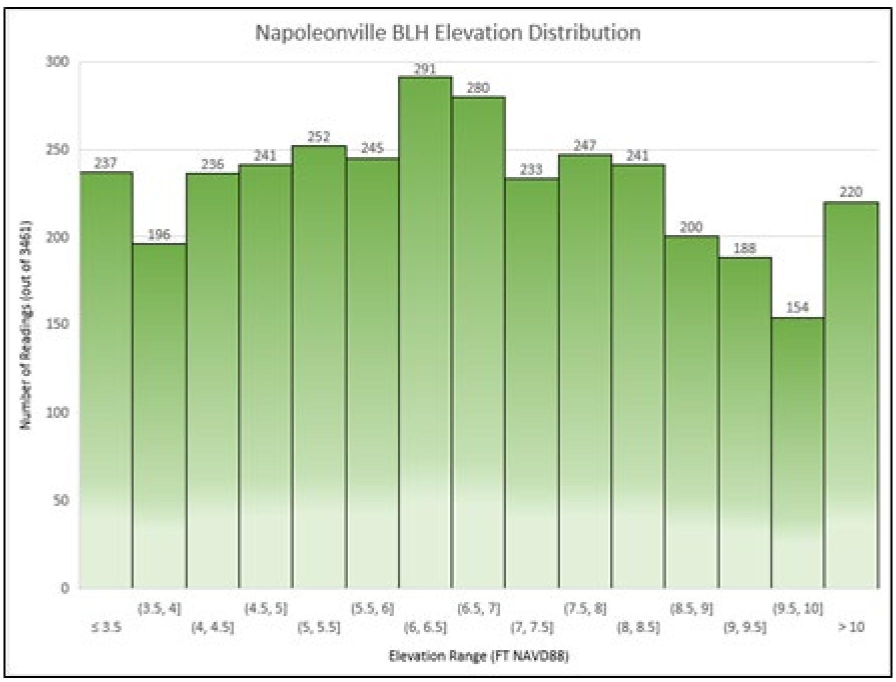

Figure C4:1-1. Napoleonville BLH Elevation Distribution (2017 LiDAR)

Existing elevations range from approximately +1.5 to +8.5 feet NAVD88. Only minor leveling is anticipated to achieve target conditions, with an expected post-leveling average elevation nearing +5 feet NAVD88—generally consistent with nearby reference BLH systems.

Subsoiling is expected to occur uniformly across all plantable zones along identified planting rows, intended to loosen compacted soils left from previous agricultural use.

To support surface water management during early establishment, shallow swales are assumed to be excavated throughout the site. Approximately 34,000 linear feet of swales are proposed, with an estimated 9,500 cubic yards of material to be excavated and redistributed within the project footprint.

1.3 PLANTING AND MATERIAL ASSUMPTIONS

Seedling quantities were estimated using the standard planting densities and spacings outlined in the main report. To reflect the full extent of planting potential within the project boundary, a range of estimated quantities is provided below, spanning from the required 527 acres to the full 534 acres of identified plantable area.

- Canopy Seedlings: 287,400 – 291,300
- Midstory Seedlings: 72,000 – 73,000
- Plant Pins: 359,400 – 364,300
- Plant Stakes: 359,400 – 364,300
- Mowing Poles: 23,300 – 23,900

1.4 IMPLEMENTATION AND DURATION ASSUMPTIONS

The initial construction phase is assumed to take approximately one to two years, followed by a three-year monitoring and maintenance period, resulting in a total estimated duration of five years.

SECTION 2

List of Acronyms and Abbreviations

BLH	Bottomland Hardwood
HWY	Highway

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1.1 PROJECT AREA AND ACCESS OVERVIEW

Located in a rural, agricultural area southwest of Supreme in Assumption Parish, the Supreme BLH project footprint encompasses approximately 616 acres, of which 533 acres are estimated to be plantable BLH zones.

A total of three (3) potential access routes have been identified:

- First Route: LA Hwy 1011, which traverses east-west through the northern portion of the project area and intersects both LA Hwy 1010 and LA Hwy 1.
- Second Route: Georgia Road, which extends westward from LA Hwy 1 and LA Hwy 1010 to reach the project area's eastern boundary.
- Third Route: Locust Street, located farther south, follows a similar alignment west from LA Hwy 1 and LA Hwy 1010 to the southeastern boundary of the project site.

1.2 SITE PREPARATION AND EARTHWORK ASSUMPTIONS

Prior to any earthwork, the entire project footprint will be cleared of existing vegetation to facilitate leveling and/or grading activities, access establishment, and site preparation for planting.

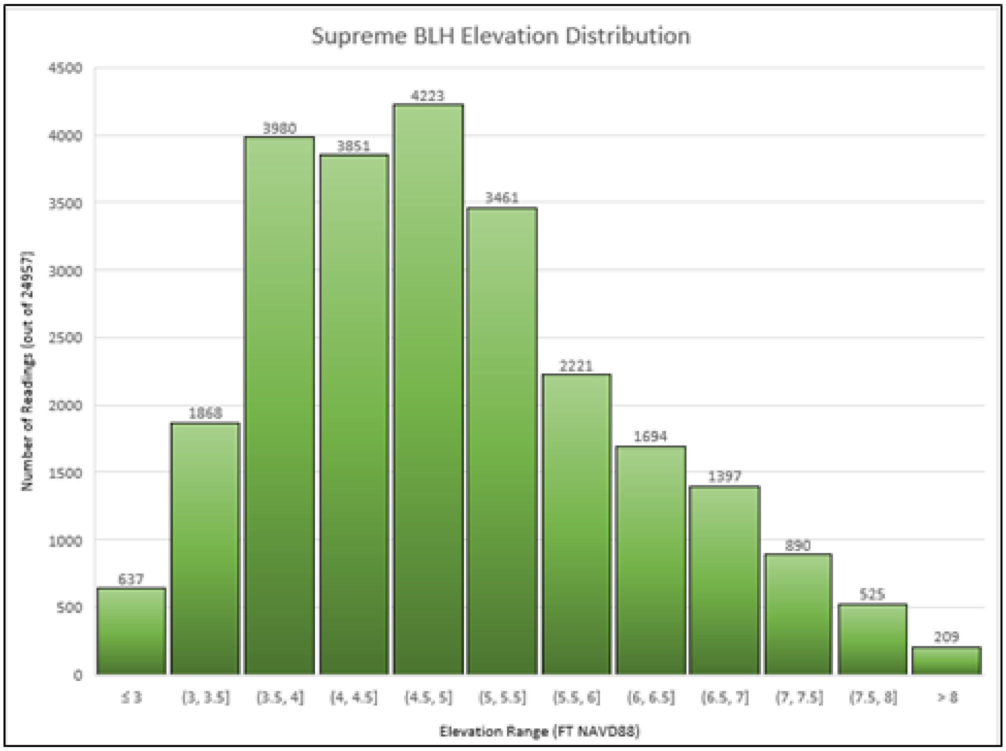

Figure C4:1-1. Supreme BLH Elevation Distribution (2017 LiDAR)

LiDAR-derived elevation data was used to develop an elevation distribution histogram for the project area. Existing elevations range from approximately +3 to +8 feet NAVD88. Only minor leveling is anticipated to achieve target conditions, with an expected post-leveling average elevation nearing +5 feet NAVD88—generally consistent with nearby reference BLH systems. Major degrading was not assumed at this stage, as current conditions appear compatible with long-term restoration goals.

Subsoiling is expected to occur uniformly across all plantable zones along identified planting rows, intended to loosen compacted soils left from previous agricultural use.

To support surface water management during early establishment, shallow swales are assumed to be excavated throughout the site. Approximately 18,000 linear feet of swales are proposed, with an estimated 4,800 cubic yards of material to be excavated and redistributed within the project footprint.

1.3 PLANTING AND MATERIAL ASSUMPTIONS

Seedling quantities were estimated using the standard planting densities and spacings outlined in the main report. To reflect the full extent of planting potential within the project boundary, a range of estimated quantities is provided below, spanning from the required 527 acres to the full 533 acres of identified plantable area.

- Canopy Seedlings: 287,400 – 291,000
- Midstory Seedlings: 72,000 – 72,800
- Plant Pins: 359,400 – 363,800
- Plant Stakes: 359,400 – 363,800
- Mowing Poles: 23,300 – 23,850

1.4 IMPLEMENTATION AND DURATION ASSUMPTIONS

The initial construction phase is assumed to take approximately one to two years, followed by a three-year monitoring and maintenance period, resulting in a total estimated duration of five years.

SECTION 2

List of Acronyms and Abbreviations

BLH	Bottomland Hardwood
HWY	Highway

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Engineering Project Description

1.1 PROJECT AREA AND ACCESS OVERVIEW

Located in an agricultural area northwest of Napoleonville in Assumption Parish, the Napoleonville Swamp project footprint encompasses approximately 1,063 acres, of which 962 acres are estimated to be plantable swamp zones.

The overall site has been subdivided into three (3) restoration cells identified herein as: North Swamp, Central Swamp, and South Swamp.

A total of eight (8) potential access routes have been identified across these areas:

<u>North Swamp</u>

The North Swamp area covers approximately 690 acres, with an estimated 632 acres deemed plantable. Four (4) potential access routes have been identified.

- First route: An unmarked gravel road extending south from LA Hwy 70 to the northwest corner of the project area.
- Second route: Ucar Road, which runs east–west through the northern region of the site, and connects to Dow Road (a north–south roadway linking Ucar Rd to LA Hwy 70).
- Third route: An unmarked dirt/gravel road extending west from Hwy 1004 into the site’s eastern boundary.
- Fourth route: Another unmarked road, also running west from Hwy 1004, located slightly farther south than the third route.

<u>Central Swamp</u>

The Central Swamp area totals 228 acres, with 197 acres considered plantable. This site lies directly south of the North Swamp unit and is separated from the South Swamp by a stretch of forested land. Two access routes have been noted.

- First route: A small, unmarked bridge crossing Westfield Canal that links the southern edge of North Swamp to the northern edge of the Central Swamp. This bridge will be referred to as the Westfield Bridge.
- Second route: An unmarked dirt/gravel road running west from Hwy 1004 into the eastern boundary of the site.

South Swamp

The South Swamp area includes 145 total acres, of which 133 acres are expected to be plantable. This cell is located south of Central Swamp and is bounded to the south by Hwy 402.

Access is provided by two unmarked dirt/gravel roads extending north from Hwy 402 into the southern portion of the project site.

1.2 SITE PREPARATION AND EARTHWORK ASSUMPTIONS

LiDAR-derived elevation data was used to develop elevation distribution histograms for each project area.

- North Swamp: Existing elevations range from 0 to +8 feet NAVD88. Only minor leveling is anticipated to achieve target conditions, with an expected post-leveling average elevation near +3.5 feet NAVD88.
- Central Swamp: Existing elevations range from -1 to +2.5 feet NAVD88. More extensive grading is anticipated to raise elevations toward a suitable target, with an expected post-leveling average elevation of +0.5 feet NAVD88.
- South Swamp: Existing elevations range from +1.5 to +5 feet NAVD88. Moderate leveling is anticipated to achieve target conditions, with an expected post-leveling average elevation near +3.0 feet NAVD88.

Post-leveling elevations in the North and South Swamps are generally consistent with nearby reference swamp systems. Central Swamp is slightly lower in some areas but still within a range considered suitable for long-term restoration.

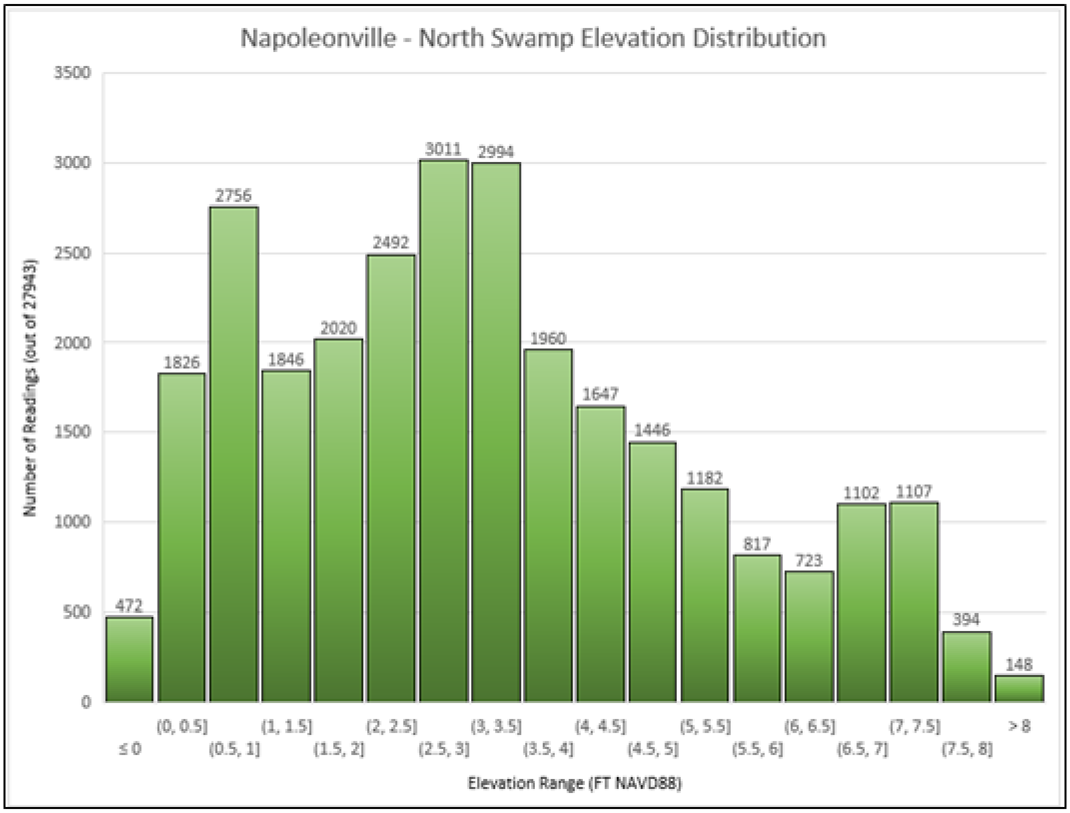

Figure C4:1-1. Napoleonville North Swamp Elevation Distribution (2017 LiDAR)

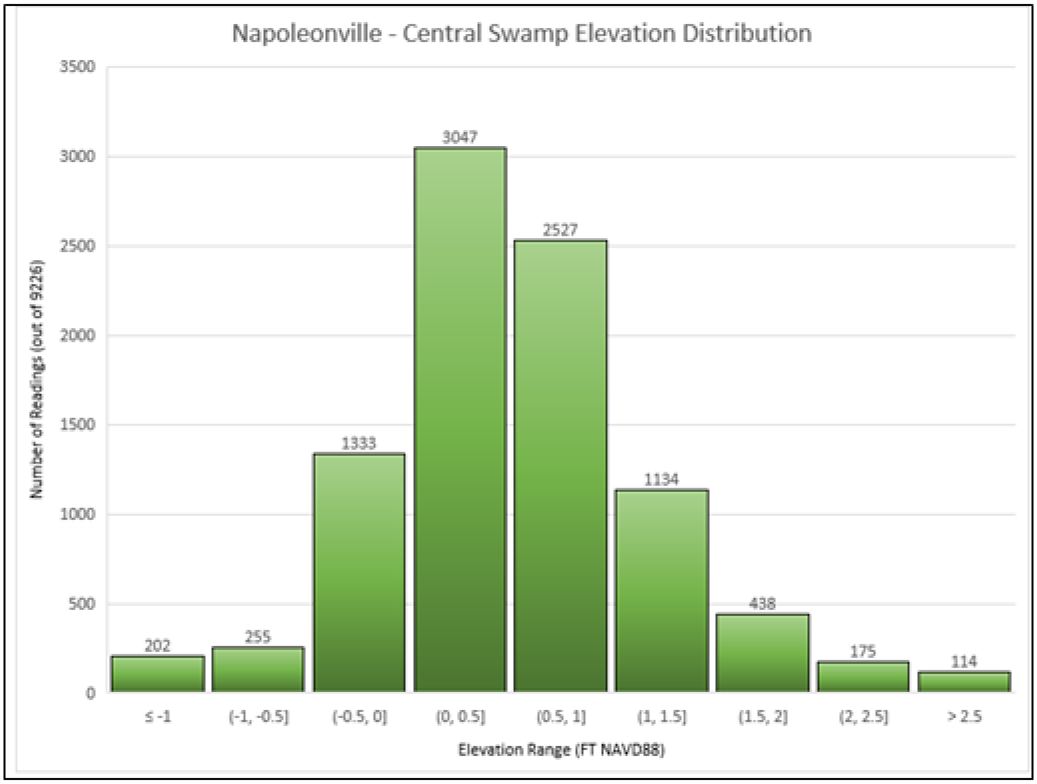

Figure C4:1-2. Napoleonville Central Swamp Elevation Distribution (2017 LiDAR)

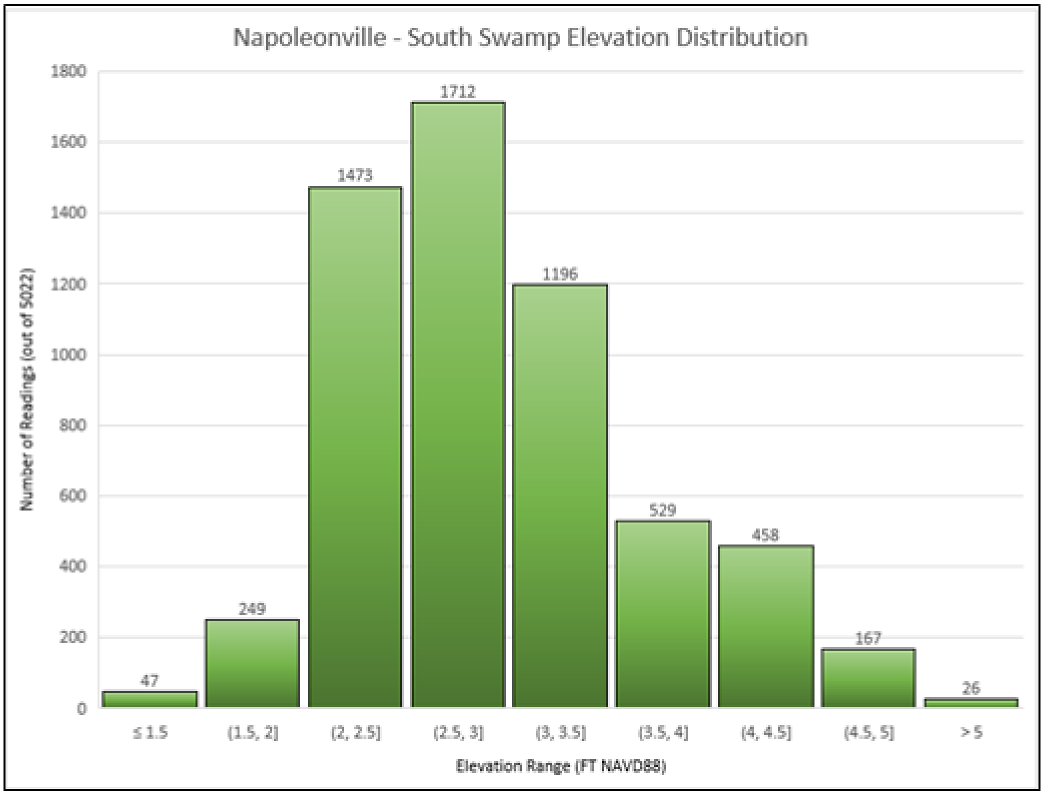

Figure C4:1-3. Napoleonville South Swamp Elevation Distribution (2017 LiDAR)

Subsoiling is expected to occur uniformly across all plantable zones along identified planting rows, intended to loosen compacted soils left from previous agricultural use.

Existing perimeter berms are assumed to provide sufficient temporary water retention during early establishment, due to the site's agricultural history. Post-planting berm gapping is assumed to occur 1-2 years after planting, at approximately 500-foot intervals. An estimated 50 gapping locations are anticipated, with about 1,500 cubic yards of material expected to be removed and redistributed within the project footprint.

1.3 PLANTING AND MATERIAL ASSUMPTIONS

Seedling quantities were estimated using the standard planting densities and spacings outlined in the main report. To reflect the full extent of planting potential within the project boundary, a range of estimated quantities is provided below, spanning from the required 949 acres to the full 962 acres of identified plantable area.

- Canopy Seedlings: 517,400 – 524,600
- Midstory Seedlings: 129,300 – 131,000
- Plant Pins: 646,700 – 655,600
- Plant Stakes: 646,700 – 655,600
- Mowing Poles: 42,000 – 42,700

1.4 IMPLEMENTATION AND DURATION ASSUMPTIONS

The initial construction phase is assumed to take approximately one to two years, followed by a three-year monitoring and maintenance period, resulting in a total estimated duration of five years.

SECTION 2
List of Acronyms and Abbreviations

HWT	Highway
LA	Louisiana
RD	Road

Mississippi Valley Division,
Regional Planning and Environment Division South

Morganza to the Gulf of Mexico, Louisiana, Hurricane and Storm Damage Risk Reduction Project

Appendix C – Attachment 4 – Supreme Swamp Project Description

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1.1 PROJECT AREA AND ACCESS OVERVIEW

Located in an agricultural area southwest of Supreme in Assumption Parish, the Supreme swamp project footprint encompasses approximately 1,105 acres, of which 958 acres are estimated to be plantable swamp zones.

A total of three (3) potential access routes have been identified:

- First Route: LA Hwy 1011, which traverses east-west through the northern portion of the project area and intersects both LA Hwy 1010 and LA Hwy 1.
- Second Route: Georgia Road, which extends westward from the intersection of LA Hwy 1 and LA Hwy 1010 to the eastern project boundary.
- Third Route: Locust Street, located farther south, follows a similar alignment west from LA Hwy 1 and LA Hwy 1010 to the southeastern boundary of the project site.

1.2 SITE PREPARATION AND EARTHWORK ASSUMPTIONS

Prior to any earthwork, the entire project footprint will be cleared of existing vegetation to facilitate leveling and/or grading activities, access establishment, and site preparation for planting.

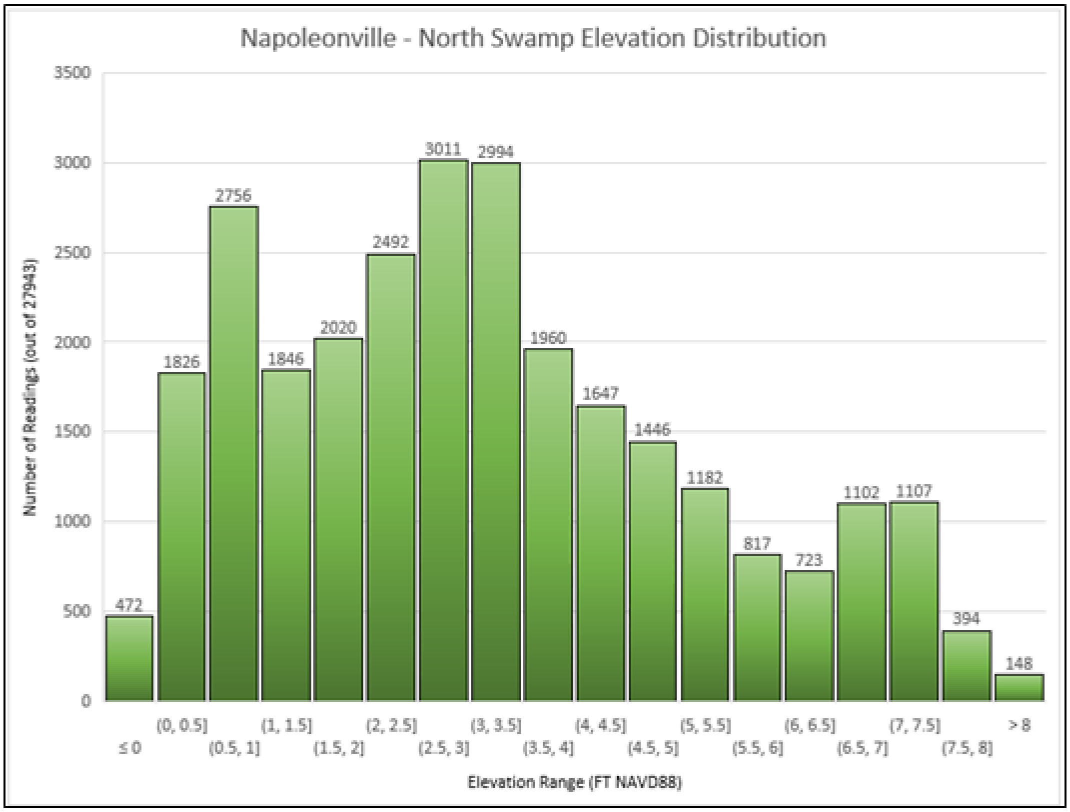

Figure C4:1-1. Supreme Swamp Elevation Distribution (2017 LiDAR)

LiDAR-derived elevation data was used to develop an elevation distribution histogram for the project area (Figure X). Existing elevations range from approximately +1.5 to +6.5 feet NAVD88. Only minor leveling is anticipated to achieve target conditions, with an expected post-leveling average elevation nearing +4 feet NAVD88—generally consistent with nearby reference swamp systems. Major degrading was not assumed at this stage, as current conditions appear compatible with long-term restoration goals.

Subsoiling is expected to occur uniformly across all plantable zones along identified planting rows, intended to loosen compacted soils left from previous agricultural use.

Existing perimeter berms are assumed to provide sufficient temporary water retention during early establishment, due to the site's agricultural history. Post-planting berm gapping is assumed to occur 1-2 years after planting, at approximately 500-foot intervals. An estimated 46 gapping locations are anticipated, with about 1,215 cubic yards of material expected to be removed and redistributed within the project footprint.

1.3 PLANTING AND MATERIAL ASSUMPTIONS

Seedling quantities were estimated using the standard planting densities and spacings outlined in the main report. To reflect the full extent of planting potential within the project boundary, a range of estimated quantities is provided below, spanning from the required 949 acres to the full 958 acres of identified plantable area.

- Canopy Seedlings: 517,400 – 522,500
- Midstory Seedlings: 129,300 – 130,800
- Plant Pins: 646,700 – 653,300
- Plant Stakes: 646,700 – 653,300
- Mowing Poles: 42,000 – 42,600

1.4 IMPLEMENTATION AND DURATION ASSUMPTIONS

The initial construction phase is assumed to take approximately one to two years, followed by a three-year monitoring and maintenance period, resulting in a total estimated duration of five years.

SECTION 2
List of Acronyms and Abbreviations

HWY	Highway
LA	Louisiana
NAVD88	North American Vertical Datum of 1988

Mississippi Valley Division,
Regional Planning and Environment Division South

Morganza to the Gulf of Mexico, Louisiana, Hurricane and Storm Damage Risk Reduction Project

Appendix C – Attachment 4 – Avoca Island Cutoff Fresh and Intermediate Marsh Constructed Project Description

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SECTION 1
Introduction

This study is for the mitigation efforts for MTG Project overall marsh impacts. This project consists of a proposed intermediate/fresh marsh creation area at a location identified as Avoca Island Cutoff. The required overall acres for marsh creation at this location is approximately 2,858 acres. The requested level of engineering and cost estimation for this study is a Rough Order of Magnitude (ROM) level, 5% to 10% level design.

1.1 PROJECT LOCATION

The proposed Avoca Island Cutoff marsh creation area is located at open water site south of the GIWW, at approximate mile 80, and north of Bayou Penchant within Terrebonne Parish, Louisiana.

1.2 DATA GAPS AND DESIGN ASSUMPTIONS

Survey data, geotechnical borings/data, and site investigation data was not available and/or conducted for this study. Engineering and design for this proposed marsh creation project will be based on the following design assumptions:

A. <u>Water bottom elevations:</u> Based on other projects constructed in this region, it is assumed the water bottom (existing grade) is at elevation -2.0-ft.
B. <u>Typical water elevations:</u> Based on other projects constructed in this region, it is assumed the typical water elevations range from elevation +0.5-ft to +3.0-ft during non-storm events.
C. <u>Platform foundations:</u> Based on other projects constructed in the region, it is assumed the top 2-ft of material below existing grade has high moisture/organics content and will displace during dike and marsh platform construction. Estimated quantities for dike and marsh platform materials will take this 2-ft of displacement into count.
D. <u>Target marsh elevation:</u> Based on other studies, it is assumed the required marsh elevation (target elevation) is approximately +1.0-ft to +1.5-ft. The target elevation will be elevation +1.0-ft for this study.
E. <u>Containment dikes:</u> Soil borings and geotechnical data are not available for this proposed marsh creation location. Based on other projects constructed in the region, it is assumed all onsite adjacent borrow material for containment dike construction will be high organics and moisture content. Issues stacking this adjacent borrow material during dike construction is likely. It is assumed all containment dikes and cross dikes will require a minimum of 1 vertical to 4 horizontal side slopes with a 5-ft wide dike crown. After conducting borings and a geotechnical analysis, stability berms for the dikes may be required, or better material for dike construction may have to be brought to the site. It is assumed

that any associated costs to bring in material for dike construction will be covered under the 25% contingency provided with the ROM estimate for this project study.

F. Primary Borrow: It was proposed that borrow material for marsh construction for this project would come from the Gulf Intercoastal Waterway (GIWW) navigation channel to the north of the project site. The proposed borrow from the GIWW is not likely available to produce the borrow quantity needed to construct the proposed marsh creation site. To complete a ROM level design and estimate, a primary borrow area adjacent to the Atchafalaya Navigation Channel at Mile 150 to Mile 147.5 is proposed due to the large borrow needs for this project. This proposed borrow location will require an in-depth review and approvals to move forward. It is assumed this borrow area will provide quality material for the construction of the marsh platform(s), as the material is assumed to have a high sand content. After geotechnical and surveys investigations are completed, the salinity content of the proposed borrow area will have to be investigated for suitability of fresh/intermediate marsh habitat.

G. Alternate Borrow: An alternate borrow source proposed for this project is the Atchafalaya Navigation Channel, to include Bayou Chene and Bayou Black, but will require additional coordination with USACE Operations in the event this project is to move forward with a full design. At a study level, the coordination for the proposed alternate borrow source was not feasible due to time, but the intent of the alternate borrow source is to possibly provide a closer borrow solution for all, or part of, the borrow material required to construct the marsh platform(s).

H. Lifts: It is assumed that this site will require two marsh platform lifts based on the assumed quality of the proposed borrow material. After geotechnical and surveys investigations are completed, it is possible that more than two lifts may be required. It is assumed that any associated costs for additional lifts will be covered under the 25% contingency provided with the ROM estimate for this project study.

I. Pipelines: This study did not conduct an in-depth pipeline locations/identification. Pipeline data for this location is assumed at a face value of what was shown on the DNR pipeline database. In addition, the proposed borrow area and marsh creation area may encounter wells and flowlines which have not been identified. Prior to any formal design or construction, the proposed project site and borrow area will require an in-depth pipeline, well, and flowline review and identification.

J. Access: Access corridors for construction equipment will transit through existing pipeline corridors, open water, and bayous that convey to the project site from federal navigation channels. It is assumed that dredging for flotation outside of the federal navigation channels may be required, but not verified at this level of design. It is assumed that any associated costs for flotation will be covered under the 25% contingency provided with the ROM estimate for this project study. Prior to any formal design or construction, the proposed project site will require surveys and pipeline verification to determine if alternate access corridors will be required.

K. Proposed marsh Footprints: Footprints for the proposed marsh creation areas were developed based on aerial imagery. There is a level of difficulty of determining what is existing marsh or what is floating vegetation. Assume that the proposed marsh creation area footprints will have to be adjusted based on actual survey data and site visits.

L. Vertical Datum: For all elevations stated herein, the vertical datum will be NAVD 88, latest established epoch.

SECTION 2
Construction Methodology

2.1 GENERAL CONSTRUCTION SUMMARY

To construct the marsh platform, it is proposed that material from a borrow area adjacent to the Atchafalaya Navigation Channel, at Mile 150 to Mile 147.5, will be dredged mechanically at the borrow site and hauled to the project site via barge. Once the barged material reaches the project site, a hydraulic unloader will pump the material from the barges to the marsh creation sites. The general order of work for construction is as follows:

1. Construct earthen perimeter containment dikes to contain dredged slurry.
2. Construct earthen cross dikes to create cells to assist in managing dredge slurry containment.
3. Construct spill boxes for each cell for effluent discharge locations.
4. Construct the 1st marsh platform lift by pumping the dredge slurry into the marsh creation cells.
5. A year after the 1st lift, construct lifts/caps on perimeter containment dikes and cross dikes to contain dredge slurry for the 2nd marsh platform lift.
6. Construct the 2nd marsh platform lift by pumping dredge slurry into the marsh creation cells.
7. A year after the 2nd lift, degrade the perimeter dikes down to elevation 1.0-ft.

2.1.1 Construction Duration

The estimated construction duration for this project will be approximately 4 years.

2.1.2 Construction Equipment

The construction equipment expected to be used for the construction of this project is as follows:

1. Spider, deck, and inland barges.
2. Barge tugs.
3. Mechanical dredge, spud barge with mechanical clamshell bucket.
4. Hydraulic Unloader, and floating pipeline.
5. Skiffs.
6. Air boats.
7. Survey vessels.
8. Marsh buggies.

9. Excavators, deck mounted.

2.1.3 Design

To provided approximately 2,858 acres of marsh at this location, the proposed construction will be three sites, marsh platforms, at this location. Site-1, Site-2 and Site-3 footprints will be 1,031 acres, 1,010 acres, and 817 acres respectively.

2.1.4 Marsh Platform Creation (Year 1 and 2)

2.1.4.1 Earthen Perimeter Containment Dikes (Initial Construction)

Perimeter containment dikes will be earthen dikes constructed from onsite borrow adjacent to the dikes. The adjacent borrow will have a minimum 40-ft setback from the interior perimeter dike toe to account for dike stability. The adjacent dike borrow will have an allowable 80-ft bottom width with 1:3 side slopes that transition to existing grade(s). The maximum excavation depth of elevation -12.0-ft for the adjacent dike borrow will be permitted. Containment dikes will be constructed with a 5-ft wide crown and 1:4 side slopes that transition down to existing grade. The perimeter dikes will be constructed to a crown elevation of +4.0-ft to contain dredge slurry and provided a minimum of 1.5-ft of freeboard. The estimated borrow material required for the initial perimeter dike construction, all sites, is approximately 1,299,000 CY.

2.1.4.2 Earthen Cross Dikes (Initial Construction)

Due to the size of the proposed marsh site, earthen cross dikes will be constructed to form multiple cells within the marsh site. These cells will provide more manageable areas for the disposal of dredge material within each site. Borrow material for the cross dikes will come from onsite adjacent borrow at a 40-ft setback from the cross dikes toe to account for dike stability. The adjacent dike borrow will have an allowable 80-ft bottom width with assumed 1:3 side slopes that transition up to existing grade(s). The maximum excavation depth of elevation -12.0ft for the adjacent dike borrow will be permitted. Cross dikes will be constructed with a 5-ft wide crown and 1:4 side slopes that transition down to existing grade. The cross dikes will be constructed to a crown elevation of 1.5ft to 2.0ft with the intent that some dredged slurry will convey to the next cell, while containing most material in the intended cell. The estimated borrow material required for the initial cross dike construction, all sites, is approximately 337,000 CY.

2.1.4.3 Effluent Discharge/Spill Boxes

Each cell constructed for the marsh creation site will have an effluent discharge point with spill boxes at exterior locations where there is open water. Spill boxes will capture most sediment material suspended in the effluent discharge, but some sediment material will deposit in the adjacent open water locations. Spill boxes will be removed once the final marsh platform lift is completed.

2.1.4.4 Borrow Plan

The material for the construction of the marsh creation platform(s) is dredge material obtained at a proposed borrow location adjacent to the Atchafalaya Navigation Channel at Mile 150 to Mile 147.5. The proposed borrow site is approximately 1,600 acres, 5,000ft wide by 14,000ft long. The maximum excavation depth of the proposed borrow site will be to elevation -25.0ft. Material at this borrow area will be dredged mechanically and transferred to barges. Once barges are filled, tugs will hull the barged material via the Atchafalaya Navigation Channel and GIWW to a staging area along the GIWW at approximate Mile 82. Once barged material is received at the staging area, the material will to be transferred to hydraulic unloader and pumped to the marsh sites via floating pipeline through an existing pipeline canal that conveys to the project site. The estimated one-way haul distance is 36 miles.

2.1.4.5 First Marsh Platform Lift

Once all perimeter containment dikes, cross dikes, and spill boxes are constructed, the first marsh platform lift will commence. The first lift will be from the assumed existing grade elevation of -2.0-ft to elevation +1.0ft, a 3-ft lift. Borrow material delivered to the project site by barge will be transferred to a hydraulic unloader and pumped to the marsh sites via floating pipeline. Dredge slurry will be pumped into the marsh creation sites to an elevation no greater than elevation +3.0-ft, and a uniform fill elevation of +1.0-ft is achieved. The estimated borrow material required for the 1st lift, all sites, is approximately 29,590,000 CY.

2.1.4.6 Second Marsh Platform Lift

One year after the completion of the 1st lift, a 2.5-ft lift to elevation +4.5-ft on all perimeter dikes will be constructed, based on the assumption that the dikes will settle down to elevation +2.0-ft after a year. The estimated borrow required for the perimeter dike lift, all sites, is approximately 396,000 CY. In addition, a 2-ft cap over all cross dikes will be constructed to achieve an elevation of +1.5-ft to +2.0-ft, based on the assumption that after a year the cross dikes will settle down to elevation 0.0-ft. The estimated borrow required for the 2-ft cap of the cross dikes is approximately 84,000 CY. Once all dike lifts/caps are complete, construction will commence with the second marsh platform lift. The second lift will be from the assumed one year settlement of the marsh platform at the elevation of 0.0-ft to elevation +2.5-ft, a 2.5-ft lift. Borrow material delivered to the project site by barge will be transferred to a hydraulic unloader and pumped to the marsh sites via floating pipeline. Dredge slurry will be pumped into the marsh creation site to an elevation no greater than elevation +3.5-ft, and a uniform fill elevation of +2.5-ft is achieved. The estimated borrow material required for all marsh creation sites for the 2nd lift is approximately 14,455,000 CY.

2.1.5 Perimeter Dike Degrade (Year 3)

One year after the second marsh platform lift, it is assumed that marsh creation site will settle down to elevation +1.0-ft. At this time, the perimeter dikes will be degraded down to elevation +1.0-ft to match the surrounding marsh elevation. The estimated degrade quantity, all sites, is approximately 137,000 CY. Degraded dike material will be disposed of within the marsh creation areas at any low locations where the adjacent dike borrow was excavated.

2.1.6 Assumed Project Life Achieved

Due to the known poor foundation material in this region, it should be noted that the project life for this project is uncertain at a study level. Projected marsh platform loss should be considered during the geotechnical analysis during or before any formal designs.

List of Acronyms and Abbreviations

AC	**Acre**
BA	**Borrow Area**
CY	**Cubic Yards**
FT	**Feet**
GIWW	**Gulf Intercoastal Waterway**
H	**Horizontal**
LA	**Louisiana**
Lbs	**Pounds**
LF	**Linear Feet**
MCA	**Marsh Creation Area**
MM/YR	**Millimeter per Year**
MTG	**Morganza to the Gulf**
NAVD88	**North American Vertical Datum 1988**
PSI	**Pounds per Square Inch**
ROM	**Rough Order of Magnitude**
SY	**Square Yard**
V	**Vertical**

Morganza to the Gulf of Mexico, Louisiana, Hurricane and Storm Damage Risk Reduction Project

Appendix C – Attachment 4 – GIWW Fresh and Intermediate Marsh Constructed Project Description

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SECTION 1
Introduction

This study is for the mitigation efforts for MTG Project overall marsh impacts. This project consists of a proposed intermediate/fresh marsh creation area at a location identified as GIWW. The required acres for marsh creation at this location is approximately 2,177 acres. The requested level of engineering and cost estimation for this study is a Rough Order of Magnitude (ROM) level, 5% to 10% level design.

1.1 PROJECT LOCATION

The proposed GIWW marsh creation area is located at open water site north of the Gulf Intercoastal Waterway (GIWW), at approximate Mile 73.5 within Terrebonne Parish, Louisiana.

1.2 DATA GAPS AND DESIGN ASSUMPTIONS

Survey data, geotechnical borings/data, and site investigation data was not available and/or conducted for this study. Engineering and design for this proposed marsh creation project will be based on the following design assumptions:

A. Water bottom elevations: Based on other projects constructed in this region, it is assumed the water bottom (existing grade) is at elevation -2.0-ft.

B. Typical water elevations: Based on other projects constructed in this region, it is assumed the typical water elevations range from elevation +0.5-ft to +3.0-ft during non-storm events.

C. Platform foundations: Based on other projects constructed in the region, it is assumed the top 2-ft of material below existing grade has high moisture/organics content and will displace during dike and marsh platform construction. Estimated quantities for dike and marsh platform materials will take this 2-ft of displacement into count.

D. Target marsh elevation: Based on other studies, it is assumed the required marsh elevation (target elevation) is approximately +1.0-ft to +1.5-ft. The target elevation will be elevation +1.0-ft for this study.

E. Containment dikes: Soil borings and geotechnical data are not available for this proposed marsh creation location. Based on other projects constructed in the region, it is assumed all onsite adjacent borrow material for containment dike construction will be high organics and moisture content. Issues stacking this adjacent borrow material during dike construction is likely. It is assumed all containment dikes and cross dikes will require a minimum of 1 vertical to 4 horizontal side slopes with a 5-ft wide dike crown. After conducting borings and a geotechnical analysis, stability berms for the dikes may be required, or better material for dike construction may have to be brought to the site. It is assumed that any associated costs to bring in material for dike construction will be covered under the 25% contingency provided with the ROM estimate for this project study.

F. Primary Borrow: It was proposed that borrow material for marsh construction for this project would come from the Gulf Intercoastal Waterway (GIWW) navigation channel to the north of the project site. The proposed borrow from the GIWW is not likely available to produce the borrow quantity needed to construct the proposed marsh creation site. To complete a ROM level design and estimate, a primary borrow area adjacent to the Atchafalaya Navigation Channel at Mile 150 to Mile 147.5 is proposed due to the large borrow needs for this project. This proposed borrow location will require an in-depth review and approvals to move forward. It is assumed this borrow area will provide quality material for the construction of the marsh platform(s), as the material is assumed to have a high sand content. After geotechnical and surveys investigations are completed, the salinity content of the proposed borrow area will have to be investigated for suitability of fresh/intermediate marsh habitat.

G. Alternate Borrow: An alternate borrow source proposed for this project is the Atchafalaya Navigation Channel, to include Bayou Chene and Bayou Black, but will require additional coordination with USACE Operations in the event this project is to move forward with a full design. At a study level, the coordination for the proposed alternate borrow source was not feasible due to time, but the intent of the alternate borrow source to possibly provide a closer borrow solution for all or part of the borrow material required to construct the marsh platform(s).

H. Lifts: It is assumed that this site will require two marsh platform lifts based on the assumed quality of the proposed borrow material. After geotechnical and surveys investigations are completed, it is possible that more than two lifts may be required. It is assumed that any associated costs for additional lifts will be covered under the 25% contingency provided with the ROM estimate for this project study.

I. Pipelines: This study did not conduct an in-depth pipeline locations/identification. Pipeline data for this location is assumed at a face value of what was shown on the DNR pipeline database. In addition, the proposed borrow area and marsh creation area may encounter wells and flowlines which have not been identified. Prior to any formal design or construction, the proposed project site and borrow area will require an in-depth pipeline, well, and flowline review and identification.

J. Access: Access corridors for construction equipment will transit through existing pipeline corridors, open water, and bayous that convey to the project site from federal navigation channels. It is assumed that dredging for flotation outside of the federal navigation channels may be required, but not verified at this level of design. It is assumed that any associated costs for flotation will be covered under the 25% contingency provided with the ROM estimate for this project study. Prior to any formal design or construction, the proposed project site will require surveys and pipeline verification to determine if alternate access corridors will be required.

K. Proposed marsh Footprints: Footprints for the proposed marsh creation areas were developed based on aerial imagery. There is a level of difficulty of determining what is existing marsh or what is floating vegetation. Assume that the proposed marsh creation area footprints will have to be adjusted based on actual survey data and site visits.

L. Vertical Datum: For all elevations stated herein, the vertical datum will be NAVD 88, latest established epoch.

SECTION 2
Construction Methodology

2.1 GENERAL CONSTRUCTION SUMMARY

To construct the marsh platform, it is proposed that material from a borrow area adjacent to the Atchafalaya Navigation Channel, at Mile 150 to Mile 147.5, will be dredged mechanically at the borrow site and hauled to the project site via barge. Once the barged material reaches the project site, a hydraulic unloader will pump the material from the barges to the marsh creation sites. The general order of work for construction is as follows:

1. Construct earthen perimeter containment dikes to contain dredged slurry.
2. Construct earthen cross dikes to create cells to assist in managing dredge slurry containment.
3. Construct spill boxes for each cell for effluent discharge locations.
4. Construct the 1st marsh platform lift by pumping the dredge slurry into the marsh creation cells.
5. A year after the 1st lift, construct lifts/caps on perimeter containment dikes and cross dikes to contain dredge slurry for the 2nd marsh platform lift.
6. Construct the 2nd marsh platform lift by pumping dredge slurry into the marsh creation cells.
7. A year after the 2nd lift, degrade the perimeter dikes down to elevation 1.0-ft.

2.1.1 Construction Duration

The estimated construction duration for this project will be approximately 4 years.

2.1.2 Construction Equipment

The construction equipment expected to be used for the construction of this project is as follows:

1. Spider, deck, and inland barges.
2. Barge tugs.
3. Mechanical dredge, spud barge with mechanical clamshell bucket.
4. Hydraulic Unloader, and floating pipeline.

5. Skiffs.
6. Air boats.
7. Survey vessels.
8. Marsh buggies.
9. Excavators, deck mounted.

2.1.3 Design

To provided approximately 2,177 acres of marsh at this location, the proposed construction will be three sites, marsh platforms, at this location. Site-1, Site-2, and Site-3 footprints will be 568 acres, 626 acres, and 983 acres respectively.

2.1.4 Marsh Platform Creation (Year 1 and 2)

2.1.4.1 Earthen Perimeter Containment Dikes (Initial Construction)

Perimeter containment dikes will be earthen dikes constructed from onsite borrow adjacent to the dikes. The adjacent borrow will have a minimum 40-ft setback from the interior perimeter dike toe to account for dike stability. The adjacent dike borrow will have an allowable 80-ft bottom width with 1:3 side slopes that transition to existing grade(s). The maximum excavation depth of elevation -12.0-ft for the adjacent dike borrow will be permitted. Containment dikes will be constructed with a 5-ft wide crown and 1:4 side slopes that transition down to existing grade. The perimeter dikes will be constructed to a crown elevation of +4.0-ft to contain dredge slurry and provided a minimum of 1.5-ft of freeboard. The estimated borrow material required for the initial perimeter dike construction, all sites, is approximately 1,193,000 CY.

2.1.4.2 Earthen Cross Dikes (Initial Construction)

Due to the size of the proposed marsh site, earthen cross dikes will be constructed to form multiple cells within the marsh site. These cells will provide more manageable areas for the disposal of dredge material within each site. Borrow material for the cross dikes will come from onsite adjacent borrow at a 40-ft setback from the cross dikes toe to account for dike stability. The adjacent dike borrow will have an allowable 80-ft bottom width with assumed 1:3 side slopes that transition up to existing grade(s). The maximum excavation depth of elevation -12.0-ft for the adjacent dike borrow will be permitted. Cross dikes will be constructed with a 5-ft wide crown and 1:4 side slopes that transition down to existing grade. The cross dikes will be constructed to a crown elevation of 1.5-ft to 2.0-ft with the intent that some dredged slurry will convey to the next cell, while containing most material in the intended cell. The estimated borrow material required for the initial cross dike construction, all sites, is approximately 225,000 CY.

2.1.4.3 Effluent Discharge/Spill Boxes

Each cell constructed for the marsh creation site will have an effluent discharge point with spill boxes at exterior locations where there is open water. Spill boxes will capture most sediment material suspended in the effluent discharge, but some sediment material will deposit in the adjacent open water locations. Spill boxes will be removed once the final marsh platform lift is completed.

2.1.4.4 Borrow Plan

The material for the construction of the marsh creation platform(s) is dredge material obtained at a proposed borrow location adjacent to the Atchafalaya Navigation Channel at Mile 150 to Mile 147.5. The proposed borrow site is approximately 1,600 acres, 5,000-ft wide by 14,000-ft long. The maximum excavation depth of the proposed borrow site will be to elevation -25.0-ft. Material at this borrow area will be dredged mechanically and transferred to barges. Once barges are filled, tugs will hull the barged material via the Atchafalaya Navigation Channel and GIWW to a staging area along the GIWW at approximate Mile 73.5 and/or a staging area located in Lake Hackberry adjacent to the project site. Once barged material is received at a staging area, the material will to be transferred to hydraulic unloader and pumped to the marsh sites via floating pipeline through an existing pipeline canal that conveys to the project site. The estimated one-way haul distance is 44 miles.

2.1.4.5 First Marsh Platform Lift

Once all perimeter containment dikes, cross dikes, and spill boxes are constructed, the first marsh platform lift for each will commence. The first lift will be from the assumed existing grade elevation of -2.0-ft to elevation +1.0-ft, a 3-ft lift. Borrow material delivered to the project site by barge will be transferred to a hydraulic unloader and pumped to the marsh sites via floating pipeline. Dredge slurry will be pumped into the marsh creation sites to an elevation no greater than elevation +3.0-ft, and a uniform fill elevation of +1.0-ft is achieved. The estimated borrow material required for the 1st lift, all sites, is approximately 22,565,000 CY.

2.1.4.6 Second Marsh Platform Lift

One year after the completion of the 1st lift, a 2.5-ft lift to elevation +4.5-ft on all perimeter dikes will be constructed, based on the assumption that the dikes will settle down to elevation +2.0-ft after a year. The estimated borrow required for the perimeter dike lift is approximately 363,000 CY. In addition, a 2-ft cap will be constructed for all cross dikes to achieve an elevation of +1.5-ft to +2.0-ft, based on the assumption that after a year the cross dikes will settle down to elevation 0.0-ft. The estimated borrow required for the 2-ft cap of the cross dikes is approximately 55,000 CY. Once all dike lifts/caps are complete, construction will commence with the second marsh platform lift. The second lift will be from the assumed settled marsh platform elevation of 0.0-ft to elevation +2.5-ft, a 2.5-ft lift. Borrow material delivered to the project site by barge will be transferred to a hydraulic unloader and pumped to the marsh sites via floating pipeline. Dredge slurry will be pumped into the marsh creation site to an elevation no greater than elevation +3.5-ft, and a uniform fill elevation of +2.5-ft is achieved. The estimated borrow material required for the marsh creation site for the 2nd lift, all sites, is approximately 11,000,000 CY.

2.1.5 Perimeter Dike Degrade (Year 3)

One year after the second marsh platform lift, it is assumed that marsh creation site will settle down to elevation +1.0-ft. At this time, the perimeter dikes will be degraded down to elevation +1.0-ft to match the surrounding marsh elevation. The estimated degrade quantity, all sites, is approximately 127,000 CY. Degraded dike material will be disposed of within the marsh creation areas at any low locations where the adjacent dike borrow was excavated.

2.1.6 Assumed Project Life Achieved

Due to the known poor foundation material in this region, it should be noted that the project life for this project is unknown at a study level. Projected marsh platform loss should be considered during the geotechnical analysis during or before any formal designs.

List of Acronyms and Abbreviations

AC	**Acre**
BA	**Borrow Area**
CY	**Cubic Yards**
FT	**Feet**
GIWW	**Gulf Intercoastal Waterway**
H	**Horizontal**
LA	**Louisiana**
Lbs	**Pounds**
LF	**Linear Feet**
MCA	**Marsh Creation Area**
MM/YR	**Millimeter per Year**
MTG	**Morganza to the Gulf**
NAVD88	**North American Vertical Datum 1988**
PSI	**Pounds per Square Inch**
ROM	**Rough Order of Magnitude**
SY	**Square Yard**
V	**Vertical**

Morganza to the Gulf of Mexico, Louisiana, Hurricane and Storm Damage Risk Reduction Project

Appendix C – Attachment 4 – Lake Salvador Fresh and Intermediate Marsh Constructed Project Description

October 2025

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SECTION 1
Introduction

This study is for the mitigation efforts for MTG Project overall marsh impacts. This project consists of a proposed intermediate/fresh marsh creation area at a location identified as Lake Salvador. The required acres for marsh creation at this location is approximately 2,380 acres. The requested level of engineering and cost estimation for this study is a Rough Order of Magnitude (ROM) level, 5% to 10% level design. This proposed project is divided into 5 different project sites. This project description covers Site-1, Site-2, Site-3, Site-4, and Site-5 of the sites proposed for this location.

1.1 PROJECT LOCATION

The proposed Lake Salvador marsh creation area is located at an open water site along the southern edge of Lake Salvador and north of the Gulf Intercoastal Waterway (GIWW), approximate Mile 26, within Lafourche Parish, Louisiana.

1.2 DATA GAPS AND DESIGN ASSUMPTIONS

Survey data, geotechnical borings/data, and site investigation data are not available and/or conducted for this study. Engineering and design for this proposed marsh creation project study is based on the following design assumptions:

A. Water bottom elevations: Based on other projects constructed in this region, it is assumed the water bottom (existing grade) is at elevation -2.0-ft.

B. Typical water elevations: Based on other projects constructed in this region, it is assumed the typical water elevations range from elevation +0.5-ft to +3.0-ft during non-storm events.

C. Platform foundations: Based on other projects constructed in the region, it is assumed the top 2-ft of material below existing grade has high moisture/organics content and will displace during dike and marsh platform construction. Estimated quantities for dike and marsh platform materials will take this 2-ft of displacement into count.

D. Target marsh elevation: Based on other studies, it is assumed the required marsh elevation (target elevation) is approximately +1.0-ft to +1.5-ft. The target elevation is elevation +1.0-ft for this study.

E. Containment dikes: Soil borings and geotechnical data are not available for this proposed marsh creation location. Based on other projects constructed in the region, it is assumed all onsite borrow material for containment dike construction will be high organics and moisture content. Issues stacking this borrow material during dike construction is likely. It is assumed all containment dikes and cross dikes will require a minimum of 1 vertical to 4 horizontal side slopes with a 5-ft wide dike crown. After conducting borings and a geotechnical analysis, stability berms for the dikes may be required, or better material for dike construction may have to be brought to the site. It is assumed that any associated costs for stability berms and/or to bring in offsite material for dike construction will be covered under the 25% contingency provided with the ROM estimate for this project study.

F. Borrow: The proposed material to construct the marsh creation area for this project is to be obtain from a borrow area within Lake Salvador. Base on other projects constructed in this region, it is assumed that the borrow material will be poor quality for marsh construction, as it is assumed that the borrow material will have a high organic and moisture content. This proposed borrow location will require an in-depth review and approvals to move forward.

G. Lifts: It is assumed that this site will require three marsh platform lifts based on the assumed quality of the proposed borrow material. After geotechnical and surveys investigations are complete, it may be determined that more than three lifts may be required, or mechanical placement may be required instead of hydraulic placement of material to construct the marsh platform. It is assumed that any associated costs for additional lifts will be covered under the 25% contingency provided with the ROM estimate for this project study.

H. Pipelines: This study did not conduct an in-depth pipeline locations/identification. Pipeline data for this marsh creation area and borrow location is assumed at a face value of what was shown on the DNR pipeline database. In addition, the proposed borrow area and marsh creation area within Lake Salvador may encounter wells and flowlines which have not been identified. Prior to any formal design or construction, the proposed project site and borrow area will require an in-depth pipeline, well, and flowline review and identification.

I. Access: Access corridors for construction equipment will transit through existing open water that convey to the project site from the GIWW navigation channel. It is assumed that dredging for flotation outside of the federal navigation channels may be required but not verified at this level of design. It is assumed that any associated costs for flotation will be covered under the 25% contingency provided with the ROM estimate for this project study. Prior to any formal design or construction, the proposed project site and access to Lake Salvador will require surveys and pipeline verification to determine if alternate access corridors will be required.

J. Proposed marsh Footprints: Footprints for the proposed marsh creation areas were developed based on aerial imagery. There is a level of difficulty of determining what is existing marsh or what is floating vegetation. Assume that the proposed marsh creation area footprints will have to be adjusted based on actual survey data and site visits.

K. Stone Armoring: For this study, assume that the stone gradation for dike armoring is 650-lb placed on top of 300-psi geotextile separator fabric based on other projects constructed in the region. The constructability of placing stone riprap on the earthen front dike is uncertain for this study and will have to be determined once a geotechnical analysis is complete. Prior to any formal design or construction, the stone size and geotextile fabric strength will need to be verified based on geotechnical and hydro/hydraulic data. Due to poor foundation and wave/fetch exposure a maintenance plan will have to be put into place to include outyear stone placement.

L. Vertical Datum: For all elevations stated herein, the vertical datum will be NAVD 88, latest established epoch.

SECTION 2
Construction Methodology

2.1 GENERAL CONSTRUCTION SUMMARY

Site 1 & Site 2: To construct the marsh platform, it is proposed that material from a 2 borrow areas within Lake Salvador be dredged via hydraulic cutterhead and dredge slurry will be pumped into the marsh creation area. The general order of work for construction is as follows:

1. Construct earthen perimeter containment dikes, front and back, to contain dredged slurry.
2. Construct earthen cross dikes to create cells to assist in managing dredge slurry containment.
3. Construct foreshore stone dike at 5 locations along the GIWW to protect the proposed marsh sites are exposed to the GIWW.
4. Construct spill boxes for each cell for effluent discharge locations.
5. Construct the 1st marsh platform lift by pumping the dredge slurry into the marsh creation cells.
6. Stone armor the front dike once the 1st lift is complete.
7. A year after the 1st lift, construct earthen lifts/caps on perimeter containment dikes and cross dikes to contain dredge slurry for the 2nd marsh platform lift.
8. Construct the 2nd marsh platform lift by pumping dredge slurry into the marsh creation cells.
9. Stone armor the front dike once the 2nd lift is complete.
10. A year after the 2nd lift, construct stone cap on front dikes and earthen caps on back dikes to contain dredge slurry for the 3rd marsh platform lift.
11. Construct the 3rd marsh platform lift by pumping dredge slurry into the marsh creation cells.
12. A year after the 3rd lift, degrade the back dikes down to elevation 1.0-ft.

Site 3 & Site 4: To construct the marsh platform, it is proposed that material from a borrow area within Lake Salvador be dredged via hydraulic cutterhead and dredge slurry will be pumped into the marsh creation area. The general order of work for construction is as follows:

1. Construct perimeter stone containment dikes to contain dredged slurry.
2. Construct spill boxes for each site for effluent discharge locations.
3. Construct the 1st marsh platform lift by pumping the dredge slurry into the marsh creation sites.
4. A year after the 1st lift, construct stone dike lifts/caps on perimeter containment dikes to contain dredge slurry for the 2nd marsh platform lift.
5. Construct the 2nd marsh platform lift by pumping dredge slurry into the marsh creation sites.
6. A year after the 2nd lift, construct stone cap on perimeter dikes to contain dredge slurry for the 3rd marsh platform lift.
7. Construct the 3rd marsh platform lift by pumping dredge slurry into the marsh creation sites.

Site 5: To construct the marsh platform, it is proposed that material from a 2 borrow areas within Lake Salvador, approximately 1,000-ft to 5,000-ft from the marsh creation sites, be dredged via hydraulic cutterhead and dredge slurry will be pumped into the marsh creation area. The general order of work for construction is as follows:

1. Construct earthen perimeter containment dikes, front and back, to contain dredged slurry.
2. Construct earthen cross dikes to create cells to assist in managing dredge slurry containment.
3. Construct foreshore stone dike along the GIWW to protect the proposed marsh site location exposed to the GIWW.
4. Construct spill boxes for each cell for effluent discharge locations.
5. Construct the 1st marsh platform lift by pumping the dredge slurry into the marsh creation cells.
6. Stone armor the front dike once the 1st lift is complete.
7. A year after the 1st lift, construct earthen lifts/caps on perimeter containment dikes and cross dikes to contain dredge slurry for the 2nd marsh platform lift.
8. Construct the 2nd marsh platform lift by pumping dredge slurry into the marsh creation cells.
9. Stone armor the front dike once the 2nd lift is complete.

10. A year after the 2nd lift, construct stone cap on front dikes and earthen caps on back dikes to contain dredge slurry for the 3rd marsh platform lift.
11. Construct the 3rd marsh platform lift by pumping dredge slurry into the marsh creation cells.
12. A year after the 3rd lift, degrade the back dikes down to elevation 1.0-ft.

2.1.1 Construction Duration

The estimated construction duration for this project will be approximately 5 years for each set: Sites 1 & 2, Site 3 & 4, and Site 5.

2.1.2 Construction Equipment

The construction equipment expected to be used for the construction of this project is as follows:

1. Spider, deck, and inland barges.
2. Barge tugs.
3. Mechanical dredge, spud barge with mechanical clamshell bucket.
4. Hydraulic Unloader, and floating pipeline.
5. Skiffs.
6. Air boats.
7. Survey vessels.
8. Marsh buggies.
9. Excavators, deck mounted.

2.1.3 Design

<u>Site 1 & 2</u>: Site-1 and Site-2 will provide approximately 1,746 acres of 2,380 acres required for the Lake Salvador location.

<u>Site 3 & 4</u>: Site-2 and Site-3 will provide approximately 331 acres of 2,380 acres required for the Lake Salvador location.

<u>Site 5</u>: Site-5 will provide approximately 303 acres of 2,380 acres required for the Lake Salvador location.

2.1.4 Marsh Platform Creation (Year 1, 2 and 3)

2.1.4.1 Perimeter Containment Dikes (Initial Construction)

Site 1 & Site 2: Earthen perimeter containment dikes will be earthen dikes constructed from onsite borrow adjacent to the dikes. Perimeter containment dikes are categized into front and back dikes for this project. Front containment dikes are located along the open waters of Lake Salvador and will require stone armoring to protect against lake fetch. Back containment dikes are located along the existing marsh and will not be stone armored. The adjacent borrow for dike construction will have a minimum 40-ft setback from the interior perimeter dike toe to account for dike stability. The adjacent dike borrow will have an allowable 80-ft bottom width with 1:3 side slopes that transition to existing grade(s). The maximum excavation depth of elevation -12.0-ft for the adjacent dike borrow will be permitted. Containment dikes will be constructed with a 5-ft wide crown and 1:4 side slopes that transition down to existing grade. The perimeter dikes will be constructed to a crown elevation of +4.0-ft to contain dredge slurry and provided a minimum of 1.5-ft of freeboard. The estimated borrow material required, all sites, for the initial perimeter dike construction is approximately 812,969 CY for the front dikes and 567,180 CY for the back dikes.

Site 3 & Site 4: Stone Perimeter containment dikes will be stone dikes to protect against wave wash and lake fetch. Containment dikes will be constructed with a 5-ft wide crown and 1:4 side slopes that transition down to existing grade. The perimeter dikes will be constructed to a crown elevation of +4.0-ft to contain dredge slurry and provided a minimum of 1.5-ft of freeboard. Stone for dikes will be 650-lb stone place on top of 300-psi strength geotextile separator fabric. Additional geotextile fabric will be placed along the interior of the perimeter stone dike to assist in the retaining dredge slurry. The estimated quantity for stone and geotextile, all sites, is approximately 850,000 TONS and 281,400 SY respectively.

Site 5: Earthen perimeter containment dikes will be earthen dikes constructed from onsite borrow adjacent to the dikes. Perimeter containment dikes are categized into front and back dikes for this project. Front containment dikes are located along the open waters of Lake Salvador and will require stone armoring to protect against lake fetch. Back containment dikes are located along the existing marsh and will not be stone armored. The adjacent borrow for dike construction will have a minimum 40-ft setback from the interior perimeter dike toe to account for dike stability. The adjacent dike borrow will have an allowable 80-ft bottom width with 1:3 side slopes that transition to existing grade(s). The maximum excavation depth of elevation -12.0-ft for the adjacent dike borrow will be permitted. Containment dikes will be constructed with a 5-ft wide crown and 1:4 side slopes that transition down to existing grade. The perimeter dikes will be constructed to a crown elevation of +4.0-ft to contain dredge slurry and provided a minimum of 1.5-ft of freeboard. The estimated borrow material required for the initial perimeter dike construction is approximately 215,000 CY for the front dikes and 118,000 CY for the back dikes.

2.1.4.2 Earthen Cross Dikes (Initial Construction)

Site 1 & Site 2: Due to the size of the proposed marsh site, earthen cross dikes will be constructed to form multiple cells within the marsh site. These cells will provide more manageable areas for the disposal of dredge material within each site. Borrow material for the cross dikes will come from onsite adjacent borrow at a 40-ft setback from the cross dikes toe to account for dike stability. The adjacent dike borrow will have an allowable 80-ft bottom width with assumed 1:3 side slopes that transition up to existing grade(s). The maximum excavation depth of elevation -12.0-ft for the adjacent dike borrow will be permitted. Cross dikes will be constructed with a 5-ft wide crown and 1:4 side slopes that transition down to existing grade. The cross dikes will be constructed to a crown elevation of 1.5-ft to 2.0-ft with the intent that some dredged slurry will convey to the next cell, while containing most material in the intended cell. The estimated borrow material required for the initial cross dike construction, all sites, is approximately 70,000 CY.

Site 3 & Site 4: NA

Site 5: Due to the size of the proposed marsh site, earthen cross dikes will be constructed to form multiple cells within the marsh site. These cells will provide more manageable areas for the disposal of dredge material within each site. Borrow material for the cross dikes will come from onsite adjacent borrow at a 40-ft setback from the cross dikes toe to account for dike stability. The adjacent dike borrow will have an allowable 80-ft bottom width with assumed 1:3 side slopes that transition up to existing grade(s). The maximum excavation depth of elevation -12.0-ft for the adjacent dike borrow will be permitted. Cross dikes will be constructed with a 5-ft wide crown and 1:4 side slopes that transition down to existing grade. The cross dikes will be constructed to a crown elevation of 1.5-ft to 2.0-ft with the intent that some dredged slurry will convey to the next cell, while containing most material in the intended cell. The estimated borrow material required for the initial cross dike construction is approximately 15,000 CY.

2.1.4.3 Foreshore Stone Dikes

Site 1 & Site 2: There are currently five locations between the GIWW and the proposed marsh creation sites that are exposed to propeller wash and fetch. These locations will have foreshore stone dikes, lengths very, to protect the new marsh platforms. The stone dikes will be constructed to elevation 4.0-ft with a 5-ft crown and 1:4 side slopes. Stone size for the dikes will be approximately 600-lbs stone gradation. Currently approximately 3,584-LF total will be required foreshore stone dikes, a total of 47,000 tons of stone and 21,500 SY of geotextile separator fabric will be required.

Site 3 & Site 4: NA

Site 5: There is currently one location between the GIWW and the proposed marsh creation sites that are exposed to propeller wash and fetch. This location will have a foreshore stone dike to protect the new marsh platforms. The stone dikes will be constructed to elevation 4.0-ft with a 5-ft crown and 1:4 side slopes. Stone size for the dikes will be approximately 650-lbs stone gradation. Currently approximately 1,795-LF will be required for the foreshore stone dike, a total of 10,500 tons of stone and 7,700 SY of geotextile separator fabric will be required.

2.1.4.4 Effluent Discharge/Spill Boxes (Initial Construction)

Site 1 & Site 2: Each cell constructed for the marsh creation site will have an effluent discharge point with spill boxes at exterior locations where there is open water. Spill boxes will capture most sediment material suspended in the effluent discharge, but some sediment material will deposit in the adjacent open water locations. Spill boxes will be removed once the final marsh platform lift is completed.

Site 3 & Site 4: Each marsh creation site will have an effluent discharge point with spill boxes at exterior locations where there is open water. Spill boxes will capture most sediment material suspended in the effluent discharge, but some sediment material will deposit in the adjacent open water locations. Spill boxes will be removed once the final marsh platform lift is completed.

Site 5: Each cell constructed for the marsh creation site will have an effluent discharge point with spill boxes at exterior locations where there is open water. Spill boxes will capture most sediment material suspended in the effluent discharge, but some sediment material will deposit in the adjacent open water locations. Spill boxes will be removed once the final marsh platform lift is completed.

2.1.4.5 Borrow Plan

Site 1 & Site 2: The material for the construction of the marsh creation platform(s) is dredge material obtained at a proposed borrow locations in Lake Salvador. The proposed borrow sites identified as Borrow Area-1 and Borrow Area-2 are approximately 1,212 acres and 482 acres respectively. The maximum excavation depth of the proposed borrow site will be to elevation -20.0-ft. Material at this borrow area will be dredged via hydraulic cutterhead and pumped to the marsh sites via floating pipeline through open waters that conveys to the project site. The estimated pump distance is 2,000-ft to 8,000-ft.

Site 3 & Site 4: The material for the construction of the marsh creation platform(s) is dredge material obtained at a proposed borrow locations in Lake Salvador. The proposed borrow site identified as Borrow Area-3 is approximately 482 acres. The maximum excavation depth of the proposed borrow site will be to elevation -20.0-ft. Material at this borrow area will be dredged via hydraulic cutterhead and pumped to the marsh sites via floating pipeline through open waters that conveys to the project site. The estimated pump distance is 3,000-ft to 8,000-ft.

Site 5: The material for the construction of the marsh creation platform(s) is dredge material obtained at a proposed borrow locations in Lake Salvador. The proposed borrow site identified as Borrow Area-2 is approximately 482 acres. The maximum excavation depth of the proposed borrow site will be to elevation -20.0-ft. Material at this borrow area will be dredged via hydraulic cutterhead and pumped to the marsh sites via floating pipeline through open waters that conveys to the project site. The estimated pump distance is 2,000-ft to 6,000-ft.

2.1.4.6 First Marsh Platform Lift

<u>Site 1 & Site 2</u>: Once all perimeter containment dikes, cross dikes, and spill boxes are constructed, the first marsh platform lift will commence. The first lift will be from the assumed varying existing grade elevation of -4.0-ft/ -2.0-ft to elevation +0.5-ft. Borrow material will be pumped to the marsh site via floating pipeline. Dredge slurry will be pumped into the marsh creation sites to an elevation no greater than elevation +3.0-ft, and a uniform fill elevation of +0.5-ft is achieved. The estimated borrow material required, all sites, for the 1st lift, all sites, is approximately 15,618,000 CY.

<u>Site 3 & Site 4</u>: Once all perimeter containment dikes are constructed, the first marsh platform lift will commence. The first lift will be from the assumed varying existing grade elevation of -5.0-ft to elevation +0.5-ft. Borrow material will be pumped to the marsh site via floating pipeline. Dredge slurry will be pumped into the marsh creation sites to an elevation no greater than elevation +3.0-ft, and a uniform fill elevation of +0.5-ft is achieved. The estimated borrow material required for the 1st lift, both sites, is approximately 4,700,000 CY.

<u>Site 5</u>: Once all perimeter containment dikes, cross dikes, and spill boxes are constructed, the first marsh platform lift will commence. The first lift will be from the assumed varying existing grade elevation of -4.0-ft/ -2.0-ft to elevation +0.5-ft. Borrow material will be pumped to the marsh site via floating pipeline. Dredge slurry will be pumped into the marsh creation sites to an elevation no greater than elevation +3.0-ft, and a uniform fill elevation of +0.5-ft is achieved. The estimated borrow material required for the 1st lift is approximately 2,432,400 CY.

2.1.4.7 First Stone Armoring

<u>Site 1 & Site 2:</u> After the completion of the first marsh platform lift, the front containment dikes will be stone armored to protect the new marsh platform until the next marsh platform lift a year later. Stone for armoring will be 650-lb stone place on top of 300-psi strength geotextile separator fabric. The estimated quantity for stone and geotextile, all sites, is approximately 173,000 TONS and 192,400 SY respectively.

<u>Site 3 & Site 4</u>: NA

<u>Site 5: </u>After the completion of the first marsh platform lift, the front containment dikes will be stone armored to protect the new marsh platform until the next marsh platform lift a year later. Stone for armoring will be 650-lb stone place on top of 300-psi strength geotextile

separator fabric. The estimated quantity for stone and geotextile is approximately 46,000 TONS and 51,000 SY respectively.

2.1.4.8 Second Marsh Platform Lift

Site 1 & Site 2: One year after the completion of the 1st lift a 2.0-ft earthen lift, with the centerline shifted to the interior, to elevation +4.0-ft on the front dikes will be constructed, based on the assumption that the front dike will settle down to elevation +2.0-ft after a year. Additionally, the back dike will have a 2.0-ft earthen lift to elevation +4.0-ft, based on the assumption that the back dikes will settle down to elevation +2.0-ft after a year. The estimated borrow required for the front and back dike earthen lifts, all sites, is approximately 150,000 CY and 155,000 CY respectively. In addition, a 2-ft cap over all cross dikes will be constructed to achieve an elevation of +1.5-ft to +2.0-ft, based on the assumption that after a year the cross dikes will settle down to elevation 0.0-ft. Once all dike lifts/caps are complete, the Contractor will commence with the second marsh platform lift. The second lift will be from the assumed settled marsh platform elevation of -1.5-ft to elevation +1.5-ft, a 3.0-ft lift. Dredge slurry will be pumped into the marsh creation site to an elevation no greater than elevation +3.0-ft, and a uniform fill elevation of +1.5-ft is achieved. The estimated borrow material required for all the marsh creation sites for the 2nd lift is approximately 10,360,000 CY.

Site 3 & Site 4: One year after the completion of the 1st lift a 2.0-ft stone lift for perimeter dikes will be constructed, based on the assumption that the dikes will settle down to elevation +2.0-ft after a year. Estimated stone and geotextile quantity, all sites, is 168,000 TONS and 45,130 SY respectively. Once all the dike lifts are complete, the Contractor will commence with the second marsh platform lift. The second lift will be from the assumed settled marsh platform elevation of -1.5-ft to elevation +1.5-ft, a 3.0-ft lift. Dredge slurry will be pumped into the marsh creation sites to an elevation no greater than elevation +3.0-ft, and a uniform fill elevation of +1.5-ft is achieved. The estimated borrow material required for the marsh creation site for the 2nd lift is approximately 1,900,000 CY.

Site 5: One year after the completion of the 1st lift a 2.0-ft earthen lift, with the centerline shifted to the interior, to elevation +4.0-ft on the front dikes will be constructed, based on the assumption that the front dike will settle down to elevation +2.0-ft after a year. Additionally, the back dike will have a 2.0-ft earthen lift to elevation +4.0-ft, based on the assumption that the back dikes will settle down to elevation +2.0-ft after a year. The estimated borrow required for the front and back dike earthen lifts is approximately 30,000 CY and 33,000 CY respectively. In addition, a 2-ft cap over all cross dikes will be constructed to achieve an elevation of +1.5-ft to +2.0-ft, based on the assumption that after a year the cross dikes will settle down to elevation 0.0-ft. Once all dike lifts/caps are complete, the Contractor will commence with the second marsh platform lift. The second lift will be from the assumed settled marsh platform elevation of -1.5-ft to elevation +1.5-ft, a 3.0-ft lift. Dredge slurry will be pumped into the marsh creation site to an elevation no greater than elevation +3.0-ft, and a uniform fill elevation of +1.5-ft is achieved. The estimated borrow material required for the marsh creation site for the 2nd lift is approximately 1,800,000 CY.

2.1.4.9 Second Stone Armoring

Site 1 & Site 2: After the completion of the second marsh platform lift, the front containment dikes will receive a 2-ft stone armoring cap to protect the new marsh platform until the next marsh platform lift a year later. Stone for armoring will be 650-lb stone place on top of 300-psi geotextile separator fabric. The estimated quantity for stone and geotextile, all sites, is approximately 180,000 TONS and 69,000 SY respectively.

Site 3 & Site 4: NA

Site 5: After the completion of the second marsh platform lift, the front containment dikes will receive a 2-ft stone armoring cap to protect the new marsh platform until the next marsh platform lift a year later. Stone for armoring will be 650-lb stone place on top of 300-psi geotextile separator fabric. The estimated quantity for stone and geotextile is approximately 48,000 TONS and 18,000 SY respectively.

2.1.5 Third Marsh Platform Lift

Site 1 & Site 2: One year after the completion of the 2nd lift a 2.0-ft to 2.5-ft stone cap to elevation +4.5-ft will be constructed on the front perimeter dikes based on the assumption that the dikes will settle down to elevation +2.0-ft after a year. The estimated stone required to cap the front dike, all sites, is approximately 90,280 TONS. The back dike will receive a 2-ft earthen lift based on the assumption the back dikes will settle down to elevation +2.0-ft after a year. The estimated borrow required to lift the back dike, all sites, is approximately 155,250 CY. Once all dike caps/lifts are complete, the Contractor will commence with the third marsh platform lift. The third lift will be from the assumed settled marsh platform elevation of -0.5-ft to elevation +2.5-ft, a 3.0-ft lift. Dredge slurry will be pumped into the marsh creation site to an elevation no greater than elevation +3.5-ft, and a uniform fill elevation of +2.5-ft is achieved. The estimated borrow material required for all the marsh creation sites for the 3rd lift is approximately 7,400,000 CY.

Site 3 & Site 4: One year after the completion of the 2nd lift a 2.0-ft stone cap for perimeter dikes will be constructed, based on the assumption that the dikes will settle down to elevation +2.5-ft after a year. Estimated stone and geotextile quantity, all sites, is 60,000 TONS and 40,000 SY respectively. Once all the dike lifts are complete, the Contractor will commence with the second marsh platform lift. The second lift will be from the assumed settled marsh platform elevation of -0.5-ft to elevation +2.5-ft, a 3.0-ft lift. Dredge slurry will be pumped into the marsh creation sites to an elevation no greater than elevation +3.5-ft, and a uniform fill elevation of +2.5-ft is achieved. The estimated borrow material required for the marsh creation site for the 2nd lift is approximately 1,300,000 CY.

Site 5: One year after the completion of the 2nd lift a 2.0-ft to 2.5-ft stone cap to elevation +4.5-ft will be constructed on the front perimeter dikes based on the assumption that the dikes will settle down to elevation +2.0-ft after a year. The estimated stone required to cap the front dike is approximately 24,000 TONS. The back dike will receive a 2-ft earthen lift based on the assumption the back dikes will settle down to elevation +2.0-ft after a year. The estimated borrow required to lift the back dike is approximately 40,000 CY. Once all dike caps/lifts are complete, the Contractor will commence with the third marsh platform lift. The third lift will be from the assumed settled marsh platform elevation of -0.5-ft to elevation +2.5-ft, a 3.0-ft lift. Dredge slurry will be pumped into the marsh creation site to an elevation no greater than elevation +3.5-ft, and a uniform fill elevation of +2.5-ft is achieved. The estimated borrow material required for the marsh creation site for the 3rd lift is approximately 1,300,000 CY.

2.1.6 Perimeter Dike Degrade (Year 4)

Site 1 & Site 2: One year after the third marsh platform lift, it is assumed that marsh creation site will settle down to elevation +1.0-ft. At this time the perimeter dikes will be degraded down to elevation +1.0-ft to match the surrounding marsh elevation. The estimated degrade quantity, all sites, is approximately 76,000 CY. Degraded dike material will be disposed of within the marsh creation areas at any low locations where the adjacent dike borrow was excavated.

Site 3 & Site 4: NA

Site 5: One year after the third marsh platform lift, it is assumed that marsh creation site will settle down to elevation +1.0-ft. At this time the perimeter dikes will be degraded down to elevation +1.0-ft to match the surrounding marsh elevation. The estimated degrade quantity, all sites, is approximately 15,000 CY. Degraded dike material will be disposed of within the marsh creation areas at any low locations where the adjacent dike borrow was excavated.

2.1.7 Assumed Project Life Achieved

Due to the known poor foundation material in this region, it should be noted that the project life for this project may be short. Projected marsh platform loss should be considered during the geotechnical analysis during or before any formal designs.

List of Acronyms and Abbreviations

AC	**Acre**
BA	**Borrow Area**
CY	**Cubic Yards**
FT	**Feet**
GIWW	**Gulf Intercoastal Waterway**
H	**Horizontal**
LA	**Louisiana**
Lbs	**Pounds**
LF	**Linear Feet**
MCA	**Marsh Creation Area**
MM/YR	**Millimeter per Year**
MTG	**Morganza to the Gulf**
NAVD88	**North American Vertical Datum 1988**
PSI	**Pounds per Square Inch**
ROM	**Rough Order of Magnitude**
SY	**Square Yard**
V	**Vertical**

Morganza to the Gulf of Mexico, Louisiana, Hurricane and Storm Damage Risk Reduction Project

Appendix C – Attachment 4 – Delta Farms Fresh and Intermediate Marsh Constructed Project Description

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SECTION 1
Introduction

This study is for the mitigation efforts for MTG Project overall marsh impacts. This project consists of a proposed intermediate/fresh marsh creation area at a location identified as Delta Farms. The required acres for marsh creation at this location is approximately 2,895 acres. The requested level of engineering and cost estimation for this study is a Rough Order of Magnitude (ROM) level, 5% to 10% level design.

1.1 PROJECT LOCATION

The proposed Delta Farms marsh creation area is located at open water site northwest of Little Lake and northeast of the town Cutoff within Lafourche Parish, Louisiana.

1.2 DATA GAPS AND DESIGN ASSUMPTIONS

Survey data, geotechnical borings/data, and site investigation data was not available and/or conducted for this study. Engineering and design for this proposed marsh creation project will be based on the following design assumptions:

A. Water bottom elevations: Based on other projects constructed in this region, it is assumed the water bottom (existing grade) is at elevation -2.0-ft.
B. Typical water elevations: Based on other projects constructed in this region, it is assumed the typical water elevations range from elevation +0.5-ft to +3.0-ft during non-storm events.
C. Platform foundations: Based on other projects constructed in the region, it is assumed the top 2-ft of material below existing grade has high moisture/organics content and will displace during dike and marsh platform construction. Estimated quantities for dike and marsh platform materials will take this 2-ft of displacement into count.
D. Target marsh elevation: Based on other studies, it is assumed the required marsh elevation (target elevation) is approximately +1.0-ft to +1.5-ft. The target elevation will be elevation +1.0-ft for this study.
E. Containment dikes: Soil borings and geotechnical data are not available for this proposed marsh creation location. Based on other projects constructed in the region, it is assumed all onsite adjacent borrow material for containment dike construction will be high organics and moisture content. Issues stacking this adjacent borrow material during dike construction is likely. It is assumed all containment dikes and cross dikes will require a minimum of 1 vertical to 4 horizontal side slopes with a 5-ft wide dike crown. After conducting borings and a geotechnical analysis, stability berms for the dikes may be required, or better material for dike construction may have to be brought to the site. It is assumed that any associated costs to bring in material for dike construction will be covered under the 25% contingency provided with the ROM estimate for this project study.

F. Borrow: The proposed material to construct the marsh creation area for this project is to be obtain from a borrow areas within Little Lake. Base on other projects constructed in this region, it is assumed that the borrow material will be poor quality for marsh construction, as it is assumed that the borrow material will have a high organic and moisture content. This proposed borrow locations will require an in-depth review and approvals to move forward. After geotechnical and surveys investigations are completed, the salinity content of the proposed borrow area will have to be investigated for suitability of fresh/intermediate marsh habitat.
G. Lifts: It is assumed that this site will require three marsh platform lifts based on the assumed quality of the proposed borrow material. After geotechnical and surveys investigations are complete it may be determined that more than three lifts may be required, or mechanical placement may be required instead of hydraulic placement of material to construct the marsh platform. It is assumed that any associated costs for additional lifts will be covered under the 25% contingency provided with the ROM estimate for this project study.
H. Pipelines: This study did not conduct an in-depth pipeline locations/identification. Pipeline data for this marsh creation area and borrow location is assumed at a face value of what was shown on the DNR pipeline database. In addition, the proposed borrow area and marsh creation area within Little Lake may encounter wells and flowlines which have not been identified. Prior to any formal design or construction, the proposed project site and borrow area will require an in-depth pipeline, well, and flowline review and identification.
I. Access: Access corridors for construction equipment will transit through existing pipeline corridors, open water, and bayous that convey to the project site from Little Lake. Access to Little Lake will be from the Gulf Intercoastal Waterway (GIWW) or Barataria Waterway navigation channels. It is assumed that dredging for flotation outside of the federal navigation channels may be required, but not verified at this level of design. It is assumed that any associated costs for flotation will be covered under the 25% contingency provided with the ROM estimate for this project study. Prior to any formal design or construction, the proposed project site and access to Little Lake will require surveys and pipeline verification to determine if alternate access corridors will be required.
J. Proposed Marsh Footprints: Footprints for the proposed marsh creation areas were developed based on aerial imagery. There is a level of difficulty of determining what is existing marsh or what is floating vegetation. Assume that the proposed marsh creation area footprints will have to be adjusted based on actual survey data and site visits.
K. Vertical Datum: For all elevations stated herein, the vertical datum will be NAVD 88, latest established epoch.
L. Stone Armoring: It is assumed that the stone armoring along the perimeter dike to protect the marsh creation area is not required. It may be determined that this project will require stone armoring once site visits and historical conditions are conducted/investigated.

SECTION 2
Construction Methodology

2.1 GENERAL CONSTRUCTION SUMMARY

To construct the marsh platform, it is proposed that material from a borrow areas within Little Lake be dredged via hydraulic cutterhead and dredge slurry will be pumped into the marsh creation area. The general order of work for construction is as follows:

1. Construct earthen perimeter containment dikes to contain dredged slurry.
2. Construct earthen cross dikes to create cells to assist in managing dredge slurry containment.
3. Construct spill boxes for each cell for effluent discharge locations.
4. Construct the 1st marsh platform lift by pumping the dredge slurry into the marsh creation cells.
5. A year after the 1st lift, construct lifts/caps on perimeter containment dikes and cross dikes to contain dredge slurry for the 2nd marsh platform lift.
6. Construct the 2nd marsh platform lift by pumping dredge slurry into the marsh creation cells.
7. A year after the 2nd lift, construct caps on perimeter containment dikes and cross dikes to contain dredge slurry for the 3rd marsh platform lift.
8. Construct the 3rd marsh platform lift by pumping dredge slurry into the marsh creation cells.
9. A year after the 3rd lift, degrade the perimeter dikes down to elevation 1.0-ft.

2.1.1 Construction Duration

The estimated construction duration for this project will be approximately 5 years.

2.1.2 Construction Equipment

The construction equipment expected to be used for the construction of this project is as follows:

1. Spider, deck, and inland barges.
2. Barge tugs.
3. Mechanical dredge, spud barge with mechanical clamshell bucket.
4. Hydraulic Unloader, and floating pipeline.
5. Skiffs.
6. Air boats.
7. Survey vessels.
8. Marsh buggies.
9. Excavators, deck mounted.

2.1.3 Design

To provided approximately 2,895 acres of marsh at this location four sites, marsh platforms, will be constructed. Site-1, Site-2, Site-3, and Site-4 footprints will be 843 acres, 606 acres, 614 acres, and 831 acres respectively.

2.1.4 Marsh Platform Creation (Year 1, 2, and 3)

2.1.4.1 Earthen Perimeter Containment Dikes (Initial Construction)

Perimeter containment dikes will be earthen dikes constructed from onsite borrow adjacent to the dikes. The adjacent borrow will have a minimum 40-ft setback from the interior perimeter dike toe to account for dike stability. The adjacent dike borrow will have an allowable 80-ft bottom width with 1:3 side slopes that transition to existing grade(s). The maximum excavation depth of elevation -12.0-ft for the adjacent dike borrow will be permitted. Containment dikes will be constructed with a 5-ft wide crown and 1:4 side slopes that transition down to existing grade. The perimeter dikes will be constructed to a crown elevation of +4.0-ft to contain dredge slurry and provided a minimum of 1.5-ft of freeboard. The estimated borrow material required for the initial perimeter dike construction, all sites, is approximately 1,480,000 CY.

2.1.4.2 Earthen Cross Dikes (Initial Construction)

Due to the size of the proposed marsh sites, earthen cross dikes will be constructed to form multiple cells within the marsh sites. These cells will provide more manageable areas for the disposal of dredge material within each site. Borrow material for the cross dikes will come from onsite adjacent borrow at a 40-ft setback from the cross dikes toe to account for dike stability. The adjacent dike borrow will have an allowable 80-ft bottom width with assumed 1:3 side slopes that transition up to existing grade(s). The maximum excavation depth of elevation -12.0-ft for the adjacent dike borrow will be permitted. Cross dikes will be constructed with a 5-ft wide crown and 1:4 side slopes that transition down to existing grade. The cross dikes will be constructed to a crown elevation of 1.5-ft to 2.0-ft with the intent that some dredged slurry will convey to the next cell, while containing most material in the intended cell. The estimated borrow material required for the initial cross dike construction, all sites, is approximately 683,460 CY.

2.1.4.3 Effluent Discharge/Spill Boxes

Each cell constructed for the marsh creation site will have an effluent discharge point with spill boxes at exterior locations where there is open water. Spill boxes will capture most sediment material suspended in the effluent discharge, but some sediment material will deposit in the adjacent open water locations. Spill boxes will be removed once the final marsh platform lift is completed

2.1.4.4 Borrow Plan

The material for the construction of the marsh creation platform(s) is dredge material obtained at a proposed borrow locations in Little Lake. The proposed borrow sites total approximately 2,546 acres. The maximum excavation depth of the proposed borrow sites will be to elevation -20.0-ft. Material at these borrow areas will be dredged via hydraulic cutterhead and pumped to the marsh sites via floating pipeline through an existing open water and canals that conveys to the project site.

2.1.4.5 First Marsh Platform Lift

Once all perimeter containment dikes, cross dikes, and spill boxes are constructed, the first marsh platform lift for each will commence. The first lift will be from the assumed existing grade elevation of -2.0-ft to elevation +1.0-ft, a 3-ft lift. Borrow material pumped to the marsh sites via floating pipeline. Dredge slurry will be pumped into the marsh creation sites to an elevation no greater than elevation +3.0-ft, and a uniform fill elevation of +1.0-ft is achieved. The estimated borrow material required for the 1st lift, all sites, is approximately 30,300,000 CY.

2.1.4.6 Second Marsh Platform Lift

One year after the completion of the 1st lift a 2.5-ft lift to elevation +4.5-ft on all perimeter dikes will be constructed, based on the assumption that the dikes will settle down to elevation +2.0-ft after a year. The estimated borrow required for the perimeter dike lift, all sites, is approximately 486,300 CY. In addition, a 2-ft cap over all cross dikes will be constructed to achieve an elevation of +1.5-ft to +2.0-ft, based on the assumption that after a year the cross dikes will settle down to elevation 0.0-ft. The estimated borrow required for the 2-ft cap of the cross dikes is approximately 146,000 CY. Once all dike lifts/caps are complete, construction will commence with the second marsh platform lift. The second lift will be from the assumed settled marsh platform elevation of -1.5-ft to elevation +1.5-ft, a 3.0-ft lift. Dredge slurry will be pumped into the marsh creation site to an elevation no greater than elevation +3.5-ft, and a uniform fill elevation of +1.5-ft is achieved. The estimated borrow material required for all the marsh creation sites for the 2nd lift is approximately 17,600,000 CY.

2.1.5 Perimeter Dike Degrade (Year 4)

One year after the second marsh platform lift, it is assumed that marsh creation sites will settle down to elevation +1.0-ft. At this time the perimeter dikes will be degraded down to elevation +1.0-ft to match the surrounding marsh elevation. The estimated degrade quantity, all sites, is approximately 160,000 CY. Degraded dike material will be disposed of within the marsh creation areas at any low locations where the adjacent dike borrow was excavated.

2.1.6 Assumed Project Life Achieved

Due to the known poor foundation material in this region, it should be noted that the project life for this project may be short. Projected marsh platform loss should be considered during the geotechnical analysis during or before any formal designs.

List of Acronyms and Abbreviations

AC	**Acre**
BA	**Borrow Area**
CY	**Cubic Yards**
FT	**Feet**
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NAVD88	**North American Vertical Datum 1988**
PSI	**Pounds per Square Inch**
ROM	**Rough Order of Magnitude**
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V	**Vertical**

Morganza to the Gulf of Mexico, Louisiana, Hurricane and Storm Damage Risk Reduction Project

Appendix C – Attachment 4 – Isle de Jean Charles Brackish and Saline Constructed Project Description

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SECTION 1
Introduction

This study is for the mitigation efforts required for the anticipated marsh impacts resulting from the construction of the Morganza to the Gulf (MTG) Project. This alternative consists of 16,709 acres of brackish/saline marsh creation at a location identified as Isle De Jean Charles developed with the intent to offset the overall brackish/saline marsh impacts of the MTG flood risk reduction system. Refer to the Environmental Analysis section for details on the marsh creation area (MCA) sizing process and requirements.

1.1 PROJECT LOCATION

The project area is primarily located in Terrebonne Parish, with some portions extending into Lafourche Parish. It is divided into four distinct marsh creation areas labeled as MCA-1, MCA-2, MCA-3, and MCA-4. Additionally, an alternative MCA was also identified during project development. These sites span a significant distance, with some areas located up to 10 miles apart, necessitating their compartmentalization to reduce the project's complexity and align with the required level of design for this study. The town of Isle de Jean Charles, LA, serves as the focal point of the project area.

MCA-1 is the northernmost marsh creation area, comprising two cells categorized as MCA-1 East and MCA-1 West. MCA-1 East is located in Lafourche Parish and includes three cells near the Pointe aux Chenes Wildlife Management Area, extending to Lake Bully Camp and the surrounding area adjacent to Bayou Bouillon, just north of Lake Cheniere. This area is accessible via Bayou Pointe au Chien and several other existing bayous and pipeline corridors, eventually leading to Cutoff Canal and open water areas near the marsh. MCA-1 West consists of two cells located to the west of Bayou St. Jean Charles, south of Wonder Lake, and below existing terrace fields. Access to this site is provided through existing pipeline corridors, bayous, and open water areas, connecting to the identified borrow areas.

MCA-2 consists of two cells centrally located in the overall project vicinity, situated within Lake Tambour. MCA-3 is located in the southeastern region of the project area, encompassing a single cell west of the Bayou Pointe au Chien limits, near Lake Billiot. This site lies along the parish boundary between Terrebonne and Lafourche Parishes. The alternative MCA consists of three cells identified directly east of the town of Isle De Jean Charles, LA and falls between the MCA-1 East and MCA-3 footprints. Each of these marsh areas can be accessed through existing bayous and open water areas in the vicinity.

MCA-4 is the westernmost marsh creation area, consisting of five cells. Located adjacent to Bayou Terrebonne, along South Madison Road, this area encompasses Madison Bay and Billy Goat Bay to the north. Access to MCA-4 for construction will be through Bayou Terrebonne and Madison Canal and other open water areas.

Three borrow areas were considered to support the project, each consisting of multiple cells strategically placed to avoid known pipelines and oyster seed grounds. The first borrow area consists of two cells located directly south of MCA-1 West and encompasses a portion of Wonder Lake (BA-1). The second borrow area consists of six cells primarily located in Lake Boudreaux (BA-2), to the directly west of MCA-4. The access corridor from Lake Boudreaux will cross Bayou Petit Caillou, Bush Canal, and Bayou Terrebonne to reach the MCAs. The third borrow area includes three cells located in the open waters of Lake Barre and Lake Felicity (BA-3). Access to this site will be via existing pipeline corridors, bayous, and open water areas, connecting the borrow area to the MCAs.

SECTION 2
Design and Construction

2.1 CONTAINMENT DIKES

Earthen perimeter dikes will be fully-confined, constructed from onsite/interior borrow adjacent to the dikes. This alternative requires two dike sections, classified as front and back dikes, due to the project's exposure to wave/fetch action in the areas adjacent to open water. The front containment dikes will be constructed with an 8-foot crown width and the back dikes, located against existing marsh, will have a 5-foot crown width. Both sections have a 1V:5H side slope that transition down to existing grade.

The perimeter dike crown elevation varies per site; MCA-1 and MCA-4 will be constructed to a crown elevation of +5.75-ft NAVD88 and MCA-2 and MCA-3 will be constructed to elevation +6.00-ft NAVD88 to contain dredge slurry and provided a minimum 2-foot freeboard. A 30% settlement assumption was applied to both the front and back dike heights and incorporated into the volumetric calculations. Due to time constraints in the study, the inclusion of rock dikes was not evaluated in this alternative. However, additional analysis could facilitate the incorporation of stone sections at the southern MCAs most exposed to wave action and storm impacts. See the Dike Design section for additional details on borrow requirements and quantity calculations.

The estimated borrow material required for the perimeter dike construction for the Overall MTG areas totals to 16,746,000 cubic yards (CY). See the Table Celow for a detailed list of the dike parameters.

Table C4:2-1. Perimeter Dike Parameters

Overall MTG Sites	MCA-1	MCA-2	MCA-3	MCA-4
Total Perimeter Length (LF):	138,185	88,369	59,503	185,885
Total Required Dike Volume (CY):	3,596,000	4,204,000	2,685,000	6,264,000
Back Dikes				
Length (LF):	124,013	36,526	22,523	112,000
Crown Width (FT):	5	5	5	5
Slope Run (1V: **X-ft** H):	5	5	5	5
Top of Dike Elevation (FT NAVD88):	+5.75	+6.00	+6.00	+5.75
Base Elevation (FT NAVD88):	-2.90	-3.50	-3.30	-2.80
Assumed Settlement (FT):	2.5	2.7	2.6	2.4
Back Dike Volume (CY):	2,856,000	1,021,000	587,000	2,450,000
Front Dikes				
Length (LF):	14,172	51,843	36,980	73,885
Crown Width (FT):	8	8	8	8
Slope Run (1V: **X-ft** H):	5	5	5	5
Top of Dike Elevation (FT NAVD88):	+5.75	+6.00	+6.00	+5.75
Base Elevation (FT NAVD88):	-2.90	-3.50	-3.30	-2.80
Assumed Settlement (FT):	2.5	2.7	2.6	2.4
Front Dike Volume (CY):	740,000	3,183,000	2,098,000	3,815,000

2.1.1 Cross Dikes

Due to the size of the proposed marsh sites, earthen cross dikes or training dikes will be constructed with the intent to assist in the vertical stacking of the dredged material by providing more manageable areas for the disposal of dredge material within the marsh sites. Cross dikes will be constructed with a 3-foot-wide crown and 1V:3H side slopes that transition down to existing grade. The cross dikes will be constructed to a crown elevation half a foot higher than the designed max slurry elevation and therefore varies per site. MCA-1 and MCA-4 will be constructed to crown elevation +4.25-ft NAVD88; MCA-2 and MCA-3 will be constructed to +4.50-ft NAVD88. The estimated borrow material required for the initial cross dike construction is approximately 1,875,000 CY for the Overall MTG Mitigation Areas. See the Dike Design section for additional details on these assumptions.

2.1.2 Discharge Monitoring

Grade stakes will be placed throughout the project areas. Discharge location will be monitored against grade stakes to determine movement needed within the marsh platform to achieve the most uniform platform possible with little mechanical relocation of high points post construction.

Spill boxes will be strategically located along the limits of the perimeter dike adjacent to open water areas to serve as the effluent discharge points at each MCA. The intent is to capture most sediment suspended in the effluent discharge, but some material will still likely deposit in the adjacent open water locations. After marsh fill operations are completed and sufficient dewatering and compaction has occurred, the spill boxes will be removed.

2.1.3 Marsh Platform Lift

Once all perimeter containment dikes, cross dikes, and spill boxes are constructed, the marsh platform lift for each site will commence. To build the overall MTG marsh mitigation areas, it is proposed that sediment will be dredged from designated borrow areas in Lake Barre and Lake Felicity using a hydraulic cutterhead. The sediment will then be pumped as slurry into the marsh creation area through a floating pipeline.

The contractor will be directed to fill the marsh creation area from the varying existing ground elevation to the max constructed fill elevation (final target elevation with the anticipated settlement), with the expectation the platform will ultimately settle into the necessary target elevation of +1.25-ft NAVD88. A +/- 0.5-foot tolerance during the fill operations will be allowable.

It's assumed only one (1) lift will be required for this project at this design stage, however this will need to be confirmed through field investigations and future geotechnical analysis. Subsidence, foundation settlement, fill compaction/shrinkage, dewatering, and construction losses were accounted for in the quantity calculations. See the Marsh Creation Area Design section for additional detail on the assumptions and calculations.

The selected parameters for the marsh fill operations vary per sites; a summary of each MCA is included in the table below. The estimated total quantity of fill material includes the backfilling of internal dike borrow areas. In total, the Overall MTG marsh platforms require 226,807,000 CYs.

Table C4:2-2. Marsh Fill Operations Per Site Per Lift

Overall MTG Sites	MCA-1	MCA-2	MCA-3	MCA-4
Area (AC):	4,215	3,623	2,055	6,816
Max Slurry Elevation (FT NAVD88):	+3.75	+4.00	+4.00	+3.75
Target Elevation (FT NAVD88):	+1.25	+1.25	+1.25	+1.25
Water Bottom Elevation (FT NAVD88):	-2.90	-3.50	-3.30	-2.80
Intermediate Subsidence (MM/YR):	13.83	13.83	13.83	13.83
Assumed Settlement (FT):	1.1	1.1	1.1	1.1
Marsh Fill Volume (CY):	55,015,000	53,757,000	29,983,000	88,054,000

2.1.4 Borrow Plan

Given the uncertainties at this design stage, several borrow areas were identified as potential sources of dredge material to achieve the required elevations for the marsh platforms and meet habitat goals. See the Borrow Area Design section for more details on the borrow analysis and quantity calculations.

The fill material for the construction of the MTG mitigation areas will be hydraulically dredged sediment obtained from Lake Barre/Felicity (BA-3). It is assumed these borrow area will provide suitable material for the construction of the marsh platform(s), as the material is assumed to have mixed sediment content according to the Louisiana Sand Resources Database (LA-0161) and other neighboring projects in the region.

Wonder Lake (BA-1) and Lake Boudreaux (BA-2) were also considered in the evaluation process as potential borrow sources. Both areas consist of primarily fine material, though appear to have some sand content in some locations. Therefore, the sites were assumed to have mixed sediment content considering data from LA-0161 and other nearby construction efforts.

The proposed borrow sites total to approximately 26,098 acres, and satisfies the overall volume needed by 128%. It is assumed that neither Wonder Lake nor Lake Boudreaux alone, or even a combination of these sources, would be able to meet the required material volume. Therefore, Alternative 1 evaluates the option of combining Lake Barre and Felicity with the two other identified borrow sources. While Alternative 2 solely considers borrow from Lake Barre and Felicity, as this area is large enough to supply the full volume needed for the marsh platform. Of the two identified alternatives, Alternative 2 is the most cost-effective, and as such, it is the proposed borrow plan for this project. While various iterations of construction sequencing using all three borrow sources could have been considered, further borrow combinations were not explored due to time constraints. Future analyses may allow for the exploration of additional options. See the Table Celow for detailed information on each borrow area.

Required Contract Borrow Quantity for the Overall MTG Areas: 458,864,000 CY.

Table C4:2-3. Borrow Site Details by Borrow Site

Overall MTG Sites	**BA-1 (Mechanical)**	**BA-2 (Hydraulic)**	**BA-3 (Hydraulic)**
Area (AC):	598	4,985	20,515
Max Allowable BEC (FT NAVD88):	-20	-20	-25
Assumed Depth of Material (FT):	10	10	15
Available Borrow Volume (CY):	9,642,000	80,418,000	496,472,000
Percentage of Overall Need Met:	2%	18%	108%

Alternative 1:

- BA-1 (Wonder Lake): 9,642,000 CY
- BA-2 (Lake Boudreaux): 80,418,000 CY
- BA-3 (Lake Barre/Lake Felicity): 368,804,000 CY

Alternative 2 – Proposed Borrow Plan:

- **BA-3 (Lake Barre/Lake Felicity): 458,864,000 CY**

2.1.5 Dike Degrade/Gapping

One to three years post-construction of the marsh platform, it is assumed that the sites will settle down to the desired target elevation. At this time the dikes will be degraded down to elevation +1.25-ft NAVD88 (+/- 0.5-foot), in attempt to align with the surrounding marsh elevation. Gapping locations will also be included in this effort to enhance tidal exchange across the MCAs. Excavated material will be disposed of within the marsh creation areas at any low locations within the project footprint. See the Dike Design section for additional information on this process. The estimated excavation quantity is approximately 1,989,000 CY for the Overall MTG Mitigation Areas.

SECTION 3

List of Acronyms and Abbreviations

AC	Acre
BA	Borrow Area
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FT	Feet
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LA	Louisiana
Lbs	Pounds
LF	Linear Feet
MCA	Marsh Creation Area
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Mississippi Valley Division,
Regional Planning and Environment Division South

Morganza to the Gulf of Mexico, Louisiana, Hurricane and Storm Damage Risk Reduction Project

Appendix C – Attachment 4 – North Barataria Bay Brackish and Saline Constructed Project Description

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SECTION 1
Introduction

This study is for the mitigation efforts required for the anticipated marsh impacts resulting from the construction of the Morganza to the Gulf (MTG) Project. This alternative consists of 6,791 acres of brackish/saline marsh creation at a location identified as North Barataria Bay developed with the intent to offset the overall brackish/saline marsh impacts of the MTG flood risk reduction system. Refer to the Environmental Analysis section for details on the marsh creation area (MCA) sizing process and requirements.

1.1 PROJECT LOCATION

The project area is primarily located in Lafourche Parish near Galliano and Golden Meadow, LA. The mitigation plan consists of two marsh creation areas directly adjacent to each other. The first site is located in the open water between Bayou L'Ours ridge and Brusle Lake (MCA-1) and the second site encompasses Kings Canal just south of Round Lake (MCA-2).

The two proposed borrow areas each consist of multiple cells in an attempt to avoid known pipelines and oyster seed grounds. The identified borrow area northeast of the MCAs is primarily located in Little Lake (BA-1) and consists of 5 cells spanning across Bay Dosgris, Round Lake, and Bay L'Ours. The two most eastern of the five cells cross over the parish boundary line from Lafourche into Jefferson Parish. The second borrow area (BA-2) located in Cat Bay is south of the MCAs, crossing over the parish boundary line from Jefferson to Plaquemines Parish. Cat Bay is roughly four miles northeast of Grand Isle and Isle Grande Terre. Access corridors for construction equipment will transit through existing pipeline corridors, open water, and bayous that convey between the marsh sites and borrow areas.

SECTION 2
Design and Construction

2.1 CONTAINMENT DIKES

Earthen perimeter dikes will be fully confined, constructed from onsite/interior borrow adjacent to the dikes. Containment dikes will be constructed with a 5-foot crown width and 1V:5H side slopes that transition down to existing grade. The perimeter dike crown elevation varies per site; MCA-1 will be constructed to a crown elevation of +5.75' NAVD88 and MCA-2 to elevation +6.00' NAVD88 to contain dredge slurry and provided a minimum 2-foot freeboard. A 30% settlement assumption was applied to the dike height and incorporated into the volumetric calculations. See the Dike Design section for additional details on borrow requirements and quantity calculations.

The estimated borrow material required for the perimeter dike construction for the Overall MTG mitigation areas totals to 6,168,000 cubic yards (CY). See the Table below for a detailed list of the dike parameters.

Table C4:2-1. List of Dike Parameters

Overall MTG Sites	MCA-1	MCA-2
Total Perimeter Length (LF):	58,329	56,070
Crown Width (FT):	5	5
Slope Run (1V: **X'** H):	5	5
Top of Dike Elevation (FT NAVD88):	+5.75	+6.00
Base Elevation (FT NAVD88):	-2.50	-3.80
Assumed Settlement (FT):	2.3	2.8
Dike Volume (CY):	2,609,000	3,559,000
Assumed Settlement (FT):	2.4	3.2
Front Dike Volume (CY):	221,000	917,000

2.1.1 Cross Dikes

Due to the size of the proposed marsh sites, earthen cross dikes or training dikes will be constructed with the intent to assist in the vertical stacking of the dredged material by providing more manageable areas for the disposal of dredge material within the marsh sites. Cross dikes will be constructed with a 3-foot-wide crown and 1V:3H side slopes that transition down to existing grade. The cross dikes will be constructed to a crown elevation half a foot higher than the designed max slurry elevation. The crown elevation varies per site; MCA-1 will be constructed to +4.75' NAVD88 and MCA-2 to +5.00' NAVD88. The estimated borrow material required for the initial cross dike construction is approximately 914,800 CYs. See the Dike Design section for additional details on these assumptions.

2.1.2 Discharge Monitoring

Grade stakes will be placed throughout the project areas. Discharge location will be monitored against grade stakes to determine movement needed within the marsh platform to achieve the most uniform platform possible with little mechanical relocation of high points post construction.

Spill boxes will be strategically located along the limits of the perimeter dike adjacent to open water areas to serve as the effluent discharge points at each MCA. The intent is to capture most sediment suspended in the effluent discharge, but some material will still likely deposit in the adjacent open water locations. After marsh fill operations are completed and sufficient dewatering and compaction has occurred, the spill boxes will be removed.

2.1.3 Marsh Platform Lift

Once all perimeter containment dikes, cross dikes, and spill boxes are constructed, the marsh platform lift for each site will commence. To build the marsh platforms, it is proposed that sediment will be dredged from designated borrow areas in Little Lake and Cat Bay using a hydraulic cutterhead. The sediment will then be pumped as slurry into the marsh creation area through a floating pipeline.

The contractor will be directed to fill the marsh creation area from the varying existing ground elevation to the max constructed fill elevation (final target elevation with the anticipated settlement), with the expectation the platform will ultimately settle into the necessary target elevation of +1.25' NAVD88. A +/- 0.5-foot tolerance during the fill operations will be allowable.

It's assumed only one (1) lift will be required for this project at this design stage, however this will need to be confirmed through field investigations and future geotechnical analysis. Subsidence, foundation settlement, fill compaction/shrinkage, dewatering, and construction losses were accounted for in the quantity calculations. See the Marsh Creation Area Design section for additional detail on the assumptions and calculations.

The selected parameters for the marsh fill operations vary per sites; a summary of each MCA is shown in the Table Celow. The estimated total quantity of fill material includes the backfilling of internal dike borrow areas. In total, the Overall MTG marsh platforms require 92,069,000 CYs.

Table C4:2-2. Marsh Fill Operations Per Site

Overall MTG Sites	MCA-1	MCA-2
Area (AC):	3,973	2,818
Max Slurry Elevation (FT NAVD88):	+3.75	+4.00
Target Elevation (FT NAVD88):	+1.25	+1.25
Water Bottom Elevation (FT NAVD88):	-2.5	-3.8
Intermediate Subsidence (MM/YR):	13.92	13.92
Assumed Settlement (FT):	1.1	1.1
Marsh Fill Volume (CY):	47,624,000	44,445,000

2.1.4 Borrow Plan

Given the uncertainties at this design stage, several borrow areas were identified as potential sources of dredge material to achieve the required elevations for the marsh platforms and meet habitat goals. See the Borrow Area Design section for more details on the borrow analysis and quantity calculations.

The material for the construction of the MCAs is to be hydraulically dredged sediment obtained at the following proposed borrow locations: Little Lake (BA-1) and Cat Bay (BA-2). It is assumed these borrow area will provide suitable material for the construction of the marsh platform(s), as the material is assumed to have mixed sediment content. According to the Louisiana Sand Resources Database (LA-0161) and other neighboring projects in the region, Little Lake is primarily fines with some sand and Cat Bay appears to have more sand content with some areas of fines.

The proposed borrow sites total to approximately 16,700 acres, and satisfies the overall volume needed by 187%. It is assumed that Little Lake will not meet the required amount of material on its own, therefore Alternative 1 evaluates the option of both Little Lake and Cat Bay borrow. Alternative 2 solely considers borrow from Cat Bay, as this area is large enough to fill the full marsh platform. The most cost effective of the two alternatives detailed below is Alternative 1, therefore this is the proposed borrow plan for this project. See the Table Celow for the details on each borrow area.

Required Contract Borrow Quantity for the Overall MTG Areas: 186,698,000 CY

Table C4:2-3. Borrow Site Details by Borrow Site

Overall MTG Sites	BA-1 (Hydraulic)	BA-2 (Hydraulic)
Area (AC):	6,651	10,018
Max Allowable BEC (FT NAVD88):	-20	-25
Assumed Depth of Material (FT):	10	15
Available Borrow Volume (CY):	107,296,000	242,439,000
Percentage of Need Met:	57%	130%

Alternative 1 – Proposed Borrow Plan:

- **BA-1 (Little Lake): 107,296,000 CY**
- **BA-2 (Cat Bay): 79,402,000 CY**

Alternative 2:

- **BA-2 (Cat Bay): 186,698,000 CY**

2.1.5 Dike Degrade/Gapping

One to three years post-construction of the marsh platform, it is assumed that the sites will settle down to the desired target elevation. At this time the dikes will be degraded down to elevation +1.25' NAVD88 (+/- 0.5-foot), in attempt to align with the surrounding marsh elevation. Gapping locations will also be included in this effort to enhance tidal exchange across the MCAs. Excavated material will be disposed of within the marsh creation areas at any low locations within the project footprint. See the Dike Design section for additional information on this process. The estimated excavation quantity is approximately 209,000 CY for the Overall MTG Mitigation Areas.

SECTION 3
List of Acronyms and Abbreviations

BA	**Borrow Area**
CY	**Cubic Yards**
FT	**Feet**
H	**Horizontal**
LA	**Louisiana**
LF	**Linear Feet**
MCA	**Marsh Creation Area**
MTG	**Morganza to the Gulf**
NAVD88	**North American Vertical Datum 1988**
V	**Vertical**

Mississippi Valley Division,
Regional Planning and Environment Division South

Morganza to the Gulf of Mexico, Louisiana, Hurricane and Storm Damage Risk Reduction Project

Appendix C – Attachment 4 – Three Mile Bay Brackish and Saline Constructed Project Description

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Introduction

This study is for the mitigation efforts required for the anticipated marsh impacts resulting from the construction of the Morganza to the Gulf (MTG) Project. This alternative consists of 8,728 acres of brackish/saline marsh creation at a location identified as Three Mile Bay developed with the intent to offset the overall brackish/saline marsh impacts of the MTG flood risk reduction system. Refer to the Environmental Analysis section for details on the marsh creation area (MCA) sizing process and requirements.

1.1 PROJECT LOCATION

The project area is located in St. Bernard Parish near the Louisiana eastern state borderline. The project is situated in between Lake Borgne and Chandeleur Sound in the vicinity of the Biloxi State Wildlife Management Area.

The mitigation plan consists of two marsh creation areas separated by Three Mile Bay. The first site (MCA-1) is to the east, spanning across multiple water bodies including: Johnson Bay, SE and NW Jack Williams Bay, Bayou Creque, Turkey Bayou, and Oyster Bay. MCA-1 consists of three distinct cells designed to minimize any impact on the surrounding marsh area. The second site (MCA-2) is on the west side of Three Mile Bay, consisting of two cells separated by Nine Mile Bayou. These cells encompass Blind Bay and Kennedys Lagoon.

One large borrow area (BA-1) identified between Lake Borgne and the Mississippi Sound was considered for this proposal and located to the north of the MCAs and directly east of Grand Island. Access corridors from the borrow site to the two MCAs traverse the open waters in Lake Borgne and Oyster Bay.

SECTION 2
Design and Construction

2.1 CONTAINMENT DIKES

The perimeter containment dikes will be a composite of both stone and earthen sections and will be fully confined. Two distinct dike sections were considered for the study and will be classified as front (stone) and back (earthen). Selection of dike section is based varying site conditions, such as depth and exposure to wave action. Additionally, two lifts were considered in this analysis to address site condition concerns, particularly the water depth associated with the hydraulic fill operation. See the Dike Design section for additional details on borrow requirements and quantity calculations.

The front perimeter containment dikes will be constructed with stone, specifically designed to protect against wave action created by long lake fetch. These dikes will feature a 4-foot crown width with 1V:3H side slopes, transitioning down to the existing grade. Stone size for the dikes will be approximately 1200-lbs stone gradation and will be placed on top of 400-psi strength geotextile separator fabric, with additional fabric on the interior of the dikes to help retain dredge slurry. A 35% settlement assumption has been factored into the dike height for volumetric calculations.

The necessity of constructing stone dikes is uncertain and would need to be verified through future hydraulic and geotechnical analysis. Due to exposure to wave action and lessons learned from other projects utilizing rock dike designs, a maintenance plan will be necessary, including periodic stone placement in the outyears.

The back perimeter containment dikes will be earthen, sourced from onsite/interior borrow material adjacent to the dikes. These earthen dikes will have a 5-foot-wide crown with 1V:3H side slopes transitioning to the existing grade. A 30% settlement assumption was applied to the height of the back dikes for volumetric calculations.

2.1.1.1 First Lift:

The perimeter dike crown elevation for both MCA-1 and MCA-2 will be constructed from the existing water bottom elevations to a crown elevation of +5.0-ft NAVD88 to contain dredge slurry while still maintaining a minimum 2-foot freeboard.

See the table below for a detailed list of the dike parameters. For the first lift of the Overall MTG areas, in total, the estimated quantity for stone and geotextile is approximately

2,056,000 TONS and 657,000 SY respectively and the estimated borrow material required for the initial earthen dike construction is approximately 6,598,000 CY.

Table C4:2-1. Perimeter Dike Parameters for First Lift

LIFT 1 - Overall MTG Sites	MCA-1	MCA-2
Total Perimeter Length (LF):	185,968	57,233
Back - Earthen Dikes		
Length (LF):	135,250	43,607
Crown Width (FT):	5	5
Slope Run (1V: X-ft H):	3	3
Top of Dike Elevation (FT NAVD88):	+5.0	+5.0
Base Elevation (FT NAVD88):	-4.8	-5.7
Assumed Settlement (FT):	2.00	2.25
Back Dike Volume (CY):	4,777,000	1,821,000
Front – Stone Dikes		
Length (LF):	50,718	13,626
Crown Width (FT):	4	4
Slope Run (1V: X-ft H):	3	3
Top of Dike Elevation (FT NAVD88):	+5.5	+6.0
Base Elevation (FT NAVD88):	-4.8	-5.7
Assumed Settlement (FT):	2.75	3.00
Front Dike Volume (TONS):	1,558,000	498,000
Geotextile (SY)	509,000	148,000

2.1.1.2 Second Lift:

One year after the completion of the 1st lift, both the earthen and stone dikes will need to be recapped prior to the next marsh fill operations. The perimeter dike for both MCA-1 and MCA-2 will be constructed from the existing base elevation to a crown elevation of +4.75-ft NAVD88 to contain dredge slurry and provided a minimum 2-foot freeboard. The estimated borrow required for the front and back dike earthen lifts is approximately 192,000 TONS and 473,000 CY respectively.

Table C4:2-2. Perimeter Dike Parameters for Second Lift

LIFT 2 - Overall MTG Sites	MCA-1	MCA-2
Total Perimeter Length (LF):	185,968	57,233
Back - Earthen Dikes		
Length (LF):	135,250	43,607
Crown Width (FT):	5	5
Slope Run (1V: **X-ft** H):	3	3
Top of Dike Elevation (FT NAVD88):	+4.75	+4.75
Base Elevation (FT NAVD88):	+2.75	+2.50
Assumed Settlement (FT):	0.75	0.75
Back Dike Volume (CY):	346,000	127,000
Front – Stone Dikes		
Length (LF):	50,718	13,626
Crown Width (FT):	4	4
Slope Run (1V: **X-ft** H):	3	3
Top of Dike Elevation (FT NAVD88):	+4.75	+4.75
Base Elevation (FT NAVD88):	+2.50	+2.25
Assumed Settlement (FT):	1.0	1.0
Front Dike Volume (TONS):	145,000	47,000

2.1.2 Cross Dikes

Due to the size of the proposed marsh sites, earthen cross dikes or training dikes will be constructed with the intent to assist in the vertical stacking of the dredged material by providing more manageable areas for the disposal of dredge material within the marsh sites. Cross dikes will be constructed with a 3-foot-wide crown and 1V:3H side slopes that transition down to existing grade. The cross dikes will be constructed to a crown elevation half a foot higher than the designed max slurry elevation.

For the first platform lift, the cross dikes will be constructed to crown elevation +3.5-ft NAVD88 at both MCAs. The estimated borrow material required for the initial cross dike construction for the large MTG marsh area is approximately 1,304,600 CY and the second lift will require approximately 96,100 CY and will be constructed to a +3.25-ft NAVD88 crown elevation. The second lift will occur at the same time the perimeter dikes are raised. See the Dike Design section for additional details on these assumptions.

2.1.3 Discharge Monitoring

Grade stakes will be placed throughout the project areas. Discharge location will be monitored against grade stakes to determine movement needed within the marsh platform to achieve the most uniform platform possible with little mechanical relocation of high points post construction.

Spill boxes will be strategically located along the limits of the perimeter dike adjacent to open water areas to serves as the effluent discharge points at each MCA. The intent is to capture most sediment suspended in the effluent discharge, but some material will still likely deposit in the adjacent open water locations. After marsh fill operations are completed and sufficient dewatering and compaction has occurred, the spill boxes will be removed.

2.1.4 Marsh Platform Lift

Once all perimeter containment dikes, cross dikes, and spill boxes are constructed, the marsh platform lift for each site will commence. To build the marsh platforms, it is proposed that sediment will be dredged from designated borrow area in Lake Borgne using a hydraulic cutterhead. The sediment will then be pumped as slurry into the marsh creation area through a floating pipeline.

It's assumed two (2) lift will be required for this project at this design stage, however this will need to be confirmed through field investigations and future geotechnical analysis. Subsidence, foundation settlement, fill compaction/shrinkage, dewatering, and construction losses were accounted for in the quantity calculations. See the Marsh Creation Area Design section for additional detail on the assumptions and calculations.

For the first platform lift, the marsh creation area will be pumped with dredged slurry to +3.0-ft NAVD88 from the varying existing ground elevation with the expectation the platform will ultimately settle to +1-ft NAVD88. A +/- 0.5-foot tolerance during the fill operations will be allowable. The second lift fill quantities were calculated from the assumed elevation after one-year of settlement has occurred, to the max constructed fill elevation (final target elevation with the anticipated settlement), with the expectation the platform will ultimately settle into the necessary target elevation of +1.25-ft NAVD88 (+/-0.5-foot tolerance).

The parameters for the marsh fill operations vary by lift, with a summary of each MCA provided in the table below. The estimated total quantity of fill material accounts for the backfilling of internal dike borrow areas. In total, the Overall MTG marsh platforms require 164,677,000 CY, with Lift 1 totaling 119,658,000 CY and Lift 2 totaling 43,057,000 CY.

Table C4:2-3. Marsh Fill Operations Per Site Per Lift

LIFT 1 - Overall MTG Sites	MCA-1	MCA-2
Area (AC):	7,153	1,575
Max Slurry Elevation (FT NAVD88):	+3.0	+3.0
Target Elevation (FT NAVD88):	+1.0	+1.0
Water Bottom Elevation (FT NAVD88):	-4.8	-5.7
Intermediate Subsidence (MM/YR):	8.83	8.83
Assumed Settlement (FT):	0.5	0.5
Marsh Fill Volume (CY):	95,424,000	24,234,000
LIFT 2 - Overall MTG Sites	**MCA-1**	**MCA-2**
Area (AC):	7,153	1,575
Max Slurry Elevation (FT NAVD88):	+2.75	+2.75
Target Elevation (FT NAVD88):	+1.25	+1.25
Existing Base Elevation (FT NAVD88):	+0	+0
Intermediate Subsidence (MM/YR):	8.83	8.83
Assumed Settlement (FT):	0.75	0.75
Marsh Fill Volume (CY):	35,226,000	7,831,000

2.1.5 Borrow Plan

One large borrow source was identified as a potential source of dredge material to achieve the required elevation for the marsh platforms to accomplish the necessary habitat goals. See the Borrow Area Design section for more details on the borrow analysis and quantity calculations.

The material for constructing the MCAs will be hydraulically dredged sediment sourced from the proposed borrow location in Lake Borgne (BA-1). It is assumed that this borrow area will yield sufficient suitable material for the construction of the marsh platform(s), as the sediment is expected to have a mixed content, based on data from the Louisiana Sand Resources Database (LA-0161) and other regional projects. The total area of the proposed borrow sites is approximately 23,877 acres, which provides 175% of the volume required. It is assumed that Lake Borgne will supply enough material to complete both lift sequences of the marsh platform, making this the proposed borrow plan for the project. See the table below for the details on the proposed borrow plan and the quantities required for each lift effort.

Total Required Borrow Quantity for the Overall MTG Areas: 329,354,000 CY

Table C4:2-4. Borrow Site Details by Borrow Site

Overall MTG Sites	BA-1 (Hydraulic)
Area (AC):	23,877
Max Allowable BEC (FT NAVD88):	-20
Assumed Depth of Material (FT):	10
Available Borrow Volume (CY):	385,215,000
Percentage of Need Met:	175%

Proposed Borrow Plan:

- **Lift 1 - BA-1 (Lake Borgne): 242,970,000 CY**
- **Lift 2 - BA-1 (Lake Borgne): 86,384,000 CY**

2.1.6 Dike Degrade/Gapping

One to three years post-construction of the marsh platform, it is assumed that the sites will settle down to the desired target elevation. At this time the dikes will be degraded down to elevation +1.25-ft NAVD88 (+/- 0.5-foot), in attempt to align with the surrounding marsh elevation. Gapping locations will also be included in this effort to enhance tidal exchange across the MCAs. Excavated material will be disposed of within the marsh creation areas at any low locations within the project footprint. See the Dike Design section for additional information on this process. The estimated excavation quantity is approximately 118,000 CY for the Overall MTG Mitigation Areas.

2.1.7 Future Rock Maintenance Events

Given the uncertainties at this design stage and lessons learned from previous marsh projects that employed rock designs, it is anticipated that maintenance events will be required in the future. For this analysis, it is projected that a rock lift will be necessary at some point around year 15 of the project's life. A conservative estimate of one-third of the original overall quantity was used, resulting in an anticipated future rock lift of 750,000 TONS. Additionally, settlement plates or equivalent monitoring methods may be incorporated to track elevation changes.

SECTION 3
List of Acronyms and Abbreviations

AC	**Acre**
BA	**Borrow Area**
CY	**Cubic Yards**
FT	**Feet**
GIWW	**Gulf Intercoastal Waterway**
H	**Horizontal**
LA	**Louisiana**
Lbs	**Pounds**
LF	**Linear Feet**
MCA	**Marsh Creation Area**
MM/YR	**Millimeter per Year**
MTG	**Morganza to the Gulf**
NAVD88	**North American Vertical Datum 1988**
PSI	**Pounds per Square Inch**
ROM	**Rough Order of Magnitude**
SY	**Square Yard**
V	**Vertical**

Mississippi Valley Division,
Regional Planning and Environment Division South

Morganza to the Gulf of Mexico, Louisiana, Hurricane and Storm Damage Risk Reduction Project

Appendix C – Attachment 4 – West Terrebonne Brackish and Saline Constructed Project Description

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Introduction

This study is for the mitigation efforts required for the anticipated marsh impacts resulting from the construction of the Morganza to the Gulf (MTG) Project. This alternative consists of 6,431 acres of brackish/saline marsh creation at a location identified as West Terrebonne developed with the intent to offset the overall brackish/saline marsh impacts of the MTG flood risk reduction system in the amount of 1,650 AAHUs. Refer to the Environmental Analysis section for details on the marsh creation area (MCA) sizing process and requirements.

1.1 PROJECT LOCATION

The project area is located in Terrebonne Parish approximately 8 miles south of Theriot, LA traveling down Bayou Dularge. The mitigation plan consists of two marsh creation areas separated by Caillou Lake. The first site, west of Caillou Lake, spans across Bay Voisin and King Lake (MCA-1). The second site is on the east side of Caillou Lake, primarily located in Moncleuse Bay and extending north into Bay de L'Ouest (MCA-2).

Two borrow areas were considered, each consisting of multiple cells in an attempt to avoid known pipelines and oyster seed grounds. The identified borrow area (BA-1) located to the north of the MCAs, consists of three cells situated within Lake Mechant and Mud Lake. Access corridors from BA-1 to the two MCAs traverse Grand Pass and Caillou Lake. The second borrow area (BA-2) south of the MCAs, consists of two cells identified in Caillou Bay. Access corridors from BA-2 traverse open water and through the following bayous to reach the MCAs: Grand Bayou du Large, Bayou Banan, and Bayou Grand Caillou.

SECTION 2
Design and Construction

2.1 CONTAINMENT DIKES

Earthen perimeter dikes will be fully-confined, constructed from onsite/interior borrow adjacent to the dikes. This alternative requires two dike sections, classified as front and back dikes, due to the project’s exposure to wave/fetch action in the areas adjacent to open water. The front containment dikes will be constructed with an 8-foot crown width and the back dikes, located against existing marsh, will have a 5-foot crown width. Both sections have a 1V:5H side slope that transition down to existing grade.

The perimeter dike crown elevation varies per site; MCA-1 will be constructed to a crown elevation of +5.5-ft NAVD88 and MCA-2 to elevation +6.0-ft NAVD88 to contain dredge slurry and provided a minimum 2-foot freeboard. Settlement assumptions were applied to the dike heights and incorporated in the volumetric calculations. The front dike parameters included a 30% settlement estimate, considering the larger sections required along the open water areas and a 25% settlement assumption was factored into the back dike calculations. See the Dike Design section for additional details on borrow requirements and quantity calculations.

The estimated borrow material required for the perimeter dike construction for the Overall MTG areas totals to 7,244,000 cubic yards (CY). See the table below for a detailed list of the dike parameters.

Table C4:2-1. List of Dike Parameters

Overall MTG Sites	MCA-1	MCA-2
Total Perimeter Length (LF):	76,072	60,195
Total Required Dike Volume (CY):	3,023,000	4,221,000
Back Dikes		
Length (LF):	71,465	49,010
Crown Width (FT):	5	5
Slope Run (1V: **X-ft** H):	5	5
Top of Dike Elevation (FT NAVD88):	+5.5	+6.0
Base Elevation (FT NAVD88):	-2.8	-4.9
Assumed Settlement (FT):	1.6	2.1
Back Dike Volume (CY):	2,802,000	3,304,000
Front Dikes		
Length (LF):	4,607	11,185
Crown Width (FT):	8	8
Slope Run (1V: **X-ft** H):	5	5
Top of Dike Elevation (FT NAVD88):	+5.5	+6.0
Base Elevation (FT NAVD88):	-2.8	-4.9
Assumed Settlement (FT):	2.4	3.2
Front Dike Volume (CY):	221,000	917,000

2.1.1 Cross Dikes

Due to the size of the proposed marsh sites, earthen cross dikes or training dikes will be constructed with the intent to assist in the vertical stacking of the dredged material by providing more manageable areas for the disposal of dredge material within the marsh sites. Cross dikes will be constructed with a 3-foot wide crown and 1V:3H side slopes that transition down to existing grade. The cross dikes will be constructed to a crown elevation half a foot higher than the designed max slurry elevation, and therefore varies per site. MCA-1 will be constructed to crown elevation +4.0-ft NAVD88 and MCA-2 to +4.5-ft NAVD88. The estimated borrow material required for the initial cross dike construction is approximately 1,045,000 CYs. See the Dike Design section for additional details on these assumptions.

2.1.2 Discharge Monitoring

Grade stakes will be placed throughout the project areas. Discharge location will be monitored against grade stakes to determine movement needed within the marsh platform to achieve the most uniform platform possible with little mechanical relocation of high points post construction.

Spill boxes will be strategically located along the limits of the perimeter dike adjacent to open water areas to serve as the effluent discharge points at each MCA. The intent is to capture most sediment suspended in the effluent discharge, but some material will still likely deposit in the adjacent open water locations. After marsh fill operations are completed and sufficient dewatering and compaction has occurred, the spill boxes will be removed.

2.1.3 Marsh Platform Lift

Once all perimeter containment dikes, cross dikes, and spill boxes are constructed, the marsh platform lift for each site will commence. To build the marsh platforms, it is proposed that sediment will be dredged from designated borrow areas in Lake Mechant and Caillou Bay using a hydraulic cutterhead. The sediment will then be pumped as slurry into the marsh creation area through a floating pipeline.

The contractor will be directed to fill the marsh creation area from the varying existing ground elevation to the max constructed fill elevation (final target elevation with the anticipated settlement), with the expectation the platform will ultimately settle into the necessary target elevation of +1.25 feet NAVD88. A +/- 0.5-foot tolerance during the fill operations will be allowable.

It's assumed only one (1) lift will be required for this project at this design stage, however this will need to be confirmed through field investigations and future geotechnical analysis. Subsidence, foundation settlement, fill compaction/shrinkage, dewatering, and construction losses were accounted for in the quantity calculations. See the Marsh Creation Area Design section for additional detail on the assumptions and calculations.

The selected parameters for the marsh fill operations vary per sites; a summary of each MCA is shown in the table below. The estimated total quantity of fill material includes the backfilling of internal dike borrow areas. In total, the Overall MTG marsh platforms require 97,163,000 CYs.

Table C4:2-2. Marsh Fill Operations Per Site

Overall MTG Sites	MCA-1	MCA-2
Area (AC):	3,243	3,188
Max Slurry Elevation (FT NAVD88):	+3.50	+4.00
Target Elevation (FT NAVD88):	+1.25	+1.25
Water Bottom Elevation (FT NAVD88):	-2.80	-4.90
Intermediate Subsidence (MM/YR):	12.09	12.09
Assumed Settlement (FT):	1.0	1.0
Marsh Fill Volume (CY):	40,489,000	56,674,000

2.1.4 Borrow Plan

Given the uncertainties at this design stage, several borrow areas were identified as potential sources of dredge material to achieve the required elevations for the marsh platforms and meet habitat goals. See the Borrow Area Design section for more details on the borrow analysis and quantity calculations.

The material for the construction of the MCAs is to be hydraulically dredged sediment obtained at the following proposed borrow locations: Lake Mechant (BA-1) and Caillou Bay (BA-2). It is assumed these borrow area will provide suitable material for the construction of the marsh platform(s), as the material is assumed to have mixed sediment content according to the Louisiana Sand Resources Database (LA-0161) and other neighboring projects in the region.

The proposed borrow sites total to approximately 14,548 acres, and satisfies the overall volume needed by 186%. It is assumed that Lake Mechant will not meet the required amount of material on its own, therefore Alternative 1 evaluates the option of both Lake Mechant and Caillou Bay borrow. Alternative 2 solely considers borrow from Caillou Bay, as this area is large enough to fill the full marsh platform. The most cost effective of the two alternatives detailed below is Alternative 1, therefore this is the proposed borrow plan for this project. See the table below for the details on each borrow area.

Required Contract Borrow Quantity for the Overall MTG Areas: 197,249,000 CY

Table C4:2-3. Borrow Site Details by Borrow Site

Overall MTG Sites	BA-1 (Hydraulic)	BA-2 (Hydraulic)
Area (AC):	1,452	13,096
Max Allowable BEC (FT NAVD88):	-20	-20
Assumed Depth of Material (FT):	10	15
Available Borrow Volume (CY):	50,661,000	316,946,000
Percentage of Need Met:	26%	160%

Alternative 1 – Proposed Borrow Plan:

- **BA-1 (Lake Mechant): 50,661,000 CY**
- **BA-2 (Caillou Bay): 146,588,000 CY**

Alternative 2:

- BA-2 (Caillou Bay): 197,249,000 CY

2.1.5 Dike Degrade/Gapping

One to three years post-construction of the marsh platform, it is assumed that the sites will settle down to the desired target elevation. At this time the dikes will be degraded down to elevation +1.25-ft NAVD88 (+/- 0.5-foot), in attempt to align with the surrounding marsh elevation. Gapping locations will also be included in this effort to enhance tidal exchange across the MCAs. Excavated material will be disposed of within the marsh creation areas at any low locations within the project footprint. See the Dike Design section for additional information on this process. The estimated excavation quantity is approximately 225,000 CY for the Overall MTG Mitigation Areas.

SECTION 3

List of Acronyms and Abbreviations

AC	**Acre**
AHHU	**Average Annual Habitat Unit**
BA	**Borrow Area**
CY	**Cubic Yards**
FT	**Feet**
GIWW	**Gulf Intercoastal Waterway**
H	**Horizontal**
LA	**Louisiana**
Lbs	**Pounds**
LF	**Linear Feet**
MCA	**Marsh Creation Area**
MM/YR	**Millimeter per Year**
MTG	**Morganza to the Gulf**
NAVD88	**North American Vertical Datum 1988**
PSI	**Pounds per Square Inch**
ROM	**Rough Order of Magnitude**
SY	**Square Yard**
V	**Vertical**

Mississippi Valley Division,
Regional Planning and Environment Division South

Morganza to the Gulf of Mexico, Louisiana, Hurricane and Storm Damage Risk Reduction Project

Appendix C – Attachment 5 – Alternative Evaluation Process Results

October 2025

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SECTION 2

Evaluation Summary Tables by Habitat Type

2.1 BOTTOMLAND HARDWOOD FOREST

Table C5:2-1. Bottomland Hardwood Forest Projects Evaluation Summary

		Evaluation Criteria	Alternatives			
			No Action	BLH MB	BLH1 - Napoleonville	BLH2 - Supreme
Watershed Considerations and Significance in Watershed	Contiguous with or within resource managed area	0-not within a managed area 1-non managed natural land 2-adjacent to or on	0	0	1	0
	Located in Parish with Impacts (Terrebonne/Lafourche Parish)	0-not within basin 1-within basin 2-within Study Area (Terrebonne Parish)	0	0	0	0
	Consistent with State Master Plan	0-not within State Master Plan 2-within St Master Plan	0	1	1	1
	Consistent with other documented plans CWPPRA (if yes which)	0-not within other documented plans 2-other documented plans	0	1	1	1
Risk and Reliability	Uncertainty Relative to Achieving Ecological Success? Need for Adaptive Management?	0-high 1-med 2-Low Risk	0	3	2	2
	Does the mitigation alternative have lower implementation risks than others?	0-Major Uncertainty 1-Medium 2-Low uncertainty	0	3	2	2
	Long-term Sustainability (against High Sea Level Rise-Creel current HQ push) - Sea Level Risk Only	0-high risk 1-Med Risk 2-Low Risk	0	2	2	2
	Can the alternative be implemented before or concurrently with construction?	0- high risk 1-medium risk 2-low risk	0	3	2	2
	Relative probability of exposure to stressors	0-highly likely 1-medium risk 2-low risk	0	2	2	2
	Project Performance relative to stressors	0-highly likely 1-medium risk 2-low risk	0	2	2	2
	Resiliency after exposure to stressors	0-highly likely 1-medium risk 2-low risk	0	1	1	1
	Anticipated OMRR&R Activities	0 - large amount needed 1 - typical amount 2 - None	0	2	1	1
	Relative Difficulty OMRR&R	0 – extensive 1 - typical 2 - No O&M	0	2	1	1

Ecological Site Considerations	Fragmentation within site boundary	0-highly fragmented site 1- slightly fragmented 2- no fragmentation	0	0	2	2
	Habitat connectivity to larger project area given existing land use	0-not adjacent of a larger area 1-partially contiguous with larger area 2-contigous with larger area	0	1	1	1
Environmental Impacts	Hydrology/Hydraulics	0 - negative impacts 1 - no impact 2 - beneficial	0	1	1	1
	Navigable Waters	0 - negative impacts 1 - no impact 2 - beneficial	0	1	1	1
	Water Quality	0 - negative impacts 1 - no impact 2 - beneficial	0	1	2	2
	Wildlife & Habitats	0 - negative impacts 1 - no impact 2 - beneficial	0	1	1	1
	Water Bottoms/Benthic	0 - negative impacts 1 - no impact 2 - beneficial	0	1	1	1
	T&E, Protected Species	0 - negative impacts 1 - no impact 2 - beneficial	0	1	1	1
	EFH	0 - negative impacts 1 - no impact 2 - beneficial	0	1	1	1
	Aquatic/Fisheries	0 - negative impacts 1 - no impact 2 - beneficial	0	1	1	1
	Prime & Unique Farmland	0 - negative impacts 1 - no impact 2 - beneficial	0	1	1	1
	Cultural Resources	0 - negative impacts 1 - no impact 2 - beneficial	0	1	1	1
	Recreation	0 - negative impacts 1 - no impact 2 - beneficial	0	1	2	2
	Noise	0 - negative impacts 1 - no impact 2 - beneficial	0	1	1	1
	HTRW	0 - negative impacts 1 - no impact 2 - beneficial	0	1	1	1
	Socioeconomics/Land Use	0 - negative impacts 1 - no impact 2 - beneficial	0	1	1	1
Implementation Risk	Can the alternative be easily scaled to meet changing mitigation acreage requirements?	2 - no issue scaling 1 - small opportunity to scale	0	1	1	2

		0 - no opportunity				
Time Considerations	Could the alternative be implemented faster than other alternatives?	0- lengthy construction anticipated				
		1- standard construction timeline				
		2- immediate implementation	0	2	1	1
	real estate acquisition timeline	0-excessive				
		1- normal negotiation				
		2- no negotiation	0	2	1	1

2.2 SWAMP

Table C5:2-2. Swamp Projects Evaluation Summary

		Evaluation Criteria	Alternatives			
			No Action	SWP MB	SWP1 - Napoleonville	SWP2 - Supreme
Watershed Considerations and Significance in Watershed	Contiguous with or within resource managed area	0-not within a managed area 1-non managed natural land 2-adjacent to or on	0	0	1	0
	Located in Parish with Impacts (Terrebonne/Lafourche Parish)	0-not within basin 1-within basin 2-within Study Area (Terrebonne Parish)	0	0	0	0
	Consistent with State Master Plan	0-not within State Master Plan 2-within St Master Plan	0	1	1	1
	Consistent with other documented plans CWPPRA (if yes which)	0-not within other documented plans 2-other documented plans	0	1	1	1
Risk and Reliability	Uncertainty Relative to Achieving Ecological Success? Need for Adaptive Management?	0-high 1-med 2-Low Risk	0	3	2	2
	Does the mitigation alternative have lower implementation risks than others?	0-Major Uncertainty 1-Medium 2-Low uncertainty	0	3	2	2
	Long-term Sustainability (against High Sea Level Rise-Creel current HQ push) - Sea Level Risk Only	0-high risk 1-Med Risk 2-Low Risk	0	2	2	2
	Can the alternative be implemented before or concurrently with construction?	0- high risk 1-medium risk 2-low risk	0	3	2	2
	Relative probability of exposure to stressors	0-highly likely 1-medium risk 2-low risk	0	2	2	2
	Project Performance relative to stressors	0-highly likely 1-medium risk 2-low risk	0	2	2	2
	Resiliency after exposure to stressors	0-highly likely 1-medium risk 2-low risk	0	1	1	1
	Anticipated OMRR&R Activities	0 - large amount needed 1 - typical amount 2 - None	0	2	1	1
	Relative Difficulty OMRR&R	0 – extensive 1 - typical 2 - No O&M	0	2	1	1
Ecolo		0-highly fragmented site	0	1	1	2

	Fragmentation within site boundary	1- slightly fragmented 2- no fragmentation				
	Habitat connectivity to larger project area given existing land use	0-not adjacent of a larger area 1-partially contiguous with larger area 2-contigous with larger area	0	2	2	2
Environmental Impacts	Hydrology/Hydraulics	0 - negative impacts 1 - no impact 2 - beneficial	0	1	1	1
	Navigable Waters	0 - negative impacts 1 - no impact 2 - beneficial	0	1	1	1
	Water Quality	0 - negative impacts 1 - no impact 2 - beneficial	0	1	2	2
	Wildlife & Habitats	0 - negative impacts 1 - no impact 2 - beneficial	0	1	1	1
	Water Bottoms/Benthic	0 - negative impacts 1 - no impact 2 - beneficial	0	1	1	1
	T&E, Protected Species	0 - negative impacts 1 - no impact 2 - beneficial	0	1	1	1
	EFH	0 - negative impacts 1 - no impact 2 - beneficial	0	1	1	1
	Aquatic/Fisheries	0 - negative impacts 1 - no impact 2 - beneficial	0	1	1	1
	Prime & Unique Farmland	0 - negative impacts 1 - no impact 2 - beneficial	0	1	1	1
	Cultural Resources	0 - negative impacts 1 - no impact 2 - beneficial	0	1	1	1
	Recreation	0 - negative impacts 1 - no impact 2 - beneficial	0	1	2	2
	Noise	0 - negative impacts 1 - no impact 2 - beneficial	0	1	1	1
	HTRW	0 - negative impacts 1 - no impact 2 - beneficial	0	1	1	1
	Socioeconomics/Land Use	0 - negative impacts 1 - no impact 2 - beneficial	0	1	1	1
Implementation Risk	Can the alternative be easily scaled to meet changing mitigation acreage requirements?	2 - no issue scaling 1 - small opportunity to scale	0	1	1	2

		0 - no opportunity				
Time Considerations	Could the alternative be implemented faster than other alternatives?	0- lengthy construction anticipated 1- standard construction timeline 2- immediate implementation	0	2	1	1
	real estate acquisition timeline	0-excessive 1- normal negotiation 2- no negotiation	0	2	1	1

2.3 BRACKISH AND SALINE MARSH

Table C5:2-3. Brackish and Saline Marsh Projects Evaluation Summary

		Evaluation Criteria	Alternatives						
			No Action	BSM MB	BSM 1 - Falgout	BSM 2 - Isle De Jean Charles	BSM 3 - North Barataria Bay	BSM 4 - Three Mile Bay	BSM 5 - West Terrebonne
Watershed Considerations and Significance in Watershed	Contiguous with or within resource managed area	0-not within a managed area 1-non managed natural land 2-adjacent to or on	0	0	0	2	0	1	0
	Located in Parish with Impacts (Terrebonne/Lafourche Parish)	0-not within basin 1-within basin 2-within Study Area (Terrebonne Parish)	0	0	2	2	2	0	2
	Consistent with State Master Plan	0-not within State Master Plan 2-within St Master Plan	0	0	0	1	0	0	0
	Consistent with other documented plans CWPPRA (if yes which)	0-not within other documented plans 2-other documented plans	0	0	0	0	0	0	0
Risk and Reliability	Uncertainty Relative to Achieving Ecological Success? Need for Adaptive Management?	0-high 1-med 2-Low Risk	0	2	1	1	1	1	1
	Does the mitigation alternative have lower implementation risks than others?	0-Major Uncertainty 1-Medium 2-Low uncertainty	0	2	1	0	1	2	2
	Long-term Sustainability (against High Sea Level Rise-Creel current HQ push) - Sea Level Risk Only	0-high risk 1-Med Risk 2-Low Risk	0	2	2	2	1	0	2
	Can the alternative be implemented before or concurrently with construction?	0- high risk 1-medium risk 2-low risk	0	1	1	0	1	0	1
	Relative probability of exposure to stressors	0-highly likely 1-medium risk 2-low risk	0	1	2	0	1	0	1
	Project Performance relative to stressors	0-highly likely 1-medium risk 2-low risk	0	1	1	0	1	0	1
		0-highly likely							

	Resiliency after exposure to stressors	1-medium risk 2-low risk	0	1	1	1	1	0	1
	Anticipated OMRR&R Activities	0 - large amount needed 1 - typical amount 2 - None	0	2	1	0	1	0	1
	Relative Difficulty OMRR&R	0 – extensive 1 - typical 2 - No O&M	0	2	1	0	1	0	1
Ecological Site Considerations	Fragmentation within site boundary	0-highly fragmented site 1- slightly fragmented 2- no fragmentation	0	1	1	2	1	1	1
	Habitat connectivity to larger project area given existing land use	0-not adjacent of a larger area 1-partially contiguous with larger area 2-contigous with larger area	0	1	1	1	1	1	1
Environmental Impacts	Hydrology/Hydraulics	0 - negative impacts 1 - no impact 2 - beneficial	0	1	1	1	1	1	1
	Navigable Waters	0 - negative impacts 1 - no impact 2 - beneficial	0	1	1	1	1	1	1
	Water Quality	0 - negative impacts 1 - no impact 2 - beneficial	0	1	2	2	2	2	2
	Wildlife & Habitats	0 - negative impacts 1 - no impact 2 - beneficial	0	1	2	2	2	2	2
	Water Bottoms/Benthic	0 - negative impacts 1 - no impact 2 - beneficial	0	1	1	1	1	1	1
	T&E, Protected Species	0 - negative impacts 1 - no impact 2 - beneficial	0	1	2	2	2	2	2
	EFH	0 - negative impacts 1 - no impact 2 - beneficial	0	1	2	2	2	2	2
	Aquatic/Fisheries	0 - negative impacts 1 - no impact 2 - beneficial	0	1	1	1	1	1	1
	Prime & Unique Farmland	0 - negative impacts 1 - no impact 2 - beneficial	0	1	1	1	1	1	1

	Cultural Resources	0 - negative impacts 1 - no impact 2 - beneficial	0	1	1	1	1	1	1
	Recreation	0 - negative impacts 1 - no impact 2 - beneficial	0	1	1	1	1	1	1
	Noise	0 - negative impacts 1 - no impact 2 - beneficial	0	1	1	1	1	1	1
	HTRW	0 - negative impacts 1 - no impact 2 - beneficial	0	1	1	1	1	1	1
	Socioeconomics/Land Use	0 - negative impacts 1 - no impact 2 - beneficial	0	1	1	1	1	1	1
Implementation Risk	Can the alternative be easily scaled to meet changing mitigation acreage requirements?	2 - no issue scaling 1 - small opportunity to scale 0 - no opportunity	0	0	0	2	2	2	2
Time Considerations	Could the alternative be implemented faster than other alternatives?	0- lengthy construction anticipated 1- standard construction timeline 2- immediate implementation	0	0	2	2	2	0	2
	real estate acquisition timeline	0-excessive 1- normal negotiation 2- no negotiation	0	2	1	0	1	1	1

2.4 FRESH AND INTERMEDIATE MARSH

Table C5:2-4. Fresh and Intermediate Marsh Projects Evaluation Summary

		Evaluation Criteria	Alternatives: No Action	MB - Mitigation Bank Marsh	M1 – Avoca Island Cutoff	M2 - GIWW	M3 – Lake Salvador	M4 – Delta Farms
Watershed Considerations and Significance in Watershed	Contiguous with or within resource managed area	0-not within a managed area 1-non managed natural land 2-adjacent to or on	0	0	0	0	0	0
	Located in Parish with Impacts (Terrebonne Parish)	0-not within basin 1-within basin 2-within Study Area (Terrebonne Parish)	0	1	2	2	2	2
	Consistent with State Master Plan	0-not within State Master Plan 2-within St Master Plan	0	0	0	0	0	0
	Other documented plans CWPPRA (if yes which)	0-not within other documented plans 2-other documented plans	0	0	0	0	0	0
Risk and Reliability	Uncertainty Relative to Achieving Ecological Success? Need for Adaptive Management?	0-high 1-med 2-Low Risk	0	2	1	1	0	0
	Does the mitigation alternative have lower implementation risks than others?	0-Major Uncertainty 1-Medium 2-Low uncertainty	0	0	1	1	1	1
	Long-term Sustainability (against High Sea Level Rise-Creel current HQ push) - Sea Level Risk Only	0-high risk 1-Med Risk 2-Low Risk	0	2	1	1	1	1
	Can the alternative be implemented before or concurrently with construction?	0- high risk 1-medium risk 2-low risk	0	2	2	2	2	2
	Relative probability of exposure to stressors	0-highly likely 1-medium risk 2-low risk	0	2	1	1	0	0
	Project Performance relative to stressors	0-highly likely 1-medium risk 2-low risk	0	1	1	1	1	1
	Resiliency after exposure to stressors	0-highly likely 1-medium risk	0	1	0	0	0	0

		2-low risk						
	Anticipated OMRR&R Activities	0 - large amount needed 1 - typical amount 2 - None	0	2	1	1	0	1
	Relative Difficulty OMRR&R	0 – extensive 1 - typical 2 - No O&M	0	2	2	2	1	2
Ecological Site Considerations	Fragmentation within site boundary	0-highly fragmented site 1- slightly fragmented 2- no fragmentation	0	0	1	1	1	1
	Habitat connectivity to larger project area given existing land use	0-not adjacent of a larger area 1-partially contiguous with larger area 2-contigous with larger area	0	1	1	1	1	1
P&G Criteria	Is the mitigation alternative cost effective? (P&G Efficient)	2 - Yes 0 - No	0	2	0	0	0	0
	Does the alternative have independent utility and not depend on another action? (not dependent on implementation of or modification to other projects)	2 - Yes 1 - partial 0 - No	*0*	*2*	*2*	*2*	*2*	*2*
	Does the mitigation alternative meet acceptability criteria?	2 - Yes 1 - partial 0 - No	*0*	*2*	*2*	*2*	*2*	*2*
	Does the mitigation alternative meet effectiveness criteria by meeting mitigation objectives?	2 - Yes 1 - partial 0 - No	*0*	*2*	*2*	*2*	*2*	*2*
Environmental Impacts	Hydrology/Hydraulics	0 - negative impacts 1 - no impact 2 - beneficial	*1*	*1*	*1*	*1*	*1*	*1*
	Navigable Waters	0 - negative impacts 1 - no impact 2 - beneficial	*1*	*1*	*1*	*1*	*1*	*1*
	Water Quality	0 - negative impacts 1 - no impact 2 - beneficial	*1*	*1*	*2*	*2*	*2*	*2*
	Wildlife & Habitats	0 - negative impacts 1 - no impact 2 - beneficial	*1*	*1*	*2*	*2*	*2*	*2*

	Water Bottoms/Benthic	0 - negative impacts 1 - no impact 2 - beneficial	1	1	0	0	0	0
	T&E, Protected Species	0 - negative impacts 1 - no impact 2 - beneficial	1	1	2	2	2	2
	EFH	0 - negative impacts 1 - no impact 2 - beneficial	1	1	2	2	2	2
	Aquatic/Fisheries	0 - negative impacts 1 - no impact 2 - beneficial	1	1	2	2	2	2
	Prime & Unique Farmland	0 - negative impacts 1 - no impact 2 - beneficial	1	1	1	1	1	1
	Cultural Resources	0 - negative impacts 1 - no impact 2 - beneficial	1	1	1	1	1	1
	Recreation	0 - negative impacts 1 - no impact 2 - beneficial	1	1	2	2	2	2
	Noise	0 - negative impacts 1 - no impact 2 - beneficial	1	1	1	1	1	1
	HTRW	0 - negative impacts 1 - no impact 2 - beneficial	1	1	1	1	1	1
	Socioeconomics/Land Use	0 - negative impacts 1 - no impact 2 - beneficial	1	1	1	1	1	1
Implementation Risk	Can the alternative be easily scaled to meet changing mitigation acreage requirements?	2 - no issue scaling 1 - small opportunity to scale	0	1	2	2	2	2

		0 - no opportunity						
Time Considerations	Could the alternative be implemented faster than other alternatives?	0- lengthy construction anticipated 1- standard construction timeline 2- immediate implementation	2	2	1	1	0	0
	real estate acquisition timeline	0-excessive 1- normal negotiation 2- no negotiation	N/A	2	1	1	1	1
	is their risk with for the alternative to be implemented before or concurrently with construction?	0-high risk 1-medium risk 2-low risk	0	2	2	2	2	2

SECTION 3
Risk and Reliability

3.1 BOTTOMLAND HARDWOOD FOREST

Table C5:3-1. Proposed Project Risk and Reliability Data Matrix (Sheet 1 of 2)

Risk & Reliability – MTG Mitigation Alternatives	Uncertainty Relative to Achieving Ecological Success	Uncertainty Relative to Implementability Concerns**	Real Estate (based on private/public landowners and available credits)	Real Estate Acquisition Timeline	Long-term Sustainability	Scalability
Napoleonville BLH	2 - Low Uncertainty • Site has correct soils and elevations for cultivating BLH habitat. • is located north of the gulf. • Some possibility of disease effecting tree health.	2 - Low risk: • Construction duration – 333 days. • L2L reach construction duration – 4 years. • Constrained by roadways.	1 - Medium risk: • 5 private landowners • No public landowners	1 – typical negotiation anticipated. • Estimated RE timeline: 12-18 months. • Acquire in fee.	2 - Low risk: • Site has low drought risk • some possibility of being affected by climate change	1 – Small opportunity to scale: Some possibility of issues scaling due to number of private landowners.
Supreme BLH	2 - Low uncertainty. • Site has correct soils for cultivating BLH habitat. • Some possibility of disease effecting tree health.	2 - Low risk: • Construction duration – 331 days. • L2L reach construction duration – 4 years.	1 - Medium risk: • 9 private landowners • No public landowners	1 – typical negotiation anticipated. • Estimated RE timeline: 12-18 months. • Acquire in fee.	2 - Low risk: • Site has low drought risk • some possibility of being affected by climate change	2 – No issue scaling: No predicted issues scaling.
Mitigation Bank	3 – No uncertainty: USACE and NFS not responsible for success as the project has already been built and being managed and monitored by a 3rd party.	3 – No Risk: Banks are already built and managed by a 3rd party.	2 - No risk: 0 landowners	2 - No risk: 0 landowners	2 – Low risk: Uncertain risk due to unknown location of credit areas until purchase	1 – Small opportunity to scale: Scalability depends on available banks

**Alternatives with any private ownerships are penalized because it is assumed that there is more uncertainty relative to the acquisition of private ownerships than public ownerships.

Table C5:3-1. Risk and Reliability Data Matrix (Sheet 2 of 2)

Risk & Reliability - MTG Mitigation Alternatives		**Self-Sustainability**		**Risk of Exposure to Stressors**		
	Implementable before or concurrent with construction	**Anticipated OMRR&R Activities**	**Relative difficulty OMRR&R**	**Relative probability of exposure to stressors**	**Project performance relative to stressors**	**Resiliency after exposure to stressors**
Napoleonville BLH	1 - Low risk	1 - Low risk: Typical equipment and procedures	1 - Low risk: Typical equipment and procedures	2 - Low risk of exposure to storm surge and flooding. Adjacent forests provide some protection.	2 - Low risk of potential performance issues.	1 - Medium risk: Some work may be needed for the project to recover. If swamp portion of project is not built, there may be potential impacts to ag fields below the BLH portion of the project. If swamp portion is also built, then there would be no impacts.
Supreme BLH	2 - Low risk	1 - Low risk: Typical equipment and procedures	1 - Low risk: Typical equipment and procedures	2 - Low risk of exposure to storm surge and flooding. Adjacent forests provide some protection.	2 - Low risk of potential performance issues.	1 - Medium risk: Some work may be needed for the project to recover. If swamp portion of project is not built, there may be potential impacts to ag fields below the BLH portion of the project. If swamp portion is also built, then there would be no impacts.
Mitigation Bank	3 - No risk: Assuming availability of credits, banks are already in place	2 - No risk: USACE and NFS not responsible for OMRR&R.	2 - No risk: USACE and NFS not responsible for OMRR&R.	2 - Low risk of exposure to storm surge and flooding. Adjacent forests provide some protection.	2 - Low risk of potential performance issues.	1 - Medium risk: Some work may be needed for the project to recover.

3.2 SWAMP

Table C5:3-2. Proposed Project Risk and Reliability Data Matrix (Sheet 1 of 2)

Risk & Reliability – MTG Mitigation Alternatives	Uncertainty Relative to Achieving Ecological Success	Uncertainty Relative to Implementability Concerns	Real Estate (based on private/public landowners and available credits)	Real Estate Acquisition Timeline	Long-term Sustainability	Scalability
Napoleonville Swamp	2 - Low risk: • Site has beneficial soils and elevations for cultivating swamp habitat. • is located north of the gulf. • Some possibility of disease effecting tree health.	2 - Low risk: • Construction duration – 535 days. • Constrained by roadways.	1 - Medium risk: • 7 private landowners • No public landowners	1 – Typical negotiation anticipated: • Estimated RE timeline: 12-18 months. • Acquire in fee.	2 - Low risk: • Site has low drought risk • some possibility of being affected by climate change	1 – Small opportunity to scale: • Greater difficulty scaling due to roadway constraints
Supreme Swamp	2 - Low risk: • Site has beneficial soils and elevations for cultivating swamp habitat. • is located north of the gulf. • Some possibility of disease effecting tree health.	2 - Low risk: • Construction duration – 560 days.	1 - Medium risk: • 9 private landowners • No public landowners	1 – Typical negotiation anticipated: • Estimated RE timeline: 12-18 months. • Acquire in fee.	2 - Low risk: • Site has low drought risk • some possibility of being affected by climate change	2 - No issue scaling: • Can extend south to suit need
Mitigation Bank	3 – No risk: USACE and NFS not responsible for success as the project has already been built and being managed and monitored by a 3rd party.	3 – No Risk: Banks are already built and managed by a 3rd party	2 - No risk: • 0 landowners	2 – No negotiation required: • 0 landowners	2 – Low risk: Uncertain risk due to unknown location of credit areas until purchase	1 – Small opportunity to scale: Scalability depends on available banks

Table C5:3-2. Risk and Reliability Data Matrix (Sheet 2 of 2)

Risk & Reliability – MTG Mitigation Alternatives		Self-Sustainability		Risk of Exposure to Stressors/ Reliability of Design		
Swamp Mitigation Alternatives	**Implementable before or concurrent with construction**	**Anticipated OMRR&R Activities**	**Relative difficulty OMRR&R**	**Relative probability of exposure to stressors**	**Project performance relative to stressors**	**Resiliency after exposure to stressors**
Napoleonville Swamp	2 - Low risk	1 - Low risk: • Typical equipment and procedures	1 - Typical equipment and procedures	2 - Low risk of exposure to storm surge and flooding.	2 - Low risk of potential performance issues.	1 - Some work may be needed for the project to recover. Elevations are lower than adjacent farmlands, so drainage/flooding risk to those properties is low. Habitat to the west is forested wetlands.
Supreme Swamp	2 - Low risk	1 - Low risk: • Typical equipment and procedures	1 - Typical equipment and procedures	2 - Low risk of exposure to storm surge and flooding.	2 - Low risk of potential performance issues.	1 - Some work may be needed for the project to recover.
Mitigation Banks	3 - No risk: Assuming availability of credits, banks already in place	2 – No O&M: USACE and NFS not responsible for OMRR&R.	2 – No O&M: USACE and NFS not responsible for OMRR&R.	2 - Low risk of exposure to storm surge and flooding.	2 - Low risk of potential performance issues.	1 - Some work may be needed for the project to recover.

3.3 FRESH AND INTERMEDIATE MARSH

Table C5:3-3 Proposed Project Risk and Reliability Data Matrix (Sheet 1 of 2)

Risk & Reliability – MTG Mitigation Alternatives	Uncertainty Relative to Achieving Ecological Success	Uncertainty Relative to Implementability Concerns	Real Estate (based on private/public landowners and available credits)	Real Estate Acquisition Timeline	Long-term Sustainability	Scalability
Avoca Island Cutoff	1 - Medium risk	1 - Medium risk: • Construction duration – 3.5 years • Oil and gas pipelines in immediate vicinity of site	1 - Medium: • 7 private landowners	1 - Normal negotiation	1 - Medium risk	2 - No issues scaling
GIWW	1 - Medium risk	1 - Medium risk: • Construction duration – 3.5 years • 1 oil/gas well potentially on the site • Oil/gas wells and pipelines in immediate vicinity of site	1 - Medium: • 6 private landowners • 1 public landowner	1 - Normal negotiation	1 - Medium risk	2 - No issues scaling
Lake Salvador	0 - Major uncertainty • Site doesn't have good material • May not be able to build dikes with adjacent borrow • May need to switch from hydraulic to mechanic fill to help address • More expose4d than other sites	1 - Medium risk: • Construction duration – 5 years • Several oil/gas wells and pipelines in immediate vicinity of site	1 - Medium: • 2 private landowners • 1 public landowner	1 - Normal negotiation	1 - Medium risk	2 - No issues scaling
Delta Farms	0 - Major uncertainty: • Potential platform issues, will require 3 lifts instead of 2 • Less than ideal substrate • Potential issues locating borrow	1 - Medium risk: • Construction duration – 4 years • 1 natural gas pipeline and 1 refined product pipeline along northeast and northwest edges of site.	1 - Medium: • 1 private landowner • 1 public landowner	1 - Normal negotiation	1 - Medium risk	2 - No issues scaling
Mitigation Bank	2 - Low uncertainty: USACE and NFS not responsible for success as the project has already been built and being managed and monitored by a third party.	0 – High risk. Uncertainty in availability of credits.	2 - No risk: 0 landowners	2 - No risk: 0 landowners	2 - Low risk	1 - Scalability depends on available banks

Table C5:3-3. Risk and Reliability Data Matrix (Sheet 2 of 2)

Risk & Reliability – MTG Mitigation Alternatives		**Self-Sustainability**		**Risk of Exposure to Stressors/ Reliability of Design**		
Fresh and Intermediate Marsh Mitigation Alternatives	**Implementable before or concurrent with construction**	**Anticipated OMRR&R Activities**	**Relative difficulty OMRR&R**	**Relative probability of exposure to stressors**	**Project performance relative to stressors**	**Resiliency after exposure to stressors**
Avoca Island Cutoff	2 - Low Risk	1 - Typical OMRR&R equipment and activities anticipated	1 - Typical OMRR&R equipment and activities anticipated	1 - Typical risk of exposure	1 - Some potential for project performance issues relative to stressors	0 - Project would be unlikely to recover from exposure to stressors
GIWW	2 - Low Risk	1 - Typical OMRR&R equipment and activities anticipated	1 - Typical OMRR&R equipment and activities anticipated	1 - Typical risk of exposure	1 - Some potential for project performance issues relative to stressors	0 - Project would be unlikely to recover from exposure to stressors
Lake Salvador	2 - Low Risk	0 - Site will likely require typical marsh OMRR&R in addition to the shoreline protection OMRR&R	0 - Site will likely require typical marsh OMRR&R in addition to the shoreline protection OMRR&R	0 - High likelihood of exposure to stressors	1 - Some potential for project performance issues relative to stressors	0 - Project would be unlikely to recover from exposure to stressors
Delta Farms	2 - Low Risk	1 - Typical OMRR&R equipment and activities anticipated	1 - Typical OMRR&R equipment and activities anticipated	0 - High likelihood of exposure to stressors	1 - Some potential for project performance issues relative to stressors	0 - Project would be unlikely to recover from exposure to stressors
Mitigation Bank	3 - Mitigation banks are already built	2 - NFS and USACE are not responsible for the OMRR&R activities at mitigation banks	2 - NFS and SUACE are not responsible for the OMRR&R activities at mitigation banks	2 - Low likelihood of exposure to stressors	1 - Some potential for project performance issues relative to stressors	1 - Project would require some work to recover from exposure to stressors

3.4 BRACKISH AND SALINE MARSH

Table C5:3-4. Proposed Project Risk and Reliability Data Matrix (Sheet 1 of 2)

Risk & Reliability – MTG Mitigation Alternatives	Uncertainty Relative to Achieving Ecological Success	Uncertainty Relative to Implementability Concerns	Real Estate (based on private/public landowners and available credits)	Real Estate Acquisition Timeline	Long-term Sustainability	Scalability
Falgout	1 - Medium risk	1 - Medium risk: • Proposed project construction duration estimate of 6.8 years	1 - Medium Risk: • 14 private landowners	1 - Normal negotiation	2 - Low risk	0 - Not scalable; size limited by pipelines and nearby existing terracing
Isle de Jean Charles	1 - Medium risk	0 - High risk: • Proposed project construction duration estimate of 12.9 years	0 - High risk: • 59 private landowners, 11 unknown landowners	0 - Excessive negotiation	2 - Low risk	2 - No issue scaling
North Barataria Bay	1 - Medium risk	1 - Medium: • Proposed project construction duration estimate of 8.76 years • Approx. 17 miles or so from nearest borrow source • Potential need for adaptive management	1 - Medium Risk: • 13 private landowners	1 - Normal negotiation	1 - Medium	2 - No issue scaling
Three Mile Bay	1 - Medium risk	2 - Low risk: • Proposed project construction duration estimate of 10.3 years	1 - Medium Risk: • 3 private landowners	1 - Normal negotiation	0 - High risk	2 - No issue scaling
West Terrebonne	1 - Medium risk	2 - Low risk • Proposed project construction duration estimate of 7.8 years	1 - Medium Risk: • 3 private landowners	1 - Normal negotiation	2 - Low risk	2 - No issue scaling
Mitigation Banks	2 – Low uncertainty. USACE and NFS not responsible for success as the project has already been built and being managed and monitored by a third party.	3 - No risk: Mitigation banks are already built and being managed and monitored by a 3rd party.	3 - No risk: 0 landowners	3 - No risk: 0 landowners	2 – Low risk	0 – No opportunity. Not likely to have enough credits to meet the full need/mitigation requirements

Table C5:3-4 Risk and Reliability Data Matrix (Sheet 2 of 2)

Risk & Reliability – MTG Mitigation Alternatives		**Self-Sustainability**		**Risk of Exposure to Stressors/ Reliability of Design**		
Brackish and Saline Marsh Mitigation Alternatives	**Implementable before or concurrent with construction**	**Anticipated OMRR&R Activities**	**Relative difficulty OMRR&R**	**Relative probability of exposure to stressors**	**Project performance relative to stressors**	**Resiliency after exposure to stressors**
Falgout	1 – Medium Risk: Standard construction timeline	1 - Typical equipment and OMRR&R anticipated	1 - Typical equipment and OMRR&R anticipated	2 - Low risk	1 - Medium	1 – Some work may be required for project to recover
Isle de Jean Charles	0 – High Risk: Lengthy construction anticipated: Will likely require shoreline protection after the marsh has been constructed Has 59 private landowners and 11 unknown landowners, so very slow negotiations are expected	0 - Extensive OMRR&R Site will likely require shoreline protection which adds additional OMRR&R of the rock feature	0 - Excessive difficulty Site will require both the OMRR&R of the marsh as well as that of the shoreline protection at Lake Tambour	0 - High risk	0 - High; site is exposed to open water and will likely require shoreline protection along Lake Tambour	1 – Some work may be required for project to recover; shoreline protection anticipated to alleviate some potential stressors
North Barataria Bay	1 – Medium Risk: Standard construction timeline	1 - Typical equipment and OMRR&R anticipated	1 - Typical equipment and OMRR&R anticipated	1 - Medium risk	1 - Medium	1 – Some work may be required for project to recover
Three Mile Bay	0 – High Risk: Lengthy construction timeline anticipated	0 - Excessive OMRR&R activities anticipated due to site's exposure to open water and proximity to the Gulf.	0 - Excessive difficulty of OMRR&R due to site's exposure to open water and proximity to the Gulf.	0 - High risk; site exposed to open water so more likely to experience storm damage, flooding, and storm surge	0 - High; there is possibility of this project being severely, irreparably damaged by storms and storm surge	0 - Project most likely unable to recover
West Terrebonne	1 – Medium Risk: Standard construction timeline	1 - Typical equipment and OMRR&R anticipated	1 - Typical equipment and OMRR&R anticipated	1 - Medium risk	1 - Medium	1 – Some work may be required for project to recover
Mitigation Banks	1 – Medium Risk: Mitigation banks are already constructed	2 – No O&M. USACE and NFS are not responsible for monitoring or maintenance of the site	2 – No O&M. USACE and NFS are not responsible for monitoring or maintenance of the site	3 - USACE and NFS are not responsible for monitoring or maintenance of the site	2 - USACE and NFS are not responsible for monitoring or maintenance of the site	1 – Some work may be required for project to recover

SECTION 4

Watershed and Ecological Site Considerations

4.1 BOTTOMLAND HARDWOOD FOREST

Table C5:4-1. Watershed & Ecological Site Considerations Data Matrix (Sheet 1 of 2)

Watershed Considerations – MTG Mitigation Alternatives	Watershed Considerations/Significance in Watershed			
BLH Mitigation Alternatives	**Contiguous with or within resource managed area**	**Located in Parish with Impacts**	**fragmentation within site boundary**	**Habitat connectivity to larger project area given future land use trends**
Napoleonville BLH	1 – in close proximity. Approximately 6 miles from Elm Hall Wildlife Management Area	0 – Site not located within impacted parish (St. Mary parish)	2 - Proposed project site has no fragmentation	1 - Proposed site is partially contiguous with larger area.
Supreme BLH	0 – not within a managed area. 6 miles from Elm Hall Wildlife Management Area	0 – Site not located within impacted parish (St. Mary parish)	2 - Proposed project site has no fragmentation Industrial site in the center of the proposed project area	1 - Proposed site is partially contiguous with larger area.
Mitigation Bank	0 – not within a managed area. A mitigation bank is a resource managed area.	0 – Not within impacted parish. Location determined by bank credit availability	2 – No fragmentation	1 - Availability of credits unknown, cannot be differentiated from corps-constructed sites

Table C5:4-1. Watershed & Ecological Site Considerations Data Matrix (Sheet 2 of 2)

Watershed Considerations/Significance in Watershed (Consistency)				
Watershed Considerations – MTG Mitigation Alternatives	**With State Master Plan**	**With Coast 2050 Plan**	**With LCA**	**Consistent with other documented plans (e.g. CWPPRA)**
Napoleonville BLH	1 - Yes. Objective 3 – Coastal Habitats – provide habitats suitable to support an array of commercial and recreational activities coastwide.	1 - Yes - Strategic Goals (Create wetlands, dedicated dredging)	0 - Not within LCA	1 - Proposed project is consistent with CWPPRA
Supreme BLH	1 - Yes. Objective 3 – Coastal Habitats – provide habitats suitable to support an array of commercial and recreational activities coastwide.	1 - Yes - Strategic Goals (Create wetlands, dedicated dredging)	0 - Not within LCA	1 - Proposed project is consistent with CWPPRA
Mitigation Bank	1 - Yes. Objective 3 – Coastal Habitats – provide habitats suitable to support an array of commercial and recreational activities coastwide.	1 - Yes - Strategic Goals (Create wetlands, dedicated dredging)	0 - Not within LCA	1 - Consistent with CWPPRA

4.2 SWAMP

Table C5:4-2 Watershed & Ecological Site Considerations Data Matrix (Sheet 1 of 2)

Watershed Considerations – MTG Mitigation Alternatives	Watershed Considerations/Significance in Watershed			
Swamp Mitigation Alternatives	**Contiguous with or within resource managed area**	**Located in Parish with Impacts**	**fragmentation within site boundary**	**Habitat connectivity to larger project area given future land use trends**
Napoleonville Swamp	1 – in close proximity. Near Elm Hall Wildlife Management Area	0 - Site not located within impacted parish. (St. Mary parish)	1 - Industrial site in the center of the proposed project area, site is fragmented around industrial site	2 - Proposed site is contiguous with larger area.
Supreme Swamp	0 – not within a managed area.	0 - Site not located within impacted parish. (St. Mary parish)	2 - Proposed project site has no fragmentation	2 - Proposed site is contiguous with larger area.
Mitigation Banks	0 – not within a managed area.	0 - Site not located within impacted parish. Location determined by bank credit availability	1 - Most banks are not big enough to capture whole need so fragmentation is likely	2 - Availability of credits unknown, cannot be differentiated from corps-constructed sites

Table C5:4-2. Watershed & Ecological Site Considerations Data Matrix (Sheet 2 of 2)

Watershed Considerations/Significance in Watershed (Consistency)				
Watershed Considerations – MTG Mitigation Alternatives	**With State Master Plan**	**With Coast 2050 Plan**	**With LCA**	**Consistent with other documented plans (e.g. CWPPRA)**
Napoleonville Swamp	1 - Yes. Objective 3 – Coastal Habitats – provide habitats suitable to support an array of commercial and recreational activities coastwide.	1 - Yes - Strategic Goals (Create wetlands, dedicated dredging)	0 - Not within LCA	1 - Proposed project is consistent with CWPPRA
Supreme Swamp	1 - Yes. Objective 3 – Coastal Habitats – provide habitats suitable to support an array of commercial and recreational activities coastwide.	1 - Yes - Strategic Goals (Create wetlands, dedicated dredging)	0 - Not within LCA	1 - Proposed project is consistent with CWPPRA
Mitigation Banks	1 - Yes. Objective 3 – Coastal Habitats – provide habitats suitable to support an array of commercial and recreational activities coastwide.	1 - Banks are already in place	0 - Not within LCA	1 - Consistent with CWPPRA

4.3 FRESH AND INTERMEDIATE MARSH

Table C5:4-3 Watershed & Ecological Site Considerations Data Matrix (Sheet 1 of 2)

Watershed Considerations – MTG Mitigation Alternatives	Watershed Considerations/Significance in Watershed			
Fresh and Intermediate Marsh Mitigation Alternatives	**Contiguous with or within resource managed area**	**Located in Parish with Impacts**	**fragmentation within site boundary**	**Habitat connectivity to larger project area given future land use trends**
Avoca Island Cutoff	0 - Not within a managed area	2 - Located within the impacted parish	1 - Site has some fragmentation	1 - Site is partially contiguous with the larger area
GIWW	0 - Not within a managed area	2 - Located within the impacted parish	1 - Site has some fragmentation	1 - Site is partially contiguous with the larger area
Lake Salvador	0 - Not within a managed area	2 - Located within the impacted parish	1 - Site has some fragmentation	1 - Site is partially contiguous with the larger area
Delta Farms	0 - Not within a managed area	2 - Located within the impacted parish	1 - Site has some fragmentation	1 - Site is partially contiguous with the larger area
Mitigation Bank	0 - Not within a managed area	1 - Within the impacted parish	0 - Site is highly fragmented	1 - Site is partially contiguous with the larger area

Table C5:4-3. Watershed & Ecological Site Considerations Data Matrix (Sheet 2 of 2)

Watershed Considerations/Significance in Watershed (Consistency)				
Watershed Considerations – MTG Mitigation Alternatives	**With State Master Plan**	**With Coast 2050 Plan**	**With LCA**	**Consistent with other documented plans (e.g. CWPPRA)**
Avoca Island Cutoff	0 - Not consistent with state master plan	1 - Yes - Regional Ecosystem Strategies (Restore and sustain marsh, maintain critical landforms) Strategic Goals (Create Wetlands, Dedicated Dredging)	0 – Not consistent with LCA	0 - Not consistent with other documented plans
GIWW	0 - Not consistent with state master plan	1 - Yes - Regional Ecosystem Strategies (Restore and sustain marsh, maintain critical landforms) Strategic Goals (Create Wetlands, Dedicated Dredging)	0 – Not consistent with LCA	0 - Not consistent with other documented plans
Lake Salvador	0 - Not consistent with state master plan	1 - Yes - Regional Ecosystem Strategies (Restore and sustain marsh, maintain critical landforms) Strategic Goals (Create Wetlands, Dedicated Dredging)	0 – Not consistent with LCA	0 - Not consistent with other documented plans
Delta Farms	0 - Not consistent with state master plan	1 - Yes - Regional Ecosystem Strategies (Restore and sustain marsh, maintain critical landforms) Strategic Goals (Create Wetlands, Dedicated Dredging)	0 – Not consistent with LCA	0 - Not consistent with other documented plans
Mitigation Bank	0 - Not consistent with state master plan	1 - Yes - Regional Ecosystem Strategies (Restore and sustain marsh, maintain critical landforms) Strategic Goals (Create Wetlands, Dedicated Dredging)	0 – Not consistent with LCA	0 - Not consistent with other documented plans

4.4 BRACKISH AND SALINE MARSH

Table C5:4-4. Watershed & Ecological Site Considerations Data Matrix (Sheet 1 of 2)

Watershed Considerations – MTG Mitigation Alternatives	**Watershed Considerations/Significance in Watershed**			
Brackish and Saline Marsh Mitigation Alternatives	**Contiguous with or within resource managed area**	**Located in Parish with Impacts**	**Fragmentation within site boundary**	**Habitat connectivity to larger project area given future land use trends**
Falgout	0 - Not within a managed area	2 - Site located within impacted parish	1 - Site has some fragmentation	1 - Site is partially contiguous with larger project area
Isle de Jean Charles	2 - Adjacent to or on managed area	2 - Site located within impacted parish	2 - Site has little to no fragmentation	1 - Site is partially contiguous with larger project area
North Barataria Bay	0 - Not within a managed area	2 - Site located within impacted parish	1 - Site has some fragmentation	1 - Site is partially contiguous with larger project area
Three Mile Bay	1 - In close proximity to a managed area	0 - Site not located within impacted parish	1 - Site has some fragmentation	1 - Site is partially contiguous with larger project area
West Terrebonne	0 - Not within a managed area	2 - Site located within impacted parish	1 - Site has some fragmentation	1 - Site is partially contiguous with larger project area
Mitigation Bank	0 - Not within a managed area	0 - Location determined by bank credit availability	1 - Most banks are not big enough to capture whole need so some fragmentation is likely	1 - Availability of credits unknown, cannot be differentiated from corps-constructed sites

Table C5:4-4. Watershed & Ecological Site Considerations Data Matrix (Sheet 2 of 2)

Watershed Considerations/Significance in Watershed (Consistency)				
Watershed Considerations – MTG Mitigation Alternatives	**With State Master Plan**	**With Coast 2050 Plan**	**With LCA**	**Consistent with other documented plans (e.g. CWPPRA)**
Falgout	0 - Not consistent with state master plan	1 - Yes - Regional Ecosystem Strategies (Restore and sustain marsh, maintain critical landforms) Strategic Goals (Create Wetlands, Dedicated Dredging)	0 – Not within LCA	0 - Not consistent with other documented plans
Isle de Jean Charles	1 - Yes. Objective 3 – Coastal Habitats – provide habitats suitable to support an array of commercial and recreational activities coastwide.	1 - Yes - Regional Ecosystem Strategies (Restore and sustain marsh, maintain critical landforms) Strategic Goals (Create Wetlands, Dedicated Dredging)	0 – Not within LCA	0 - Not consistent with other documented plans
North Barataria Bay	0 - Not consistent with state master plan	1 - Yes - Regional Ecosystem Strategies (Restore and sustain marsh, maintain critical landforms) Strategic Goals (Create Wetlands, Dedicated Dredging)	0 – Not within LCA	0 - Not consistent with other documented plans
Three Mile Bay	0 - Not consistent with state master plan	1 - Yes - Regional Ecosystem Strategies (Restore and sustain marsh, maintain critical landforms) Strategic Goals (Create Wetlands, Dedicated Dredging)	0 – Not within LCA	0 - Not consistent with other documented plans
West Terrebonne	0 - Not consistent with state master plan	1 - Yes - Regional Ecosystem Strategies (Restore and sustain marsh, maintain critical landforms) Strategic Goals (Create Wetlands, Dedicated Dredging)	0 – Not within LCA	0 - Not consistent with other documented plans
Mitigation Bank	1 - Yes. Objective 3 – Coastal Habitats – provide habitats suitable to support an array of commercial and recreational activities coastwide.	1 - Yes - Regional Ecosystem Strategies (Restore and sustain marsh, maintain critical landforms) Strategic Goals (Create Wetlands, Dedicated Dredging)	0 – Not within LCA	0 - Not consistent with other documented plans

SECTION 5
Environmental Impact Summary

5.1 BOTTOMLAND HARDWOOD FOREST

Table C5:5-1. Environmental Impact Summary Data Matrix (Sheet 1 of 2)

Environmental Impact – MTG Mitigation Alternatives	Hydrology/ Hydraulics	Navigable Waters	Water Quality	Wildlife & Habitats	Water Bottoms/ Benthic	T & E	EFH	Aquatic/Fisheries
Napoleonville BLH	1 - Possible impact: If the swamp component is not built, there may be increased flood risk for the agricultural fields below the BLH portion of the site.	1 - No	2 - Will enhance water quality	1 - No impact	1 - No impact	1 - No impact	1 - No impact	1 - No impact
Supreme BLH	1 - Possible impact: If the swamp component is not built, there may be increased flood risk for the agricultural fields below the BLH portion of the site.	1 - No	2 - Will enhance water quality	1 - No impact	1 - No impact	1 - No impact	1 - No impact	1 - No impact
Mitigation Bank	1 – No impact	1 - Unknown; dependent on location of available banks	1 – No impact	1 - No impact	1 - No impact	1 - No impact	1 - No impact	1 - No impact

Table C5:5-1. Environmental Impact Summary Data Matrix (Sheet 2 of 2)

Environmental Impact – MTG Mitigation Alternatives	Prime Farmland	Cultural Resources	Recreation	Noise	HTRW	Socioeconomics/ Land Use
Napoleonville BLH	1 – No impacts	1 – No impacts	2 – beneficial impacts	1 - No impacts	1 - No impacts	1 - No impacts
Supreme BLH	1 – No impacts	1 – No impacts	2 – beneficial impacts	1 - No impacts	1 - No impacts	1 - No impacts
Mitigation Bank	1 – No impacts	1 – No impacts	1 – no impacts	1 - No impacts	1 - No impacts	1 - No impacts

5.2 SWAMP

Table C5:5-2. Environmental Impact Summary Data Matrix (Sheet 1 of 2)

Environmental Impact – MTG Mitigation Alternatives	Hydrology/ Hydraulics	Navigable Waters	Water Quality	Wildlife & Habitats	Water Bottoms/ Benthic	T & E
Napoleonville Swamp	1 – No impacts	1 – No impacts	2 - Will enhance water quality	1 – No impacts	1 – No impacts	1 – No impacts
Supreme Swamp	1 – No impacts	1 – No impacts	2 - Will enhance water quality	1 – No impacts	1 – No impacts	1 – No impacts
Mitigation Bank	1 – No impacts	1 – No impacts	1 – No impacts	1 – No impacts	1 – No impacts	1 – No impacts

Table C5:5-2. Environmental Impact Summary Data Matrix (Sheet 2 of 2)

Environmental Impact – MTG Mitigation Alternatives	Aquatics/Fisheries	Prime Farmland	Cultural Resources	Recreation	Noise	HTRW	Socioeconomics/ Land Use
Napoleonville Swamp	1 – No impacts	1 – No impacts	1 – No impacts	2 - beneficial impacts	1 – No impacts	1 – No impacts	1 – No impacts
Supreme Swamp	1 – No impacts	1 – No impacts	1 – No impacts	2 – beneficial impacts	1 – No impacts	1 – No impacts	1 – No impacts
Mitigation Bank	1 – No impacts	1 – No impacts	1 – No impacts	1 – No impacts	1 – No impacts	1 – No impacts	1 – No impacts

5.3 FRESH AND INTERMEDIATE MARSH

Table C5:5-3. Environmental Impact Summary Data Matrix (Sheet 1 of 2)

Environmental Impact – MTG Mitigation Alternatives	Hydrology/ Hydraulics	Navigable Waters	Water Quality	Wildlife & Habitats	Water Bottoms/ Benthic	T & E	EFH
Avoca Island Cutoff	1 - No impact	1 - No impact	2 – Beneficial Impacts	2 – Beneficial Impacts	0 - Negative impacts	2 – Beneficial Impacts	2 – Beneficial Impacts
GIWW	1 - No impact	1 - No impact	2 – Beneficial Impacts	2 – Beneficial Impacts	0 - Negative impacts	2 – Beneficial Impacts	2 – Beneficial Impacts
Lake Salvador	1 - No impact	1 - No impact	2 – Beneficial Impacts	2 – Beneficial Impacts	0 - Negative impacts	2 – Beneficial Impacts	2 – Beneficial Impacts
Delta Farms	1 - No impact	1 - No impact	2 – Beneficial Impacts	2 – Beneficial Impacts	0 - Negative impacts	2 – Beneficial Impacts	2 – Beneficial Impacts
Mitigation Bank	1 - No impact	1 - No impact	1 - No impact	1 - No impact	1 - No impact	1 - No impact	1 - No impact

Table C5:5-3. Environmental Impact Summary Data Matrix (Sheet 2 of 2)

Environmental Impact – MTG Mitigation Alternatives	Aquatics/Fisheries	Prime Farmland	Cultural Resources	Recreation	Noise	HTRW	Socioeconomics/ Land Use
Avoca Island Cutoff	2 – Beneficial Impacts	1 - No impact	1 - No impact	2 – Beneficial Impacts	1 - No impact	1 - No impact	1 - No impact
GIWW	2 – Beneficial Impacts	1 - No impact	1 - No impact	2 – Beneficial Impacts	1 - No impact	1 - No impact	1 - No impact
Lake Salvador	2 – Beneficial Impacts	1 - No impact	1 - No impact	2 – Beneficial Impacts	1 - No impact	1 - No impact	1 - No impact
Delta Farms	2 – Beneficial Impacts	1 - No impact	1 - No impact	2 – Beneficial Impacts	1 - No impact	1 - No impact	1 - No impact
Mitigation Bank	1 - No impact	1 - No impact	1 - No impact	1 - No impact	1 - No impact	1 - No impact	1 - No impact

5.4 BRACKISH AND SALINE MARSH

Table C5:5-4. Environmental Impact Summary Data Matrix (Sheet 1 of 2)

Environmental Impact – MTG Mitigation Alternatives	Hydrology/ Hydraulics	Navigable Waters	Water Quality	Wildlife & Habitats	Water Bottoms/ Benthic	T & E	EFH
Falgout	1 - No impact	1 - No impact	2 – Beneficial Impacts	2 – Beneficial Impacts	1 - No impact	2 – Beneficial Impacts	2 – Beneficial Impacts
Isle de Jean Charles	1 - No impact	1 - No impact	2 – Beneficial Impacts	2 – Beneficial Impacts	1 - No impact	2 – Beneficial Impacts	2 – Beneficial Impacts
North Barataria Bay	1 - No impact	1 - No impact	2 – Beneficial Impacts	2 – Beneficial Impacts	1 - No impact	2 – Beneficial Impacts	2 – Beneficial Impacts
Three Mile Bay	1 - No impact	1 - No impact	2 – Beneficial Impacts	2 – Beneficial Impacts	1 - No impact	2 – Beneficial Impacts	2 – Beneficial Impacts
West Terrebonne	1 - No impact	1 - No impact	2 – Beneficial Impacts	2 – Beneficial Impacts	1 - No impact	2 – Beneficial Impacts	2 – Beneficial Impacts
Mitigation Bank	1 - No impact	1 - No impact	1 - No impact	1 - No impact	1 - No impact	1 - No impact	1 - No impact

Table C5:5-4. Environmental Impact Summary Data Matrix (Sheet 2 of 2)

Environmental Impact – MTG Mitigation Alternatives	Aquatics/ Fisheries	Prime Farmland	Cultural Resources	Recreation	Noise	HTRW	Socioeconomics/ Land Use
Falgout	1 - No impact	1 - No impact	1 - No impact	1 - No impact	1 - No impact	1 - No impact	1 - No impact
Isle de Jean Charles	1 - No impact	1 - No impact	1 - No impact	1 - No impact	1 - No impact	1 - No impact	1 - No impact
North Barataria Bay	1 - No impact	1 - No impact	1 - No impact	1 - No impact	1 - No impact	1 - No impact	1 - No impact
Three Mile Bay	1 - No impact	1 - No impact	1 - No impact	1 - No impact	1 - No impact	1 - No impact	1 - No impact
West Terrebonne	1 - No impact	1 - No impact	1 - No impact	1 - No impact	1 - No impact	1 - No impact	1 - No impact
Mitigation Bank	1 - No impact	1 - No impact	1 - No impact	1 - No impact	1 - No impact	1 - No impact	1 - No impact

Mississippi Valley Division, Regional Planning and Environment Division South

Hurricane and Storm Damage Risk Reduction Project Morganza to the Gulf of Mexico, Terrebonne Parish, Louisiana

Appendix C – Attachment 6 - Compensatory Mitigation Plan Related Cost Data

November 2025

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SECTION 1 FRESH AND INTERMEDIATE MARSH

Cost Considerations Matrices

Table C6:1-1. Fresh and Intermediate Marsh - Other Cost Considerations Matrices

		Total Project Cost	Average Annual Cost
Mitigation Bank Credits	High	Least Cost	Least Cost
	Low	Least Cost	Least Cost
Avoca Island Cutoff	High	447% > least cost	444% > least cost
	Low	730% > least cost	724% > least cost
GIWW	High	318% > least cost	316% > least cost
	Low	534% > least cost	530% > least cost
Lake Salvador	High	72% > least cost	74% > least cost
	Low	161% > least cost	164% > least cost
Delta Farms	High	86% > least cost	87% > least cost
	Low	183% > least cost	182% > least cost
25% Mitigation Bank Credits, 75% Avoca Island Cutoff	High	335% > least cost	334% > least cost
	Low	547% > least cost	543% > least cost
50% Mitigation Bank Credits, 50% Avoca Island Cutoff	High	223% > least cost	222% > least cost
	Low	365% > least cost	362% > least cost
75% Mitigation Bank Credits, 25% Avoca Island Cutoff	High	111% > least cost	111% > least cost
	Low	182% > least cost	181% > least cost
25% Mitigation Bank Credits, 75% GIWW	High	238% > least cost	237% > least cost
	Low	400% > least cost	397% > least cost
50% Mitigation Bank Credits, 50% GIWW	High	159% > least cost	158% > least cost
	Low	267% > least cost	265% > least cost

75% Mitigation Bank Credits, 25% GIWW	High	79% > least cost	79% > least cost
	Low	133% > least cost	132% > least cost
25% Mitigation Bank Credits, 75% Lake Salvador	High	54% > least cost	56% > least cost
	Low	121% > least cost	123% > least cost
50% Mitigation Bank Credits, 50% Lake Salvador	High	36% > least cost	38% > least cost
	Low	80% > least cost	83% > least cost
75% Mitigation Bank Credits, 25% Lake Salvador	High	18% > least cost	20% > least cost
	Low	40% > least cost	42% > least cost
25% Mitigation Bank Credits, 75% Delta Farms	High	65% > least cost	65% > least cost
	Low	137% > least cost	137% > least cost
50% Mitigation Bank Credits, 50% Delta Farms	High	43% > least cost	43% > least cost
	Low	91% > least cost	91% > least cost
75% Mitigation Bank Credits, 25% Delta Farms	High	21% > least cost	22% > least cost
	Low	45% > least cost	46% > least cost

Table C6:1-2. Fresh and Intermediate Marsh – Cost Effectiveness Matrices

Fresh and Intermediate Marsh		
Alternative		**Cost/AAHU**
Mitigation Bank Credits	High	Least Cost
	Low	Least Cost
Avoca Island Cutoff	High	445% > Least Cost
	Low	742% > Least Cost
GIWW	High	316% > Least Cost
	Low	530% > Least Cost
Lake Salvador	High	74% > Least Cost
	Low	164% > Least Cost
Delta Farms	High	87% > Least Cost

	Low	182% > Least Cost
25% Mitigation Bank Credits, 75% Avoca Island Cutoff	High	334% > Least Cost
	Low	543% > Least Cost
50% Mitigation Bank Credits, 50% Avoca Island Cutoff	High	222% > Least Cost
	Low	362% > Least Cost
75% Mitigation Bank Credits, 25% Avoca Island Cutoff	High	111% > Least Cost
	Low	181% > Least Cost
25% Mitigation Bank Credits, 75% GIWW	High	237% > Least Cost
	Low	397% > Least Cost
50% Mitigation Bank Credits, 50% GIWW	High	158% > Least Cost
	Low	265% > Least Cost
75% Mitigation Bank Credits, 25% GIWW	High	79% > Least Cost
	Low	132% > Least Cost
25% Mitigation Bank Credits, 75% Lake Salvador	High	56% > Least Cost
	Low	123% > Least Cost
50% Mitigation Bank Credits, 50% Lake Salvador	High	38% > Least Cost
	Low	83% > Least Cost
75% Mitigation Bank Credits, 25% Lake Salvador	High	20% > Least Cost
	Low	42% > Least Cost
25% Mitigation Bank Credits, 75% Delta Farms	High	65% > Least Cost
	Low	137% > Least Cost
50% Mitigation Bank Credits, 50% Delta Farms	High	43% > Least Cost
	Low	91% > Least Cost
75% Mitigation Bank Credits, 25% Delta Farms	High	22% > Least Cost

	Low	46% > Least Cost

SECTION 2 BRACKISH AND SALINE MARSH

Cost Considerations Matrices

Table C6:2-1. Brackish and Saline Marsh - Other Cost Considerations Matrices

		Total Project Cost	Average Annual Cost
Mitigation Bank Credits	High	Least Cost	Least Cost
	Low	Least Cost	Least Cost
Isle de Jean Charles	High	233% > least cost	294% > least cost
	Low	958% > least cost	974% > least cost
North Barataria Bay	High	248% > least cost	288% > least cost
	Low	769% > least cost	778% > least cost
Three Mile Bay	High	69% > least cost	97% > least cost
	Low	512% > least cost	519% > least cost
West Terrebonne	High	48% > least cost	62% > least cost
	Low	300% > least cost	303% > least cost
25% Mitigation Bank Credits, 75% Isle de Jean Charles	High	174% > least cost	229% > least cost
	Low	718% > least cost	731% > least cost
50% Mitigation Bank Credits, 50% Isle de Jean Charles	High	116% > least cost	160% > least cost
	Low	479% > least cost	488% > least cost
75% Mitigation Bank Credits, 25% Isle de Jean Charles	High	58% > least cost	90% > least cost
	Low	239% > least cost	245% > least cost
25% Mitigation Bank Credits, 75% North Barataria Bay	High	186% > least cost	223% > least cost
	Low	577% > least cost	584% > least cost
50% Mitigation Bank Credits, 50% North Barataria Bay	High	124% > least cost	153% > least cost
	Low	385% > least cost	389% > least cost

75% Mitigation Bank Credits, 25% North Barataria Bay	High	62% > least cost	83% > least cost
	Low	192% > least cost	195% > least cost
25% Mitigation Bank Credits, 75% Three Mile Bay	High	52% > least cost	77% > least cost
	Low	384% > least cost	390% > least cost
50% Mitigation Bank Credits, 50% Three Mile Bay	High	34% > least cost	56% > least cost
	Low	256% > least cost	260% > least cost
75% Mitigation Bank Credits, 25% Three Mile Bay	High	17% > least cost	36% > least cost
	Low	128% > least cost	131% > least cost

Table C6:2-2. Brackish and Saline Marsh – Cost Effective Matrices

		Cost/AAHU
Mitigation Bank Credits	Least Cost	Least Cost
	Least Cost	Least Cost
Isle de Jean Charles	294% > Least Cost	233% > least cost
	974% > Least Cost	958% > least cost
North Barataria Bay	288% > Least Cost	248% > least cost
	778% > Least Cost	769% > least cost
Three Mile Bay	97% > Least Cost	69% > least cost
	519% > Least Cost	512% > least cost
West Terrebonne	62% > Least Cost	48% > least cost
	303% > Least Cost	300% > least cost
25% Mitigation Bank Credits, 75% Isle de Jean Charles	229% > Least Cost	174% > least cost
	731% > Least Cost	718% > least cost
50% Mitigation Bank Credits, 50% Isle de Jean Charles	160% >Least Cost	116% > least cost
	488% > Least Cost	479% > least cost
75% Mitigation Bank Credits, 25% Isle de Jean Charles	91% > Least Cost	58% > least cost
	245% > Least Cost	239% > least cost
25% Mitigation Bank Credits, 75% North Barataria Bay	223% > Least Cost	186% > least cost
	584% > Least Cost	577% > least cost
50% Mitigation Bank Credits, 50% North Barataria Bay	153% > Least Cost	124% > least cost
	389% > Least Cost	385% > least cost
75% Mitigation Bank Credits, 25% North Barataria Bay	83% > Least Cost	62% > least cost
	195% > Least Cost	192% > least cost
25% Mitigation Bank Credits, 75% Three Mile Bay	77% > Least Cost	52% > least cost
	390% > Least Cost	384% > least cost
50% Mitigation Bank Credits, 50% Three Mile Bay	56% > Least Cost	34% > least cost
	260% > Least Cost	256% > least cost

75% Mitigation Bank Credits, 25% Three Mile Bay	36% > Least Cost	17% > least cost
	131% > Least Cost	128% > least cost

SECTION 3 BOTTOMLAND HARDWOOD FOREST

Cost Considerations Matrices

Table C6:3-1. Bottomland Hardwood Forest - Other Cost Considerations Matrices

	Total Project Cost	Average Annual Cost
Mitigation Bank Credits	25% > Least Cost	25% > Least Cost
Napoleonville	Least Cost	Least Cost
Supreme	2% > Least Cost	2% > Least Cost
25% Mitigation Bank Credits, 75% Napoleonville	6% > Least Cost	6% > Least Cost
50% Mitigation Bank Credits, 50% Napoleonville	12% > Least Cost	12% > Least Cost
75% Mitigation Bank Credits, 25% Napoleonville	19% > Least Cost	19% > Least Cost
25% Mitigation Bank Credits, 75% Supreme	7% > Least Cost	7% > Least Cost
50% Mitigation Bank Credits, 50% Supreme	13% > Least Cost	13% > Least Cost
75% Mitigation Bank Credits, 25% Supreme	19% > Least Cost	19% > Least Cost

Table C6:3-2. Bottomland Hardwood Forest – Cost Effectiveness Matrices

	Cost/AAHU
Mitigation Bank Credits	25% > Least Cost
Napoleonville	Least Cost
Supreme	2% > Least Cost
25% Mitigation Bank Credits, 75% Napoleonville	6% > Least Cost
50% Mitigation Bank Credits, 50% Napoleonville	12% > Least Cost
75% Mitigation Bank Credits, 25% Napoleonville	19% > Least Cost
25% Mitigation Bank Credits, 75% Supreme	7% > Least Cost
50% Mitigation Bank Credits, 50% Supreme	13% > Least Cost
75% Mitigation Bank Credits, 25% Supreme	19% > Least Cost

SECTION 4 SWAMP

Cost Considerations Matrices

Table C6:4-1. Swamp - Other Cost Considerations Matrices

	Total Project Cost	Average Annual Cost
Mitigation Bank Credits	130% > Least Cost	128% > Least Cost
Napoleonville	Least Cost	Least Cost
Supreme	2% > Least Cost	3% > Least Cost
25% Mitigation Bank Credits, 75% Napoleonville	33% > Least Cost	31% > Least Cost
50% Mitigation Bank Credits, 50% Napoleonville	65% > Least Cost	63% > Least Cost
75% Mitigation Bank Credits, 25% Napoleonville	98% > Least Cost	95% > Least Cost
25% Mitigation Bank Credits, 75% Supreme	34% > Least Cost	32% > Least Cost
50% Mitigation Bank Credits, 50% Supreme	66% > Least Cost	64% > Least Cost
75% Mitigation Bank Credits, 25% Supreme	98% > Least Cost	96% > Least Cost

Table C6:4-2. Swamp – Cost Effectiveness Matrices

	Cost/AAHU
Mitigation Bank Credits	128% > Least Cost
Napoleonville	Least Cost
Supreme	3% > Least Cost
25% Mitigation Bank Credits, 75% Napoleonville	31% > Least Cost
50% Mitigation Bank Credits, 50% Napoleonville	63% > Least Cost
75% Mitigation Bank Credits, 25% Napoleonville	95% > Least Cost
25% Mitigation Bank Credits, 75% Supreme	32% > Least Cost
50% Mitigation Bank Credits, 50% Supreme	64% > Least Cost
75% Mitigation Bank Credits, 25% Supreme	96% > Least Cost

Mississippi Valley Division,
Regional Planning and Environment Division South

Morganza to the Gulf of Mexico, Louisiana, Hurricane and Storm Damage Risk Reduction Project

Appendix C – Attachment 7 – Bottomland Hardwood and Swamp Planting and Monitoring Guidelines and Adaptive Management Plan

October 2025

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SECTION 1
Mitigation Planting Guidelines

1.1 PLANTING GUIDELINES FOR BOTTOMLAND HARDWOOD (BLH) HABITATS

Canopy species will be planted on 8 by 10 foot spacing to achieve a minimum initial stand density of 545 seedlings (trees) per acre. Midstory species will be planted at 16 by 20 foot spacing (average) to achieve a minimum initial stand density of 136 seedlings per acre. Stock will be at least 1 year old; root collars shall not exceed 3/8 inch in diameter and not less than 1/4 inch in diameter. The maximum height from root collar to the terminal bud shall not exceed 24 inches, nor be less than 12 inches. All tap root lengths for bareroot seedlings must measure between 6 inches (minimum) and 8 inches (maximum).and must be obtained from a registered licensed regional nursery/grower and of a regional eco-type species properly stored and handled to ensure viability. The plants will typically be installed during the period from December through March 15 (planting season/dormant season); however, unanticipated events such as spring flooding may delay plantings until late spring or early summer. The seedlings will be installed in a manner that avoids monotypic rows of canopy and midstory species (i.e. goal is to have spatial diversity and mixture of planted species). If herbivory may threaten seedling survival, then seedling protection devices such as wire-mesh fencing or plastic seedling protectors will be installed around each planted seedling.

1.2 SPECIES FOR WET BOTTOMLAND HARDWOOD HABITATS (BLH-WET HABITATS)

The canopy species installed will be in general accordance with the species lists provided in Tables C7:1-1 and C7:1-2. Plantings will be conducted such that the total number of plants installed in a given area consists of approximately 60% hard mast-producing species (Table C7:1-1) and approximately 40% soft mast-producing species (Table C7:1-2). The species composition of the plantings for each of the two groups of canopy species (e.g. hard mast species and soft mast species) should mimic the percent composition guidelines indicated in Tables C7:1-1 and C7:1-2. However, site conditions (factors such as hydrologic regime, soils, composition of existing native canopy species, etc.) and planting stock availability may necessitate deviations from the species lists and/or the percent composition guidelines indicated in these tables. In general, a minimum of 3 hard mast species and a minimum of 3 soft mast species should be utilized.

The midstory species installed will be selected from the species list provided in Table C7:1-3. Plantings will consist of at least 3 different species. The species used and the proportion of the total midstory plantings represented by each species (percent composition) will be dependent on various factors including site conditions (composition and frequency of existing native midstory species, hydrologic regime, soils, etc.) and planting stock availability.

Table C7:1-1. Preliminary Planting List for Wet Bottomland Hardwood Habitat, Hard Mast-Producing Canopy Species (60% of Total Canopy Species)

Common Name	Scientific name	Percent Composition
Nuttall oak	*Quercus nuttalli, Q. texana*	30% - 40%
Willow oak	*Quercus phellos*	30% - 40%
Water oak	*Quercus nigra*	5%
Overcup oak	*Quercus lyrata*	10% - 20%
Swamp chestnut oak	*Quercus michauxii*	10% - 20%
Water hickory	*Carya aquatica*	10% - 20%

Table C7:1-2. Preliminary Planting List for Wet Bottomland Hardwood Habitat, Soft Mast-Producing Canopy Species (40% of Total Canopy Species)

Common Name	Scientific name	Percent Composition
Drummond red maple	*Acer rubrum* var. *drummondii*	15% - 25%
Sugarberry	*Celtis laevigata*	15% - 25%
Green ash	*Fraxinus pennsylvanica*	15% - 25%
Sweetgum	*Liquidambar styraciflua*	10% - 20%
American elm	*Ulmus americana*	10% - 20%
Bald cypress	*Taxodium distichum*	5% - 15%

Table C7:1-3: Preliminary Planting List for Wet Bottomland Hardwood Habitat, Midstory Species

Common Name	Scientific name	Percent Composition
Saltbush	*Baccharis halimifolia*	TBD
Buttonbush	*Cephalanthus occidentalis*	TBD
Roughleaf dogwood	*Cornus drummondii*	TBD
Mayhaw	*Crataegus opaca*	TBD
Green hawthorn	*Crataegus viridis*	TBD
Common persimmon	*Diospyros virginiana*	TBD
Honey locust	*Gleditsia triacanthos*	TBD
Possumhaw	*Ilex decidua*	TBD
Dahoon holly	*Ilex cassine*	TBD

Red mulberry	*Morus rubra*	TBD
Wax myrtle	*Myrica cerifera*	TBD

TBD = To Be Determined

1.3 DEVIATIONS FROM TYPICAL PLANTING GUIDELINES

Proposed mitigation features that involve restoration will commonly require planting the entire feature using the prescribed planting guidance addressed in the preceding sections. In contrast, mitigation features that involve enhancement will often require adjustments to the typical plant spacing/density guidelines and may further require adjustments to the guidelines pertaining to species composition.

Where initial enhancement activities include the eradication of invasive and nuisance plant species, significant numbers of native canopy and/or midstory species may remain, but in a spatial distribution that leaves relatively large "gaps" in the canopy stratum and/or the midstory stratum. In such cases, areas measuring approximately 25 feet by 25 feet that are devoid of native canopy species should be planted and areas measuring approximately 45 feet by 45 feet that are devoid of native midstory species should be planted.

The initial enhancement actions involved within a particular mitigation site could include a variety of measures such as the eradication of invasive and nuisance plant species, topographic alterations (excavation, filling, grading, etc.), and hydrologic enhancement actions (alterations to drainage patterns/features, installation of water control structures, etc.). These actions may result in areas of variable size that require planting of both canopy and midstory species using the typical densities/spacing described previously. There may also be areas where several native canopy and/or midstory species remain, thus potentially altering the general guidelines described as regards the spacing of plantings, and/or the species to be planted, and/or the percent composition of planted species. Similarly, areas that must be re-planted due to failure in achieving applicable mitigation success criteria may involve cases where the general guidelines discussed above will not necessarily be applicable.

Given these uncertainties, initial planting plans specific to enhancement features will be required and must be specified in the Mitigation Work Plan for the mitigation site. The initial planting plans will be developed by the USACE in cooperation with the Interagency Team. Initial plantings will be the responsibility of the USACE. If re-planting of an area is necessary following initial plantings, a specific re-planting plan must also be prepared and must be approved by the USACE in cooperation with the Interagency Team prior to re-planting. With the exception of any re-planting actions necessary to attain the initial survivorship success criteria (i.e. survival required after first growing season following the yearly following completion of initial plantings), the NFS will be responsible for preparing re-planting plans and conducting re-planting activities, subject to the provisions mentioned in the Introduction section.

Re-planting necessary to achieve the initial survivorship criteria will be the responsibility of the USACE subject to the provisions mentioned in the Introduction section.

SECTION 2
Monitoring Plan and Success Criteria

2.1 INTRODUCTION

This document follows the monitoring and success criteria guidelines developed for the The Morganza to the Gulf Mitigation Program. The guidelines were developed by the U.S. Army Corps of Engineers (USACE) in coordination with an Interagency Team and the non-Federal project sponsor (NFS). This appendix outlines the refined project specific monitoring, reporting and success criteria for the mitigation alternative included in the MTG SEIS. The specific mitigation projects are fully described in and include the following:

Table C7:2-1. BLH and Swamp Projects with Respective Acres

	Projects	Habitat	Acres*
BLH-Wet in basin in CZ	Mitigation Bank	BLH-wet	TBD
	Napoleonville	BLH-wet	588
	Supreme	BLH-wet	616
Swamp in CZ	Mitigation Bank	Swamp	TBD
	Napoleonville	Swamp	1063
	Supreme	Swamp	958

*Note total constructable acres were inserted in the table.

It should be noted that even though the proposed mitigation actions under MTG SEIS include the potential purchase of credits from a mitigation bank this appendix only details the project specific information for the Corps constructed projects. In the event that mitigation bank credits are purchased the mitigation success criteria, mitigation monitoring and reporting requirements, and mitigation management and maintenance activities will be set forth in the Mitigation Banking Instrument (MBI) for each particular bank. The bank sponsor (bank permittee) will be responsible for these activities rather than the USACE and/or the local Sponsor. USACE Regulatory staff will review the mitigation bank monitoring reports and conduct periodic inspections of mitigation banks to ensure compliance with mitigation success criteria stated in the MBI. The proposed mitigation actions under MTG SEIS include construction of Swamp and BLH habitat with the NFS responsible for operation and maintenance of functional portions of work as they are completed. On a cost shared basis, the USACE will monitor completed the mitigation to determine whether additional construction, invasive species control and/or plantings are necessary to achieve mitigation success. The USACE will undertake additional actions necessary to achieve mitigation success in accordance with cost sharing applicable to the project and subject to the availability of funds. Once the USACE determines that the mitigation has achieved initial success criteria, monitoring will be performed by the NFS as part of its OMRR&R obligations. If, after meeting initial success criteria, the mitigation fails to meet its intermediate and/or long-term ecological success criteria, USACE will consult with other agencies and the NFS to determine whether operational changes would be sufficient to achieve ecological success criteria. If, instead, structural changes are deemed necessary to achieve ecological success, USACE will implement appropriate adaptive management measures in accordance with the contingency plan and subject to cost sharing requirements, availability of funding, and current budgetary and other guidance.

The respective responsibilities for the construction, monitoring and maintenance of the mitigation projects within the TSA are as follows:

1. Construction and planting (the “construction phase”) - performed by the USACE per applicable cost-sharing;
2. After construction and planting, the USACE issues Notice of Construction Complete (NCC) and provides the Operation, Maintenance, Repair, Replacement, and Rehabilitation manual to the NFS (the “O&M phase”);
3. Notwithstanding NCC, the USACE will monitor the project on a cost-shared basis until it reaches its Initial Success Criteria;
4. If, after NCC but before Initial Success Criteria are achieved, the project needs additional construction, invasive species control or planting, the USACE will perform these items subject to applicable cost-sharing and availability of funds;
5. After Initial Success Criteria are achieved, the NFS will monitor project;
6. If, after Initial Success Criteria are achieved, there is a problem that can be corrected through a change in operation, the NFS will be responsible to change its operation of the project; and
7. If, after Initial Success Criteria are achieved, there is a problem that requires structural changes, USACE will implement adaptive management according to applicable cost-sharing and subject to availability of funds.

2.2 MITIGATION SUCCESS CRITERIA

The success criteria for the BLH and Swamp project features were initially included in the PIER Appendix L and are presented below and summarized in Table C7:2-1. Again, these criteria are currently under revision and will be incorporated when completed.

2.2.1 Success Criteria-Bottomland Hardwood Forest

The success (performance) criteria for BLH-Wet are included.

2.2.1.1 General Construction

A. Complete all necessary initial earthwork and related construction activities in accordance with the mitigation work plan as well as the final project plans and specifications. These requirements classify as initial success criteria.

2.2.1.2 Native Vegetation

A. Complete initial planting of canopy and midstory species in accordance with the authorized initial planting plan described in Section 1. This requirement classifies as an initial success criterion.

B.1 Initial Success Criteria for BLH Mitigation Areas (applies at the end of the first growing season following the year plantings adequately meet initial construction requirements, as determined by USACE staff) --

- Achieve a minimum average survival of 50% of the planted canopy species (i.e. achieve a minimum average canopy species density of 272 living seedlings/ac.). The surviving plants must approximate the species composition and the species percentages specified in the initial plantings component of the Mitigation Work Plan. These criteria would apply to the initial plantings as well as any subsequent replantings necessary to achieve this initial success requirement.
- The surviving canopy plants must include at least 6 different species, of which at least 3 species must be hard mast producing species. The living hard mast species must, together, comprise approximately 50% to 70% of the average total density (e.g. average number of living seedlings per acre) of all the living native canopy species present.
- Each living canopy species must comprise at least 5% of the average total density (plants/acre) of all living canopy species present. However, if the initial planting event included one or more canopy species whose number planted accounted for 5% or less of the total number of canopy plants installed, then this requirement will not apply to such species.

B. Intermediate Success Criteria (applies 3 growing seasons following initial success criteria)–

- Achieve a minimum average density of 272 living native canopy species per acre (planted trees and/or naturally recruited native canopy species).
- Achieve an average cover of 136 (50% of 272) living, native, hard mast-producing species. These criteria will thereafter remain in effect for the duration of the overall monitoring period. Modifications to these criteria could be necessary for reasons such as avoidance of tree thinning if thinning is not warranted and the long-term effects of sea level rise on tree survival. Proposed modifications must first be approved by the USACE in coordination with the Interagency Team.
- Demonstrate that dominant vegetation satisfies USACE hydrophytic (wetland) vegetation criteria using one of the three hydrophytic vegetation indicators (hydrophytic vegetation "tests" discussed in USACE, 2010 (e.g. the Indicator 1 Rapid Test, the Indicator 2 Dominance Test, or the Indicator 3 Prevalence Index test, with use of Indicators 1 or 2 preferred). The wetland indicator status of plants will be based on the most recent National Wetland Plant List (USACE, 2018 or most current version).

C. Within 12 years Following Attainment of Initial Success Vegetation criteria.

- Achieve one of the two following vegetative cover requirements:
    - (1) The average percent cover by native species in the canopy stratum is at least 75% and the average percent cover by native species in the midstory stratum is at least 33%, or the average percent cover by native species in the ground cover stratum is at least 33%; OR
    - (2) The average percent cover by native species in the canopy stratum is at least 50%, the average percent cover by native species in the midstory stratum is at least 33%, and the average percent cover by native species in the ground cover stratum is at least 33%.

D. Long-Term Success Criteria (applies within 6 growing seasons following attainment of Initial Success Criteria and must be maintained thereafter for the duration of the remaining 50-year monitoring period.

- Attain a minimum average canopy cover of 80% by planted canopy species and/or naturally recruited native canopy species. This criterion will thereafter remain in effect for the duration of the overall monitoring period.
- Achieve a minimum average density of 136 (50% of 272) living hard-mast producing canopy species (planted seedlings and/or naturally recruited native canopy species). The remaining living canopy trees must be dominated by soft-mast producing native species.
- Demonstrate that dominant vegetation satisfies USACE hydrophytic vegetation criteria.

2.2.1.3 Invasive and Nuisance Vegetation

A. Initial, Intermediate, and Long-term Success Criteria for BLH Mitigation Areas. Maintain the BLH mitigation features (areas) such that they are essentially free from invasive and nuisance plant species immediately following a given maintenance event and such that the total average vegetative cover accounted for by invasive and nuisance species each constitute less than 5% of the average total plant cover during periods between maintenance events. These criteria must be satisfied throughout the duration of the overall monitoring period.

2.2.1.4 Topography

A. Following completion of initial construction activities, demonstrate that at least 80% of the total area within each feature is within approximately 0.5 feet of the proposed target soil surface elevation (e.g. the desired soil surface elevation). This requirement classifies as an initial success criterion.

2.2.1.5 Thinning of Native Vegetation (Timber Management)

The USACE, in cooperation with the Interagency Team, may determine that thinning of the canopy and/or midstory strata is warranted to ensure the achievement of success criteria within the plan. This determination would be made approximately 15 to 20 years following completion of initial plantings. If, under normal climatic conditions, two or more successive monitoring reports do not indicate average growth rates for the species installed and site conditions are being achieved then remedial actions will be discussed with the resource agencies. If it is decided that timber management efforts are necessary, the NFS would develop a Timber Stand Improvement/Timber Management Plan, and associated long-term success criteria, in coordination with the USACE and Interagency Team. Following approval of the plan, the NFS would perform the necessary thinning operations and demonstrate that these operations have been successfully completed. Timber management activities would only be allowed for the operations that have been successfully completed.

Reference Table 2. Desired stand conditions for bottomland hardwood forests within the MS Alluvial Valley. (Page 23) in the following Handbook:

LMVJV Forest Resource Conservation Working Group. 2007. Restoration. Mangement, and Monitoring of Forest Resources in the Mississippi Alluvial Valley: Recommendations for Enhancing Wildlife Habitat. Edited by R. Wilson, K. Ribbeck, S. King, and D. Twedt.

2.2.1.6 Hydrology

The optimal hydrologic regime for BLH-Wet forests also involves both brief seasonal flooding and sufficient surface water exchange between the forest and adjacent systems. Wet BLH forests are commonly flooded for some portion of the year, although the timing, extent, depth, duration, and source of floodwaters can be highly variable. The hydroperiod commonly includes temporary flooding for brief periods during the growing season; however the water table is typically below the soil surface for the majority of the growing season. When flooding (inundation) does occur, freshwater input from riverine systems is most desirable as is relatively consistent surface water flow through the forest. Having good surface water exchange between the BLH forest and adjacent habitats is the primary objective, thus other sources of sheetflow into the forest besides riverine sources can be similarly beneficial.

2.2.1.6.1 Success Criteria

A. Ground surface elevations must be conducive to establishment and support of hydrophytic vegetation, and re-establishment and maintenance of hydric soil characteristics.
B. Two years following attainment of the one-year survivorship criteria, site hydrology will be restored such that the Property meets the wetland criterion as described in the 1987

Manual as well as the November 2010 Regional Supplement to the Corps of Engineers wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region Version 2.0 (USACE 1987, 2010). Data demonstrating that wetland hydrology is being or has been re-established is to be presented in the monitoring report.

2.2.2 Success Criteria-Swamp Habitat Restoration

2.2.2.1 General Construction

A. As applicable, complete all necessary initial earthwork and related construction activities in accordance with the mitigation work plan as well as the final project plans and specifications. Examples include but are not limited to: grading and clearing activities; modifications/alterations to existing perimeter dikes. These requirements classify as initial success criteria.

2.2.2.2 Native Vegetation

A. Complete initial planting of canopy and midstory species in accordance with the authorized initial planting plan. This requirement classifies as an initial success criterion.
B. Initial Success Criteria for Swamp Mitigation Areas (applies at the end of the first growing season following the year plantings adequately meet initial construction requirements, as determined by USACE staff)

- Achieve a minimum a minimum average survival of 50% of the planted canopy species (i.e. achieve a minimum average canopy species density of 272 living seedlings/ac.).
- Achieve a surviving canopy plants must include at least 3 different species.
- Each living canopy species must comprise at least 5% of the average total density (plants/acre) of all living canopy species present. However, if the initial planting event included one or more canopy species whose number planted accounted for 5% or less of the total number of canopy plants installed, then this requirement will not apply to such species.

C. Intermediate Success Criteria for Swamp Mitigation Areas (applies 3 growing seasons following attainment of Native Vegetation)

- Achieve a minimum average density of 250 living native canopy species per acre (planted trees and/or naturally recruited native canopy species).
- Achieve a minimum average density of 125 living baldcypress trees (planted trees and/or naturally recruited native canopy species). The species composition of the additional native canopy species present must be generally consistent with the planted ratios for such species.
- Demonstrate that vegetation satisfies USACE hydrophytic vegetation criteria. This criterion will thereafter remain in effect for the duration of the overall monitoring period.

- The requirements above classify as intermediate success criteria; with the exception that the requirement to demonstrate vegetation satisfies USACE hydrophytic vegetation criteria throughout the duration of the overall monitoring period classifies as a long-term success criterion.

D. Within 12 Years Following Completion of Initial Plantings –

- Achieve one of the two following vegetative cover requirements:
    1. The average percent cover by native species in the canopy stratum is at least 50%, <u>and</u>; the average percent cover by native species in the midstory stratum exceeds 33%, <u>and</u>; the average percent cover by native species in the ground cover stratum (herbaceous cover) exceeds 33%.
    2. The average percent cover by native species in the canopy stratum is at least 75%, and:
        (a) the average percent cover by native species in the midstory stratum exceeds 33%, or;
        (b) the average percent cover by native species in the ground cover stratum (herbaceous cover) exceeds 33%.
- The requirements above classify as intermediate success criteria.

E. Long term Success criteria within 30 years following achievement of initial success criteria and must be maintained thereafter for the duration of the remaining 50-year monitoring period.

- Demonstrate that the average percent cover by native species in the canopy stratum is at least 75%.
- Demonstrate that the average diameter at breast height (DBH) of living bald cypress trees in the canopy stratum exceeds 10 inches.
- Demonstrate that the average DBH of the other living native trees in the canopy stratum (native trees other than bald cypress) exceeds 12 inches.
- Demonstrate that the average total basal area accounted for by all living native trees in the canopy stratum combined exceeds approximately 161 square feet per acre.

2.2.2.3 Invasive and Nuisance Vegetation

A. Initial, Intermediate, and Long-term Success Criteria for Swamp Mitigation Areas. Maintain the swamp mitigation features (areas) such that they are essentially free from invasive and nuisance plant species immediately following a given maintenance event and such that the total average vegetative cover accounted for by invasive and nuisance species each constitute less than 5% of the average total plant cover during periods between maintenance events. These criteria must be satisfied throughout the duration of the overall monitoring period.

2.2.2.4 Topography

A. Following completion of initial construction activities, demonstrate that at least 80% of the total area within each feature is within approximately 0.5 feet of the proposed target soil surface elevation (e.g. the desired soil surface elevation). This requirement classifies as an initial success criterion.

2.2.2.5 Thinning of Native Vegetation (Timber Management)

The USACE, in cooperation with the Interagency Team, may determine that thinning of the canopy and/or midstory strata is warranted to ensure the achievement of success criteria within the plan. This determination would be made approximately 15 to 20 years following completion of initial plantings. If, under normal climatic conditions, two or more successive monitoring reports do not indicate average growth rates for the species installed and site conditions are being achieved then remedial actions will be discussed with the resource agencies. If it is decided that timber management efforts are necessary, the NFS would develop a Timber Stand Improvement/Timber Management Plan, and associated long-term success criteria, in coordination with the USACE and Interagency Team. Following approval of the plan, the NFS would perform the necessary thinning operations and demonstrate that these operations have been successfully completed. Timber management activities would only be allowed for the operations that have been successfully completed.

2.2.2.6 Hydrology

The optimal hydrologic regime for baldcypress/tupelogum swamp involves both seasonal flooding and good surface water exchange between a particular swamp and adjacent systems. The typical hydroperiod should include several periods of flooding (inundation) and drawdown, or a “pulsing” hydrology. Surface water should be present for extended periods, especially during portions of the growing season, but should be absent (water table at or below the soil surface) by the end of the growing season in most years. At a minimum, standing surface water should be absent for approximately 2 months during the growing season once every 5 years. Abundant and consistent freshwater input from riverine systems is most desirable, as is relatively consistent surface water flow through the swamp during flooded periods. However, other sources of sheetflow into the swamp can be similarly beneficial. The main objective is to have sufficient surface water exchange between the swamp and adjacent habitats. Situations involving permanent flooding and/or no surface water exchange should be avoided when possible.

2.2.2.6.1 General Hydrologic Guidelines

The following provides some general hydrologic guidelines for the mitigation project since altering the existing hydrologic regime by modifying the perimeter dikes is a component of the mitigation work plan. It is emphasized that 1-4 below are not the required success criteria they are merely guidelines and the attainment of one or more of these guidelines may not be possible in some situations. The required success criteria are outlined below these guidelines.

1. Strive for a minimum of about 200 consecutive days but no more than roughly 300 consecutive days of inundation (flooding). This period of inundation should overlap a portion of the growing season (preferably the early portion or late portion).
2. Strive for a minimum of roughly 40 to 60 consecutive days during the growing season where the water table is at or below the soil surface (i.e. non-inundated period). This non- inundated period should preferably occur during the middle portion of the growing season. The non-inundated period should not exceed approximately 90 to 120 days.
3. Strive to achieve an average maximum (peak) water table elevation that ranges between approximately 1.0 feet to 2.0 feet above the soil surface (i.e. depth of average peak inundation is 1.0 to 2.0 feet). Water table elevations greater than 2 feet above the soil surface may occur, however such occurrences should be of relatively short duration (i.e. brief “spikes” in the depth of inundation).
4. Locate the mitigation area such that it naturally receives freshwater inputs via surface flow from adjacent lands and such that, during periods of inundation, there is good sheet flow through the mitigation area including a means for surface water discharge from the mitigation area. If the mitigation area cannot be located to attain these goals naturally, then mitigation activities should include actions to achieve these goals to the greatest degree practicable (e.g. include measures to provide for good surface water exchange between the swamp and adjacent systems), while at the same time not jeopardizing hydrology objectives pertaining to the swamp’s hydroperiod.

2.2.2.6.2 Hydrologic Success Criteria

The following criteria will be used to determine hydrologic success of the mitigation feature.

A. Ground surface elevations must be conducive to establishment and support of hydrophytic vegetation, and re-establishment and maintenance of hydric soil characteristics.
B. Two years following attainment of the one-year survivorship criteria, site hydrology will be restored such that the Property meets the wetland criterion as described in the 1987 Manual as well as the November 2010 Regional Supplement to the Corps of Engineers wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region Version 2.0 (USACE 1987, 2010). Data demonstrating that wetland hydrology is being or has been re-established is to be presented in the monitoring report.

Table C7:2-2. Summary of Standard BLH and Swamp Success Criteria

Performance Categories	**Mitigation Success Criteria by Habitat Type**	
	BLH Wet	**Swamp**
Mitigation Construction	Criteria 1A: Complete necessary initial earthwork and construction activities.	Criteria 1A: Complete necessary initial earthwork and construction activities.
Native Vegetation	Criteria 2A: Complete initial plantings. Criteria 2B: 1 growing season after initial plantings achieve: • Survival of ≥50% canopy species. Criteria 2C: 3 growing seasons following attainment after initial success achieve: • ≥272 living native canopy species per acre. • 60% living, native hard mast trees per acre in the canopy stratum. • 40% living soft mast species in the canopy stratum. • If applicable in final design BLH-wet must meet hydrophytic vegetation criteria. Criteria 2D: Within 12 years after initial plantings, achieve: • (1) ≥50% native canopy cover & >33% native midstory cover & >33% ground cover. OR • (2): ≥75% native canopy cover AND:	Criteria 2A: Complete initial plantings. Criteria 2B: 1 growing season after initial plantings achieve: • Survival of ≥50% canopy species. Criteria 2C: 3 growing seasons following attainment after initial success achieve: • ≥272 native canopy species per acre. • ≥125 living bald cypress trees per acre. • ≥ 85 native midstory species per acre. • Vegetation meets hydrophytic vegetation criteria. Criteria 2D. Within 12 years after initial plantings, achieve: • (1) ≥50% native canopy cover & >33% native midstory cover & >33% ground cover. OR • (2): ≥75% native canopy cover AND: >33% native midstory cover; OR >33% native ground cover

	>33% native midstory cover; OR >33% native ground cover Criteria 2E: 6 growing seasons after initial plantings, achieve: • >80% cover by native midstory species. • >136 Trees per acre of hardmast the rest must be softmast.	Criteria 2E: Within 30 years after initial plantings, achieve: • DBH of living trees >10 inches. • DBH of Bald cypress >10 inches. • >75% native canopy cover • Achieve a >161 Basal area
Invasive and Nuisance Vegetation (INV)	Criteria 3A. Complete initial Eradication of INV. Criteria 3B. Maintain <5% cover by INV.	Criteria 3A. Complete initial Eradication of INV. Criteria 3B. Maintain <5% cover by INV.
Topography	Criteria 4A: After completion of construction, ≥ 80% of total area must be within 0.5 ft of target elevation.	Criteria 4A: After completion of construction, ≥ 80% of total graded area must be within 0.5 ft of target elevation (for mitigation other than in open water areas).
Thinning of Native Vegetation	Criteria 5: TBD; at 15 to 20 years following initial plantings PDT will determine if thinning of canopy and midstory strata is warranted.	Criteria 5: TBD; at 15 to 20 years following initial plantings PDT will determine if thinning of canopy and midstory strata is warranted.
Hydrology	Criteria 6A: Ground surface elevations must be conducive to establishment and support of hydrophytic vegetation, and re-establishment and maintenance of hydric soil characteristics. Criteria 6B: 2 years following attainment of survivorship criteria, demonstrate wetland hydrology has been reestablished.	Criteria 6A: Ground surface elevations must be conducive to establishment and support of hydrophytic vegetation, and re-establishment and maintenance of hydric soil characteristics. Criteria 6B: 2 years following attainment of survivorship criteria, demonstrate wetland hydrology has been reestablished.

SECTION 3
MITIGATION MONITORING GUIDELINES

3.1.1 Bottomland Hardwood Forest

3.1.1.1 Initial Succes Criteria Monitoring report

The Initial Success Criteria (ISC) monitoring report will be prepared or contracted by USACE after all final construction activities (completion of earthwork and grading, initial eradication of invasive and nuisance plants, and initial installation of native canopy and midstory seedlings) associated with General Construction Success. If a re-planting event is required, as determined by USACE field monitoring, preparation of this ISC monitoring report will not occur until two growing seasons after the re-planting event has passed. If actions are necessary to satisfactorily achieve general construction success criteria or topography success criteria, then the final ISC monitoring report could be further delayed depending on the actions necessary and their relationship to attaining other initial success criteria. Besides documenting past significant mitigation and maintenance activities, the main focus of the ISC report will be to determine whether all applicable initial success criteria have been achieved. These success criteria include:

For the BLH mitigation component of the project:

- General Construction
- Topography
- Native Vegetation
- Invasive & Nuisance Vegetation

Information provided in the ISC Monitoring Report will include the following items:

- A discussion of all mitigation (including construction) and maintenance/management activities completed thus far along with any other significant occurrences.
- Plan view drawings and GIS shape files of the mitigation site (project property) showing:
    - the overall property boundaries; the boundaries of the various mitigation features (areas)
    - the limits of areas within each mitigation feature that do not count toward satisfying mitigation needs, if necessary
    - the limits of access easements and any other important easements affecting the project
    - the approximate center point of each of any earthen constructed feature
    - the limits of “buffer” areas established for the pipelines, padsites, or any other feature that needs a buffer.
    - the main project access route(s)

    - the location and approximate alignment of monitoring transects used, the location of sampling points used along each monitoring transect, the location of permanent photo stations used, and the approximate location where any additional photos used in the monitoring report were taken.
- Drawings showing as-built topographic contours covering each of the mitigation features (areas; polygons), including shading or other means of indicating the area(s) within each mitigation feature where the soil surface elevations fall within the elevation range required by Topography Success Criteria, as applicable to a particular mitigation feature.
- Copies of other final as-built drawings prepared for the project, that may include but not necessarily limited to: as-builts for the constructed water exchange gaps (plan views, profiles) or any other feature.
- A detailed inventory of all canopy and midstory species initially planted in each BLH mitigation feature, including the number of each species planted. This will be supported by a drawing depicting the general layout of the plantings, information about the alignment of planted rows, and a discussion of the plant stock utilized.
- If re-planting was necessary in BLH mitigation features, a detailed inventory of all canopy and midstory species that were re-planted in each mitigation feature (after the initial planting event), including the number of each species re-planted. If warranted, drawings showing the approximate limits of areas re-planted will also be provided.
- Photographs taken at permanent monitoring photo stations that document conditions in the mitigation features. At least two photos will be taken at each permanent photo station with the view of each photo always oriented in the same general direction from one monitoring event to the next. Other photographs may also be included to illustrate significant site conditions.
- A description of the monitoring methods used to gather quantitative data.
- Quantitative plant data collected from permanent sampling points established along the course of permanent monitoring transects, sampled using the point-centered quarter (PCQ) method. The data collected will be used to generate the following estimates for BLH:
    - average number of living planted canopy species (excluding recruited) present per acre (average density), the species composition, and the wetland indicator status of each species.
    - average number of living planted midstory species present per acre, the species composition, and the wetland indicator status of each species.
    - average percent survival of planted canopy species following each planting event. Note that these data will be provided for the individual mitigation features and for all mitigation features combined.
- Quantitative percent cover data for living native, nuisance, and invasive plants as collected at each permanent sampling point mentioned above. The data collected will be used to generate the following estimates for each of the two mitigation types:
    - For each vegetation strata separately (canopy, midstory, groundcover), provide: the average cover by native species, the average cover by invasive species, the average cover by nuisance species, and the average total percent cover by all plant species (native, invasive, and nuisance combined).

    - For all vegetation strata combined, provide the average total percent cover by all plant species, then the average percentage of the total percent cover accounted for by native plant species, by invasive species, and by nuisance species. A discussion of the dominant invasive and nuisance plant species will be included. Note that these data will be provided for the individual mitigation features and for all mitigation features combined.
- Quantitative data from the topographic drawings discussed above. For BLH tables will contain:
    - For each mitigation feature separately: the acreage of areas that meet the applicable topographic success criteria and the acreage of areas that do not meet these criteria; the percentage of the total acreage that meets the success criteria and the percentage that does not meet the success criteria.
    - For all the mitigation features combined: the total acres that meet and the total acres that do not meet applicable topographic success criteria; the percentage of the total acreage that meets and the percentage that does not meet the success criteria.
- In addition, various qualitative observations will be made in the mitigation site to help assess the status and success of mitigation and maintenance activities. These observations will include:
    - General estimates of the average percent cover by native plant species in the canopy, midstory, and ground cover strata.
    - General estimates of the average percent cover by invasive and by nuisance plant species, as a percentage of the average total plant cover;
    - General observations concerning the growth of planted canopy and midstory species;
    - General observations concerning colonization by volunteer native plant species;
    - General observations regarding areas within the mitigation areas that were inundated during monitoring (if any) and signs of past inundation and current wetland hydrology.
    - General observations made during the course of monitoring may also address potential problem zones (ex. large areas with high mortality of plantings; areas with heavy infestations of invasive and/or nuisance plant species; areas damaged by wild animals such as feral pigs; damage caused by trespassers, etc.), the general condition of native vegetation, trends in the composition of the plant communities, wildlife utilization as observed during monitoring, and other pertinent factors.
    - A general discussion of key monitoring data acquired during the any prior mitigation monitoring evens and a brief evaluation of these data.
    - An evaluation of whether applicable initial mitigation success criteria have been achieved for each of the mitigation types.
    - A summary assessment of all data and observations along with recommendations as to actions necessary to help meet mitigation and management/maintenance goals and mitigation success criteria.

- A brief description of anticipated maintenance/management work to be conducted during the period from the current monitoring report to the next monitoring report.

3.1.1.2 Additional Monitoring reports

All monitoring reports generated after the ISC Monitoring Report will be called Intermediate or Long Term Success Criteria Monitoring Reports (as applicable) and will be numbered sequentially based on the year in which the monitoring occurred. All these monitoring reports will provide the following information unless otherwise noted:

- All items listed for the ISC Monitoring Report with the exception of: (a) the topography drawings/as-builts; (b) the inventory of initially planted species and of any initially re-planted species; (c) other as-builts provided in the ISC Monitoring Report.
- Once monitoring is necessary to evaluate attainment of Native Vegetation Success (for BLH) ensure the monitoring includes measures necessary to demonstrate that dominant vegetation in the mitigation features satisfies USACE wetland vegetation (hydrophytic vegetation) criteria (per USACE, 2010). The monitoring report must discuss the monitoring methodology and the results.
- • Once monitoring is necessary to evaluate achievement of Native Vegetation Success Criteria 3.B2.2 (for BLH), obtain and present quantitative data to determine the average percent cover accounted for by native species in the canopy, midstory, and ground cover strata separately. These data could be obtained from the sampling required to evaluate Invasive and Nuisance Vegetation Success Criteria, or through other appropriate means. The monitoring report must discuss the monitoring methodology and the results. Note that success will be gaged from the overall average of the monitoring data from all the individual swamp mitigation features combined (via a weighted average approach, with weighting factor based on the percent of the total swamp acreage represented by a particular mitigation feature).
- Once monitoring is necessary to assess attainment of long-term Native Vegetation Success obtain and present quantitative data to determine the average percent cover occupied by planted or naturally recruited and living native canopy species. The necessary data could be obtained using the same general approach used in gathering percent cover data for native, nuisance, and invasive species, but focusing only on native canopy species and restricting cover estimates to the canopy strata. Alternately, the NFS may want to use other sampling plots or belt transects, as long as the alternative approach is first approved by USACE. The monitoring report must discuss the monitoring methodology and the results.
- Once monitoring is necessary to assess the attainment of intermediate Hydrology Success Criteria 5.A (for BLH), obtain and present quantitative data to demonstrate the applicable mitigation features satisfy USACE wetland hydrology criteria, following one of the approaches described in USACE, 2010. This will only be required once in accordance this criteria's requirements, unless additional monitoring is necessary to document successful attainment of the applicable criteria. The monitoring report must discuss the monitoring methodology and the results.

- A brief description of maintenance and/or management and/or mitigation work performed since the previous monitoring report along with a discussion of any other significant occurrences.

3.1.1.3 Monitoring reports following replanting activities

Re-planting of certain mitigation features (swamp) may be necessary to ensure attainment of applicable native vegetation success criteria. Any monitoring report submitted following completion of a re-planting event must include:

- An inventory of the number of each species planted and the stock size used in each feature replanted
- A depiction of the approximate limits of the areas re-planted within those mitigation features that were subject to re-planting activities. If the entirety of a given mitigation feature was completely re-planted, this can simply be noted on drawings.
- The approximate acreage re-planted in each mitigation feature that required re-planting, plus the total acreage of each mitigation type (swamp) that was re-planted.
- A narrative description of how and when re-planting was conducted.

3.1.1.4 Monitoring Reports Following Timber Management Activities (If Applicable)

In cases where timber management activities (thinning of trees and/or shrubs in the canopy and/or midstory strata) have been approved by the USACE in coordination with the IET, monitoring will be required in the year immediately preceding and in the year following completion of the timber management activities (i.e., pre-timber management and post-timber management reports). These reports must include data and information that are in addition to the typical monitoring requirements. The NFS's proposed Timber Stand Improvement/Timber Management Plan must include the proposed monitoring data and information that will be included in the pre-timber management and post-timber management monitoring reports. The proposed monitoring plan must be approved by the USACE in coordination with the IET prior to the monitoring events and implementation of the timber management activities. Separate timber management and monitoring plans must be prepared for BLH mitigation if timber management will be conducted in both mitigation types.

3.1.1.5 Monitoring Methodology For Initial Success Criteria Report

The following sub-sections describe the monitoring features that will be established, the quantitative and qualitative data to be collected (including the approach that will be used), and the data analyses that will be performed by USACE leading up to the preparation of the Initial Success Criteria Monitoring Report.

3.1.1.6 Installation of Monitoring Features

Permanent monitoring transects with sampling points will be established in the mitigation features to be used for each survey. The distance between the sampling points on the transects will mirror other established BLH mitigation projects, but may be field adjusted. The approximant layout will be determined by USACE and then agreed with by the IET. The transect endpoints also serve as sampling points for a given transect. Furthermore, each monitoring transect endpoint serves as a permanent photo station.

3.1.1.7 Quantitative Field Monitoring

The point-centered quarter (PCQ) method will be used to collect data for native canopy and midstory species planted at the site and for volunteer native trees. The method can be used to estimate parameters such as: average survival of planted canopy and midstory species; average density of living planted or naturally recruited canopy and midstory species; average DBH of trees; average basal area of trees; typical plant species composition of canopy and midstory strata. For initial success criteria monitoring, the PCQ method will mainly be used to determine the average density of living planted canopy and midstory species, and the average percent composition of living planted canopy and midstory species.

At each sampling point along each monitoring transect, the following data will be recorded; transect ID, sampling point ID, and sampling date. At each sampling point, four sampling quarters will be established, and the following data will be recorded within each of the four sampling quarters:

- Quarter ID
- Distance (in feet and tenths of feet) from the sampling point to the nearest planted canopy species, the species name, and whether the plant is living or dead.
- Distance (in feet and tenths of feet) from the sampling point to the nearest planted midstory species, the species name, and whether the plant is living or dead.

If it is not easily discernable whether the plant is living or dead, the bark near its base will be scraped to remove a small strip of exterior bark, thereby exposing the cambium layer. In a living tree, the cambium layer is green; in a dead tree, it is brown and dry.

Note that once initial success criteria is achieved for BLH mitigation features, future monitoring events in the successful mitigation features will record the distance from the sampling point to the nearest living native canopy species (planted or volunteer) in each sampling quarter rather than the distance to the nearest living or dead planted native canopy species. Dead canopy or midstory species will not need to be considered, other than from a qualitative standpoint perhaps.

In the canopy stratum, percent cover by living native plant species, by invasive plant species, and by nuisance plant species will be estimated within a circle having a 15-foot radius centered at each sampling point. The names of the dominant native, invasive, and nuisance species will be recorded. Similarly, in the midstory stratum, percent cover by living native plant species, by invasive plant species, and by nuisance plant species will be estimated within a circle having a 15-foot radius centered at each sampling point. The names of the dominant native, invasive, and nuisance species in this stratum will also be recorded. It is noted that estimates of plant cover in the canopy and midstory strata may be used by using a “canopy-scope” rather than using the circular “plots” discussed above. Use of a canopy scope is described by Brown et al, 2000, and by Hale, S.E, and Brown, N., 2005).

At each sampling point, a temporary 3.28-foot-by-3.28-foot (1-meter-by-1-meter) quadrat will be established to estimate groundcover. Each quadrat will be positioned with its southwestern corner situated at the sampling point, such that it falls within the northeast sampling quarter. The cover accounted for by each living native, invasive, and nuisance groundcover species observed within the quadrat will be estimated. Data recorded will include: quadrat ID; positioning of the quadrat relative to the sample point; all living plant species present and the percent cover occupied by each species. Percent cover estimates will be based on the area occupied by individual live plants or groups of plants. This approach allows the areas to be occupied by different plants that overlap; therefore, the total percent cover accounted for by all plants in the quadrat can exceed 100% (i.e., absolute cover is determined rather than relative cover).

3.1.1.8 Qualitative Field Monitoring

Two photographs will be taken at each endpoint of each monitoring transect during the field monitoring. These endpoints, also serve as permanent photo stations and as sampling points. Each photograph will be oriented to provide a view that is representative of general conditions present in the immediate area surrounding the photo station. The approximate direction of the view captured in each photograph will be recorded (e.g., north, south, east, west, northwest, northeast, southwest, and southeast). Photographs may also be taken at other locations within or near mitigation features. Such photos could include images of things such as: representative “gaps” cut in perimeter berms as part of mitigation construction; examples of perimeter drainage ditch areas that were filled as part of mitigation construction; any significant problem areas/conditions encountered during field monitoring activities. For all photographs, the location (determined using a GPS unit with sub-meter accuracy), the direction of the photograph view, and the subject of the photographs will be recorded.

During a field monitoring event, various qualitative observations will be recorded. Common qualitative observations may include, but are not limited to:

- General condition of planted canopy and midstory species, as well as volunteer native plants
- Colonization of the mitigation features by volunteer native plant species
- Wildlife utilization of the project site
- Trends in the composition of plant communities within the mitigation features
- Areas within mitigation areas that were inundated during monitoring (if any) and signs of past inundation and current wetland hydrology
- Potential problem areas (ex. large areas with high mortality of plantings; areas with heavy infestations of invasive and/or nuisance plant species; areas damaged by wild animals such as feral pigs; damage caused by trespassers; etc.)

3.1.1.9 Topographic Survey

A topographic using LiDAR (Light Detection & Ranging) should be used to survey the entire mitigation property. Contour maps will be developed from the LIDAR to determine if there is topographic success.

3.1.2 Swamp Monitoring Guidelines

3.1.2.1 Initial Succes Criteria Monitoring report

The Initial Success Criteria (ISC) monitoring report will be prepared or contracted by USACE after all final construction activities (completion of earthwork and grading, initial eradication of invasive and nuisance plants, and initial installation of native canopy and midstory seedlings) associated with General Construction Success. If a re-planting event is required, as determined by USACE field monitoring, preparation of this ISC monitoring report will not occur until two growing seasons after the re-planting event has passed. If actions are necessary to satisfactorily achieve general construction success criteria or topography success criteria, then the final ISC monitoring report could be further delayed depending on the actions necessary and their relationship to attaining other initial success criteria. Besides documenting past significant mitigation and maintenance activities, the main focus of the ISC report will be to determine whether all applicable initial success criteria have been achieved. These success criteria include:

For the swamp mitigation component of the project:

- General Construction
- Topography
- Native Vegetation
- Invasive & Nuisance Vegetation

Information provided in the ISC Monitoring Report will include the following items:

- A discussion of all mitigation (including construction) and maintenance/management activities completed thus far along with any other significant occurrences.
- Plan view drawings and GIS shape files of the mitigation site (project property) showing:
  - the overall property boundaries; the boundaries of the various mitigation features (areas)
  - the limits of areas within each mitigation feature that do not count toward satisfying mitigation needs, if necessary
  - the limits of access easements and any other important easements affecting the project
  - the approximate center point of each of any earthen constructed feature
  - the limits of "buffer" areas established for the pipelines, padsites, or any other feature that needs a buffer.
  - the main project access route(s)
  - the location and approximate alignment of monitoring transects used, the location of sampling points used along each monitoring transect, the location of permanent photo stations used, and the approximate location where any additional photos used in the monitoring report were taken.
- Drawings showing as-built topographic contours covering each of the mitigation features (areas; polygons), including shading or other means of indicating the area(s) within each mitigation feature where the soil surface elevations fall within the elevation range

required by Topography Success Criteria, as applicable to a particular mitigation feature.

- Copies of other final as-built drawings prepared for the project, that may include but not necessarily limited to: as-builts for the constructed water exchange gaps (plan views, profiles) or any other feature.
- A detailed inventory of all canopy and midstory species initially planted in each swamp mitigation feature, including the number of each species planted. This will be supported by a drawing depicting the general layout of the plantings, information about the alignment of planted rows, and a discussion of the plant stock utilized.
- If re-planting was necessary in swamp mitigation features, a detailed inventory of all canopy and midstory species that were re-planted in each mitigation feature (after the initial planting event), including the number of each species re-planted. If warranted, drawings showing the approximate limits of areas re-planted will also be provided.
- Photographs taken at permanent monitoring photo stations that document conditions in the mitigation features. At least two photos will be taken at each permanent photo station with the view of each photo always oriented in the same general direction from one monitoring event to the next. Other photographs may also be included to illustrate significant site conditions.
- A description of the monitoring methods used to gather quantitative data.
- Quantitative plant data collected from permanent sampling points established along the course of permanent monitoring transects, sampled using the point-centered quarter (PCQ) method. The data collected will be used to generate the following estimates for swamp:
    - average number of living planted canopy species (excluding recruited) present per acre (average density), the species composition, and the wetland indicator status of each species.
    - average number of living planted midstory species present per acre, the species composition, and the wetland indicator status of each species.
    - average percent survival of planted canopy species following each planting event. Note that these data will be provided for the individual mitigation features and for all mitigation features combined.
- Quantitative percent cover data for living native, nuisance, and invasive plants as collected at each permanent sampling point mentioned above. The data collected will be used to generate the following estimates for each of the two mitigation types:
    - For each vegetation strata separately (canopy, midstory, groundcover), provide: the average cover by native species, the average cover by invasive species, the average cover by nuisance species, and the average total percent cover by all plant species (native, invasive, and nuisance combined).
    - For all vegetation strata combined, provide the average total percent cover by all plant species, then the average percentage of the total percent cover accounted for by native plant species, by invasive species, and by nuisance species. A discussion of the dominant invasive and nuisance plant species will be included. Note that these data will be provided for the individual mitigation features and for all mitigation features combined.
- Quantitative data from the topographic drawings discussed above. For swamp tables will contain:

- For each mitigation feature separately: the acreage of areas that meet the applicable topographic success criteria and the acreage of areas that do not meet these criteria; the percentage of the total acreage that meets the success criteria and the percentage that does not meet the success criteria.
- For all the mitigation features combined: the total acres that meet and the total acres that do not meet applicable topographic success criteria; the percentage of the total acreage that meets and the percentage that does not meet the success criteria.

- In addition, various qualitative observations will be made in the mitigation site to help assess the status and success of mitigation and maintenance activities. These observations will include:
    - General estimates of the average percent cover by native plant species in the canopy, midstory, and ground cover strata.
    - General estimates of the average percent cover by invasive and by nuisance plant species, as a percentage of the average total plant cover;
    - General observations concerning the growth of planted canopy and midstory species;
    - General observations concerning colonization by volunteer native plant species;
    - General observations regarding areas within the mitigation areas that were inundated during monitoring (if any) and signs of past inundation and current wetland hydrology.
    - General observations made during the course of monitoring may also address potential problem zones (ex. large areas with high mortality of plantings; areas with heavy infestations of invasive and/or nuisance plant species; areas damaged by wild animals such as feral pigs; damage caused by trespassers, etc.), the general condition of native vegetation, trends in the composition of the plant communities, wildlife utilization as observed during monitoring, and other pertinent factors.
    - A general discussion of key monitoring data acquired during the any prior mitigation monitoring evens and a brief evaluation of these data.
    - An evaluation of whether applicable initial mitigation success criteria have been achieved for each of the mitigation types.
    - A summary assessment of all data and observations along with recommendations as to actions necessary to help meet mitigation and management/maintenance goals and mitigation success criteria.
- A brief description of anticipated maintenance/management work to be conducted during the period from the current monitoring report to the next monitoring report.

3.1.2.2 Additional Monitoring reports

All monitoring reports generated after the ISC Monitoring Report will be called Intermediate or Long Term Success Criteria Monitoring Reports (as applicable) and will be numbered sequentially based on the year in which the monitoring occurred. All these monitoring reports will provide the following information unless otherwise noted:

- All items listed for the ISC Monitoring Report with the exception of: (a) the topography drawings/as-builts; (b) the inventory of initially planted species and of any initially re-planted species; (c) other as-builts provided in the ISC Monitoring Report.
- Once monitoring is necessary to evaluate attainment of Native Vegetation Success (for swamp) ensure the monitoring includes measures necessary to demonstrate that dominant vegetation in the mitigation features satisfies USACE wetland vegetation (hydrophytic vegetation) criteria (per USACE, 2010). The monitoring report must discuss the monitoring methodology and the results.
- Once monitoring is necessary to evaluate achievement of Native Vegetation Success Criteria (for swamp), obtain and present quantitative data to determine the average percent cover accounted for by native species in the canopy, midstory, and ground cover strata separately. These data could be obtained from the sampling required to evaluate Invasive and Nuisance Vegetation Success Criteria, or through other appropriate means. The monitoring report must discuss the monitoring methodology and the results. Note that success will be gaged from the overall average of the monitoring data from all the individual swamp mitigation features combined (via a weighted average approach, with weighting factor based on the percent of the total swamp acreage represented by a particular mitigation feature).
- Once monitoring is necessary to assess attainment of long-term Native Vegetation Success obtain and present quantitative data to determine the average percent cover occupied by planted or naturally recruited and living native canopy species. The necessary data could be obtained using the same general approach used in gathering percent cover data for native, nuisance, and invasive species, but focusing only on native canopy species and restricting cover estimates to the canopy strata. Alternately, the NFS may want to use other sampling plots or belt transects, as long as the alternative approach is first approved by USACE. The monitoring report must discuss the monitoring methodology and the results.
- Once monitoring is necessary to assess the attainment of intermediate Hydrology Success Criteria (for swamp), obtain and present quantitative data to demonstrate the applicable mitigation features satisfy USACE wetland hydrology criteria, following one of the approaches described in USACE, 2010. This will only be required once in accordance this criteria's requirements, unless additional monitoring is necessary to document successful attainment of the applicable criteria. The monitoring report must discuss the monitoring methodology and the results.
- A brief description of maintenance and/or management and/or mitigation work performed since the previous monitoring report along with a discussion of any other significant occurrences.

3.1.2.3 Monitoring reports following replanting activities

Re-planting of certain mitigation features (swamp) may be necessary to ensure attainment of applicable native vegetation success criteria. Any monitoring report submitted following completion of a re-planting event must include:

- An inventory of the number of each species planted and the stock size used in each feature replanted

- A depiction of the approximate limits of the areas re-planted within those mitigation features that were subject to re-planting activities. If the entirety of a given mitigation feature was completely re-planted, this can simply be noted on drawings.
- The approximate acreage re-planted in each mitigation feature that required re-planting.
- A narrative description of how and when re-planting was conducted.

3.1.2.4 Monitoring Reports Following Timber Management Activities (If Applicable)

In cases where timber management activities (thinning of trees and/or shrubs in the canopy and/or midstory strata) have been approved by the USACE in coordination with the IET, monitoring will be required in the year immediately preceding and in the year following completion of the timber management activities (i.e., pre-timber management and post-timber management reports). These reports must include data and information that are in addition to the typical monitoring requirements. The NFS's proposed Timber Stand Improvement/Timber Management Plan must include the proposed monitoring data and information that will be included in the pre-timber management and post-timber management monitoring reports. The proposed monitoring plan must be approved by the USACE in coordination with the IET prior to the monitoring events and implementation of the timber management activities. Separate timber management and monitoring plans must be prepared for swamp mitigation if timber management will be conducted in both mitigation types.

3.1.2.5 Monitoring Methodology For Initial Success Criteria Report

The following sub-sections describe the monitoring features that will be established, the quantitative and qualitative data to be collected (including the approach that will be used), and the data analyses that will be performed by USACE leading up to the preparation of the Initial Success Criteria Monitoring Report.

3.1.2.6 Installation of Monitoring Features

Permanent monitoring transects with sampling points will be established in the mitigation features to be used for each survey. The distance between the sampling points on the transects will mirror other established swamp mitigation projects but may be field adjusted. The approximant layout will be determined by USACE and then agreed with by the IET. The transect endpoints also serve as sampling points for a given transect. Furthermore, each monitoring transect endpoint serves as a permanent photo station.

3.1.2.7 Quantitative Field Monitoring

The point-centered quarter (PCQ) method will be used to collect data for native canopy and midstory species planted at the site and for volunteer native trees. The method can be used to estimate parameters such as: average survival of planted canopy and midstory species; average density of living planted or naturally recruited canopy and midstory species; average DBH of trees; average basal area of trees; typical plant species composition of canopy and midstory strata. For initial success criteria monitoring, the PCQ method will mainly be used to determine the average density of living planted canopy and midstory species, and the average percent composition of living planted canopy and midstory species.

At each sampling point along each monitoring transect, the following data will be recorded; transect ID, sampling point ID, and sampling date. At each sampling point, four sampling quarters will be established, and the following data will be recorded within each of the four sampling quarters:

- Quarter ID
- Distance (in feet and tenths of feet) from the sampling point to the nearest planted canopy species, the species name, and whether the plant is living or dead.
- Distance (in feet and tenths of feet) from the sampling point to the nearest planted midstory species, the species name, and whether the plant is living or dead.

If it is not easily discernable whether the plant is living or dead, the bark near its base will be scraped to remove a small strip of exterior bark, thereby exposing the cambium layer. In a living tree, the cambium layer is green; in a dead tree, it is brown and dry.

Note that once initial success criteria is achieved for swamp mitigation features, future monitoring events in the successful mitigation features will record the distance from the sampling point to the nearest living native canopy species (planted or volunteer) in each sampling quarter rather than the distance to the nearest living or dead planted native canopy species. Dead canopy or midstory species will not need to be considered, other than from a qualitative standpoint perhaps.

In the canopy stratum, percent cover by living native plant species, by invasive plant species, and by nuisance plant species will be estimated within a circle having a 15-foot radius centered at each sampling point. The names of the dominant native, invasive, and nuisance species will be recorded. Similarly, in the midstory stratum, percent cover by living native plant species, by invasive plant species, and by nuisance plant species will be estimated within a circle having a 15-foot radius centered at each sampling point. The names of the dominant native, invasive, and nuisance species in this stratum will also be recorded. It is noted that estimates of plant cover in the canopy and midstory strata may be used by using a “canopy-scope” rather than using the circular “plots” discussed above. Use of a canopy scope is described by Brown et al, 2000, and by Hale, S.E, and Brown, N., 2005).

At each sampling point, a temporary 3.28-foot-by-3.28-foot (1-meter-by-1-meter) quadrat will be established to estimate groundcover. Each quadrat will be positioned with its southwestern corner situated at the sampling point, such that it falls within the northeast sampling quarter. The cover accounted for by each living native, invasive, and nuisance groundcover species observed within the quadrat will be estimated. Data recorded will include quadrat ID; positioning of the quadrat relative to the sample point; all living plant species present and the percent cover occupied by each species. Percent cover estimates will be based on the area occupied by individual live plants or groups of plants. This approach allows the areas to be occupied by different plants that overlap; therefore, the total percent cover accounted for by all plants in the quadrat can exceed 100% (i.e., absolute cover is determined rather than relative cover).

3.1.2.8 Qualitative Field Monitoring

Two photographs will be taken at each endpoint of each monitoring transect during the field monitoring. These endpoints, also serve as permanent photo stations and as sampling points. Each photograph will be oriented to provide a view that is representative of general conditions present in the immediate area surrounding the photo station. The approximate direction of the view captured in each photograph will be recorded (e.g., north, south, east, west, northwest, northeast, southwest, and southeast). Photographs may also be taken at other locations within or near mitigation features. Such photos could include images of things such as: representative “gaps” cut in perimeter berms as part of mitigation construction; examples of perimeter drainage ditch areas that were filled as part of mitigation construction; any significant problem areas/conditions encountered during field monitoring activities. For all photographs, the location (determined using a GPS unit with sub-meter accuracy), the direction of the photograph view, and the subject of the photographs will be recorded.

During a field monitoring event, various qualitative observations will be recorded. Common qualitative observations may include, but are not limited to:

- General condition of planted canopy and midstory species, as well as volunteer native plants
- Colonization of the mitigation features by volunteer native plant species
- Wildlife utilization of the project site
- Trends in the composition of plant communities within the mitigation features
- Areas within mitigation areas that were inundated during monitoring (if any) and signs of past inundation and current wetland hydrology
- Potential problem areas (ex. large areas with high mortality of plantings; areas with heavy infestations of invasive and/or nuisance plant species; areas damaged by wild animals such as feral pigs; damage caused by trespassers; etc.)

3.1.2.9 Topographic Survey

A topographic using LiDAR (Light Detection & Ranging) should be used to survey the entire mitigation property. Contour maps will be developed from the LIDAR to determine if there is topographic success.

SECTION 4

MONITORING SCHEDULE, RESPONSIBILITIES AND COSTS

4.1 BOTTOMLAND HARDWOOD WET

Monitoring for BLH Wet will typically take place in late summer of the year of monitoring but may be delayed until later in the growing season due to site conditions or other unforeseen circumstances. Monitoring reports will be submitted by December 31 of each year of monitoring. Monitoring reports will be provided to the USACE, the NFS, and the agencies comprising the Interagency Team. See Table C7:4-1 for a schedule of the currently proposed monitoring events. The timing of these events may be modified or shifted once the final project design and construction schedule have been identified.

The USACE will be responsible for conducting the monitoring events and preparing the associated monitoring reports until such time that the following mitigation success criteria are achieved (criteria follow numbering system used in success criteria section):

1. General Construction – 1.A
2. Native Vegetation – 2.A and 2.B.
3. Invasive & Nuisance Vegetation – 3A, plus 3B until such time as monitoring responsibilities are transferred to the NFS.
4. Topography – 4A

Monitoring events associated with the above will include the first or baseline monitoring event plus annual monitoring events thereafter until the monitoring responsibilities are transferred to the NFS. The NFS will be responsible for conducting the required monitoring events and preparing the associated monitoring reports after the USACE has demonstrated the mitigation success criteria listed above have been achieved. The overall responsibility for management, maintenance, and monitoring of the mitigation will typically be transferred to the Sponsor during the first quarter of the year immediately following submittal of the monitoring report that demonstrates attainment of said criteria, subject to the provisions identified in the Introduction section.

Once monitoring responsibilities have been transferred to the NFS, the next monitoring event will typically take place during the year that attainment of success criterion 2.C (native vegetation criterion applicable 4 years after completion of initial plantings) must be demonstrated. Thereafter, monitoring will typically be conducted every 5 years throughout the 50-year period of analysis. See Table C7:4-1 and C7:4-2 for the currently proposed monitoring events. The timing of these events may be shifted once the final project design and construction schedule have been identified.

If the initial survival criteria for planted canopy and midstory species are not achieved (i.e. the 1-year survival criteria specified in native vegetation success criteria 2.B), a monitoring report will be required for each consecutive year until two annual sequential reports indicate that all survival criteria have been satisfied (i.e. that corrective actions were successful). The USACE will be responsible for conducting this additional monitoring and preparing the monitoring reports. The

USACE will also be responsible for the purchase and installation of supplemental plants needed to attain this success criterion, subject to the provisions mentioned in the Introduction section.

If the native vegetation success criteria specified for 4 years following completion of initial plantings are not achieved (i.e. native vegetation success criteria 2.C), a monitoring report will be required for each consecutive year until two annual sequential reports indicate that these criteria have been satisfied. The NFS will be responsible for conducting this additional monitoring and preparing the monitoring reports. The NFS will also be responsible for the purchase and installation of supplemental plants needed to attain these success criteria.

Once monitoring responsibilities have transferred to the NFS, the NFS will retain the ability to modify the monitoring plan and the monitoring schedule should this become necessary due to unforeseen events or to improve the information provided through monitoring. Twenty years following completion of initial plantings, the number of monitoring plots and/or monitoring transects that must be sampled during monitoring events may be reduced substantially if it is clear that mitigation success is proceeding as anticipated. Any significant modifications to the monitoring plan or the monitoring schedule must first be approved by the USACE in coordination with the Interagency Team.

Table C7:4-1 provides a cost estimate based on the currently available information and may need to be revised in the future as additional information regarding the mitigation feature designs and construction schedule become available.

Table C7:4-1. Mitigation Monitoring Report Schedule and NFS Costs for BLH Wet

Target	**Work Item**	**Work Item Description**
Year	Work Item	Work Item Description
0	Begin Construction	Start of mitigation construction activities
1	Complete Construction	Finish clearing, grubbing, grading (excavation; ditch & berm removal), drainage alterations, etc.
	Topographic/As-Built Survey	Perform as-built topographic survey of areas in enhancement features requiring significant grading. Includes survey of any structures installed plus cross-sections of significant ditches or berms removed, and for any new drainage features. Results documented in mitigation monitoring report.
	Invasive/Nuisance Plant Eradication	Initial eradication of invasive and nuisance plant species in enhancement features. Ground application.
	Invasive/Nuisance Plant Eradication	Follow-up eradication of invasive and nuisance plant species in enhancement features. Ground application.

2	Initial Plantings*	Install canopy and midstory species
	Nutria Guards	Install nutria guards for all initial plantings.
	Invasive/Nuisance Plant Eradication	Follow-up eradication of invasive and nuisance plant species in enhancement features. Ground application.
	Invasive/Nuisance Plant Eradication	Follow-up eradication of invasive and nuisance plant species in enhancement features. Ground application.
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.
3	Invasive/Nuisance Plant Eradication	Follow-up eradication of invasive and nuisance plant species in enhancement features. Ground application.
	Analysis for Notice of Construction Complete	Review As-Builts and O&M manual. Review monitoring report from prior year and other data as compared to success criteria. Coordination with Interagency Team as needed.
	NCC	Transfer (turn-over) project to the Non-Federal Sponsor. The USACE will continue to monitor and conduct activities necessary to ensure initial success criteria are met
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.
4	Additional Plantings*	Re-plant restoration features where plant survival success criteria not achieved
	Invasive/Nuisance Plant Eradication	Follow-up eradication of invasive and nuisance plant species in enhancement features. Ground application.
	Monitoring & Report*	Perform field mitigation monitoring. Submit report by Dec. 31. This monitoring required only if area had to be replanted in TY4 per success criteria requirements.
	Review and Coordination	Review monitoring report from prior year and other data as compared to success criteria. Coordination with Interagency Team as needed.

5	Invasive/Nuisance Plant Eradication	Follow-up eradication of invasive and nuisance plant species in enhancement features. Ground application.
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31. Report also accomplished added monitoring needed due to re-planting.
	Review and Coordination	Review monitoring report from prior year and other data as compared to success criteria. Coordination with Interagency Team as needed.
6	Analysis for Success Criteria	Review monitoring report from prior year and other data to make initial success criteria determination and to turn over monitoring to Non-Federal Sponsor.
		Transfer (turn-over) project monitoring to Non-Federal Sponsor. Note: transfer occurs this year unless additional plantings needed in TY5 or canopy/midstory densities not achieved in TY5 per success criteria.
	Invasive/Nuisance Plant Eradication	Follow-up eradication of invasive and nuisance plant species in enhancement features. Ground application.
7	Invasive/Nuisance Plant Eradication	Follow-up eradication of invasive and nuisance plant species in enhancement features. Ground application.
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.
	Analysis for satisfaction of initial success criteria	Review monitoring report from TY7 and other data as compared to success criteria. Make determination to completely turn over project to Non-Federal Sponsor.
10	Invasive/Nuisance Plant Eradication	Follow-up eradication of invasive and nuisance plant species in enhancement features. Ground application.
	Transfer to NFS	Transfer (turn-over) project to Non-Federal Sponsor (Feb. thru April?) for all OMRR&R. Note: transfer occurs early this year unless topographic corrections and/or marsh planting required.

12	Invasive/Nuisance Plant Eradication	Follow-up eradication of invasive and nuisance plant species in enhancement features. Ground application.
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.
	Review and Coordination	Review monitoring report from TY12 and other data as compared to success criteria. Coordination with Interagency Team as needed.
17	Aerial Photography	Obtain rectified aerial photo of restoration features. Provide as part of mitigation monitoring report.
	Invasive/Nuisance Plant Eradication	Follow-up eradication of invasive and nuisance plant species in enhancement features. Ground application.
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.
	Review and Coordination	Review monitoring report and other data as compared to success criteria. Coordination with Interagency Team as needed.
22	Invasive/Nuisance Plant Eradication	Follow-up eradication of invasive and nuisance plant species in enhancement features. Ground application.
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.
	Review and Coordination	Review monitoring report and other data as compared to success criteria. Coordination with Interagency Team as needed.
27	Invasive/Nuisance Plant Eradication	Follow-up eradication of invasive and nuisance plant species in enhancement features. Ground application.
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.
	Review and Coordination	Review monitoring report and other data as compared to success criteria. Coordination with Interagency Team as needed.
32	Invasive/Nuisance Plant Eradication	Follow-up eradication of invasive and nuisance plant species in enhancement features. Ground application.

	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.
	Review and Coordination	Review monitoring report and other data as compared to success criteria. Coordination with Interagency Team as needed.
37	Invasive/Nuisance Plant Eradication	Follow-up eradication of invasive and nuisance plant species in enhancement features. Ground application.
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.
	Review and Coordination	Review monitoring report and other data as compared to success criteria. Coordination with Interagency Team as needed.
42	Invasive/Nuisance Plant Eradication	Follow-up eradication of invasive and nuisance plant species in enhancement features. Ground application.
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.
	Review and Coordination	Review monitoring report and other data as compared to success criteria. Coordination with Interagency Team as needed.
47	Invasive/Nuisance Plant Eradication	Follow-up eradication of invasive and nuisance plant species in enhancement features. Ground application.
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.
	Review and Coordination	Review monitoring report and other data as compared to success criteria. Coordination with Interagency Team as needed.
52	Invasive/Nuisance Plant Eradication	Follow-up eradication of invasive and nuisance plant species in enhancement features. Ground application.
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.
	Review and Coordination	Review monitoring report and other data as compared to

		success criteria. Coordination with Interagency Team as needed.
NOTES:		
The contract to obtain plants for initial planting will need to be issued at least 13 to 14 months prior to the date that plants will be installed since the plants must be 1 year old at the time of installation (must start growing the plants at the nursery).		

4.2 SWAMP

Monitoring for swamp will typically take place in late summer of the year of monitoring but may be delayed until later in the growing season due to site conditions or other unforeseen circumstances. Monitoring reports will be submitted by December 31 of each year of monitoring. Monitoring reports will be provided to the USACE, the NFS, and the agencies comprising the Interagency Team. The various monitoring and reporting responsibilities addressed in this section are all subject to the provisions set forth in the Introduction section. See Table C7:4-1 for a schedule of the currently proposed monitoring events. The timing of these events may be modified or shifted once the final project design and construction schedule have been identified.

The USACE will be responsible for conducting the monitoring events and preparing the associated monitoring reports until such time that the following mitigation success criteria are achieved (criteria follow numbering system used in success criteria section):

1. General Construction – 1.A
2. Native Vegetation – A and B.
3. Invasive & Nuisance Vegetation – A, plus B until such time as monitoring responsibilities are transferred to the NFS.
4. Topography – 4.A.

Monitoring events associated with the above will include the “time zero” (first or baseline) monitoring event plus annual monitoring events thereafter until the mitigation monitoring responsibility is transferred to the NFS. The NFS will be responsible for conducting the required monitoring events and preparing the associated monitoring reports after the USACE has demonstrated the mitigation success criteria listed above have been achieved. The overall responsibility for management, maintenance, and monitoring of the mitigation will typically be transferred to the NFS during the first quarter of the year immediately following submittal of the monitoring report that demonstrates attainment of said criteria.

Once monitoring responsibilities have been transferred to the NFS, the next monitoring event will take place during the year that attainment of success criterion 2.C (native vegetation criterion applicable 4 years after completion of initial plantings) must be demonstrated.

Thereafter, monitoring will typically be conducted every 5 years throughout the 50-year period of analysis. See Table C7:4-1 for a schedule of the currently proposed monitoring events. The timing of these events may be modified or shifted once the final project design and construction schedule have been identified.

If the initial survival criteria for planted canopy and midstory species are not achieved (i.e. the 1-year survival criteria specified in native vegetation success criterion 2.B), a monitoring report will be required for each consecutive year until two annual sequential reports indicate that all survival criteria have been satisfied (i.e. that corrective actions were successful). The USACE will be responsible for conducting this additional monitoring and preparing the monitoring reports. The USACE will also be responsible for the purchase and installation of supplemental plants needed to attain this success criterion.

If the native vegetation success criteria specified for 4 years following completion of initial plantings are not achieved (i.e. native vegetation success criterion 2.C), a monitoring report will be required for each consecutive year until two annual sequential reports indicate that these criteria have been satisfied. The NFS will be responsible for conducting this additional monitoring and preparing the monitoring reports. The NFS will also be responsible for the purchase and installation of supplemental plants needed to attain this success criterion.

If timber management activities conducted in the mitigation features by the NFS, the NFS will be responsible for conducting the additional monitoring and preparing the associated monitoring reports necessary for such activities (e.g. one monitoring event and report in the year immediately preceding timber management activities and one monitoring event and report in the year that timber management activities are completed).

Once monitoring responsibilities have transferred to the NFS, the NFS will retain the ability to modify the monitoring plan and the monitoring schedule should this become necessary due to unforeseen events or to improve the information provided through monitoring. Twenty years following completion of initial plantings, the number of monitoring plots and/or monitoring transects that must be sampled during monitoring events may be reduced substantially if it is clear that mitigation success is proceeding as anticipated. Any significant modifications to the monitoring plan or the monitoring schedule must first be approved by the USACE in coordination with the Interagency Team.

Table C7:4-2 also provides a cost estimate based on the currently available information and may need to be revised in the future as additional information regarding mitigation feature designs and the construction schedule becomes available.

Table C7:4-2. - Mitigation Monitoring Report Schedule and NFS Costs for Swamp

Target Year	Work Item	Work Item Description
0	Begin Construction	Start of mitigation construction activities.
1	Complete Construction	Finish clearing, grubbing, grading (excavation; ditch & berm removal), drainage alterations, etc.
	Topographic/As-Built Survey	Perform as-built topographic survey of areas in enhancement. Includes survey of any structures installed plus cross-sections of significant ditches or berms removed, and for any new drainage features. Results documented in mitigation monitoring report.
	Invasive/Nuisance Plant Eradication	Initial eradication of invasive and nuisance plant species in enhancement features. Ground application.

	Invasive/Nuisance Plant Eradication	Follow-up eradication of invasive and nuisance plant species in enhancement features. Ground application.
	Review and Coordination	Review ongoing activities, coordination with Interagency Team as needed.
2	Initial Plantings*	Install canopy and midstory species
	Nutria Guards	Install nutria guards for all initial plantings.
	Invasive/Nuisance Plant Eradication	Follow-up eradication of invasive and nuisance plant species in enhancement features. Ground application.
	Invasive/Nuisance Plant Eradication	Follow-up eradication of invasive and nuisance plant species in enhancement features. Ground application.
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.
	Review and Coordination	Review ongoing activities, coordination with Interagency Team as needed.
3	Topographic/As-Built Survey	Perform topographic survey. Includes survey of any structures installed plus cross-sections of significant ditches or berms removed, and for any new drainage features. Results documented in mitigation monitoring report.
	Invasive/Nuisance Plant Eradication	Follow-up eradication of invasive and nuisance plant species in enhancement features. Ground application.
	Invasive/Nuisance Plant Eradication	Follow-up eradication of invasive and nuisance plant species in enhancement features. Ground application.
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.
		Review As-Builts and O&M manual. Review ongoing activities, review monitoring report from prior year and

	Analysis for Notice of Construction Complete	other data as compared to success criteria. Coordination with Interagency Team as needed.
	NCC	Transfer (turn-over) project to the Non-Federal Sponsor. The USACE will continue to monitor and conduct activities necessary to ensure initial success criteria are met.
4	Additional Plantings*	Re-plant restoration features where plant survival success criteria not achieved (Feb. thru mid-March).
	Invasive/Nuisance Plant Eradication	Follow-up eradication of invasive and nuisance plant species in enhancement features. Ground application.
	Invasive/Nuisance Plant Eradication	Follow-up eradication of invasive and nuisance plant species in enhancement features. Ground application.
	Monitoring & Report*	Perform field mitigation monitoring. Submit report by Dec. 31. This monitoring required only if area had to be replanted in TY4 per success criteria requirements.
	Review and Coordination	Review ongoing activities, review monitoring report from prior year and other data as compared to success criteria. Coordination with Interagency Team as needed.
5	Invasive/Nuisance Plant Eradication	Follow-up eradication of invasive and nuisance plant species in enhancement features. Ground application.
	Invasive/Nuisance Plant Eradication	Follow-up eradication of invasive and nuisance plant species in enhancement features. Ground application.
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31. Report also accomplished added monitoring needed due to re-planting.

	Review and Coordination	Review ongoing activities, review monitoring report from prior year and other data as compared to success criteria. Coordination with Interagency Team as needed.
6	Analysis for Success Criteria	Review monitoring report from prior year and other data to make initial success criteria determination and to turn over monitoring to Non-Federal Sponsor.
		Transfer (turn-over) project to Non-Federal Sponsor. Note: transfer occurs this year unless additional plantings needed in TY5 or canopy/midstory densities not achieved in TY5 per success criteria.
	Invasive/Nuisance Plant Eradication	Follow-up eradication of invasive and nuisance plant species in enhancement features. Ground application.
7	Aerial Photography	Obtain rectified aerial photo of restoration features if available. Provide as part of mitigation monitoring report.
	Invasive/Nuisance Plant Eradication	Follow-up eradication of invasive and nuisance plant species in enhancement features. Ground application.
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.
	Analysis for satisfaction of initial success criteria.	Review monitoring report from prior year and other data to make determination to completely turn over project to Non-Federal Sponsor. Review ongoing activities, review monitoring report and other data as compared to success criteria. Coordination with Interagency Team as needed.
	Transfer to NFS	Transfer (turn-over) project to Non-Federal Sponsor for all OMRR&R. Note: transfer occurs early this year unless topographic corrections and/or plantings required.

10	Invasive/Nuisance Plant Eradication	Follow-up eradication of invasive and nuisance plant species in enhancement features. Ground application.
12	Invasive/Nuisance Plant Eradication	Follow-up eradication of invasive and nuisance plant species in enhancement features. Ground application.
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.
	Review and Coordination	Review ongoing activities, review monitoring report and other data as compared to success criteria. Coordination with Interagency Team as needed.
17	Invasive/Nuisance Plant Eradication	Follow-up eradication of invasive and nuisance plant species in enhancement features. Ground application.
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.
	Review and Coordination	Review ongoing activities, review monitoring report and other data as compared to success criteria. Coordination with Interagency Team as needed.
22	Invasive/Nuisance Plant Eradication	Follow-up eradication of invasive and nuisance plant species in enhancement features. Ground application.
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.
	Review and Coordination	Review ongoing activities, review monitoring report and other data as compared to success criteria. Coordination with Interagency Team as needed.
27	Invasive/Nuisance Plant Eradication	Follow-up eradication of invasive and nuisance plant species in enhancement features. Ground application.

	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.
	Review and Coordination	Review ongoing activities, review monitoring report and other data as compared to success criteria. Coordination with Interagency Team as needed.
32	Invasive/Nuisance Plant Eradication	Follow-up eradication of invasive and nuisance plant species in enhancement features. Ground application.
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.
	Review and Coordination	Review ongoing activities, review monitoring report and other data as compared to success criteria. Coordination with Interagency Team as needed.
37	Invasive/Nuisance Plant Eradication	Follow-up eradication of invasive and nuisance plant species in enhancement features. Ground application.
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.
	Review and Coordination	Review ongoing activities, review monitoring report and other data as compared to success criteria. Coordination with Interagency Team as needed.
42	Invasive/Nuisance Plant Eradication	Follow-up eradication of invasive and nuisance plant species in enhancement features. Ground application.
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.
	Review and Coordination	Review ongoing activities, review monitoring report and other data as compared to success criteria. Coordination with Interagency Team as needed.

47	Invasive/Nuisance Plant Eradication	Follow-up eradication of invasive and nuisance plant species in enhancement features. Ground application.
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.
	Review and Coordination	Review ongoing activities, review monitoring report from prior year and other data as compared to success criteria. Coordination with Interagency Team as needed.
52	Invasive/Nuisance Plant Eradication	Follow-up eradication of invasive and nuisance plant species in enhancement features. Ground application.
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.
	Review and Coordination	Review ongoing activities, review monitoring report and other data as compared to success criteria. Coordination with Interagency Team as needed.
NOTES		
The contract to obtain plants for initial planting will need to be issued at least 13 to 14 months prior to the date that plants will be installed since the plants must be 1 year old at the time of installation (must start growing the plants at the nursery).		

SECTION 5

DRAFT ENVIRONMENTAL ASSESSMENT (EA #576) ADAPTIVE MANAGEMENT

5.1 BOTTOM LAND HARDWOOD WET AND SWAMP

5.1.1 Introduction

This Adaptive Management (AM) Plan is for MTG mitigation sites included in the MTG SEIS which are designed to mitigate for bottomland hardwood wet and swamp impacts. The mitigation features are fully described in the MTG SEIS. The Water Resources Development Act (WRDA) of 2007, Section 2036(a) and U.S Army Corps of Engineers (USACE) implementation guidance for Section 2036(a) (CECW-PC Memorandum dated August 31, 2009: "Implementation Guidance for Section *2036 (a) of the Water Resources Development* Act of 2007 (WRDA 2007) – Mitigation for Fish and Wildlife and Wetland Losses") require adaptive management be included in all mitigation plans for fish and wildlife habitat and wetland losses.

It should be noted that even though the proposed mitigation actions under the MTG SEIS include the potential purchase of credits from a mitigation bank this appendix only details the Adaptive Management planning for the Corps constructed projects. In the event that mitigation bank credits are purchased the mitigation management and maintenance activities for the mitigation bank credits will be set forth in the Mitigation Banking Instrument (MBI) for each particular bank. The bank sponsor (bank permittee) will be responsible for these activities rather than the USACE and/or the local Sponsor. USACE Regulatory staff reviews mitigation bank monitoring reports and conducts periodic inspections of mitigation banks to ensure compliance with mitigation success criteria stated in the MBI.

5.1.2 Adaptive Management Planning

Adaptive management planning elements included: 1) development of a Conceptual Ecological Model (CEM), 2) identification of key project uncertainties and associated risks, 3) evaluation of the mitigation projects as a candidate for adaptive management and 4) the identification of potential adaptive management actions (contingency plan) to better ensure the mitigation project meets identified success criteria. The adaptive management plan is a living document and will be refined as necessary as new mitigation project information becomes available.

5.1.3 Sources of Uncertainty and Associated Risks

A fundamental tenet underlying adaptive management is decision making and achieving desired project outcomes in the face of uncertainties. There are many uncertainties associated with restoration of the coastal systems. The project delivery team identified the following uncertainties during the planning process.

A. Climate change, such as relative sea level rise, drought conditions, and variability of tropical storm frequency, intensity, and timing
B. Subsidence and water level trends at the mitigation sites
C. Uncertainty Relative to Achieving Ecological Success:
    i. Water, sediment, and nutrient requirements for BLH and Swamp
    ii. Magnitude and duration of wet/dry cycles for BLH and Swamp
    iii. Nutrients required for desired productivity for BLH and Swamp
    iv. Growth curves based on hydroperiod and nutrient application for BLH and Swamp
    v. Tree litter production based on nutrient and water levels for BLH and Swamp
    vi. Tree propagation in relation to management/regulation of hydroperiod for BLH and Swamp
D. Loss rate of vegetative plantings due to herbivory
E. Long-Term Sustainability of Project Benefits

5.1.4 Adaptive Management Evaluation

The project sites were evaluated and planned to develop a project with minimal risk and uncertainty. The items listed below were incorporated into the mitigation project implementation plan and Operation, Maintenance, Repair, Replacement and Rehabilitation (OMRR&R) plans to minimize project risks.

- Specified success criteria (i.e., mitigation targets)
- Detailed planting guidelines for BLH and Swamp
- Invasive species control
- Supplementary plantings as necessary (contingency)
- Corrective actions to meet topographic and hydrologic success as required (contingency)

Subsequently, as part of the adaptive management planning effort the mitigation project features were re-evaluated against the CEM and sources of uncertainty and risk were identified to determine if there was any need for additional actions and costs under the adaptive management plan to ensure that the project meets the required success criteria. Based on the uncertainties and risks associated with the project implementation the following contingency actions have been identified to be implemented if needed to ensure the required AAHUs are met.

Potential Action #1. Additional vegetative plantings as needed to meet identified success criteria.

Uncertainties addressed: A,B,C,D, E

Potential Action #2. Additional earthwork at mitigation sites (by adding sediment or degrading) to obtain elevations necessary for BLH and Swamp vegetative establishment and maintenance.

Uncertainties addressed: A,B,C,E

Potential Action #3. Invasive species control to ensure survival of native species and meet required success criteria.

Uncertainties addressed: E

Actions 1 & 3 are not recommended as separate adaptive management actions since they are already built into the mitigation plan and success criteria identified. In the event that monitoring reveals the project does not meet the identified vegetation, or hydrologic success criteria, additional plantings or construction activities are already accounted for and would be conducted under the mitigation project. Specific measures to implement Action 2, if determined necessary to achieve project benefits, would be coordinated with the NFS and other agencies to determine the appropriate course of action. If it is determined that the project benefits are significantly compromised because of improper elevation, additional fill material may need to be pumped into or removed from the project area. Due to the impact the addition of fill to the mitigation projects once they have been planted would incur, lifts to the projects are not currently considered as a viable remedial action. Instead, increasing the size of the existing mitigation project or mitigating the outstanding balance of the mitigation requirement elsewhere or through the purchase of mitigation bank credits would be options that could be considered through additional coordination with the NFS and the IET. However, such options would have to undergo further analysis in a supplemental NEPA document.

Action 2 is potentially very costly actions. Before implementing such an action, the Corps would coordinate with the NFS and other agencies to determine if other actions, such as purchasing of credits in a mitigation bank or building additional mitigation elsewhere, would be more cost-effective options to fulfill any shortfalls in the overall project success. The USACE would be responsible for performing any necessary corrective actions, but the overall cost would be shared with the NFS according to the project cost-share agreement.

The USACE would be responsible for the proposed mitigation construction and monitoring until the initial success criteria are met. Initial construction and monitoring would be funded in accordance with all applicable cost-share agreements with the NFS. The USACE would monitor (on a cost-shared basis) the completed mitigation to determine whether additional construction, invasive/nuisance plant species control, and/or plantings are necessary to achieve initial mitigation success criteria. Once the USACE determines that the mitigation has met the initial success criteria, monitoring would be performed by the NFS as part of its OMRR&R obligations. If after meeting initial success criteria, the mitigation fails to meet its intermediate and/or long- term ecological success criteria, the USACE would consult with other agencies and the NFS to determine the appropriate management or remedial actions required to achieve ecological success. The USACE would retain the final decision on whether or not the project's required mitigation benefits are being achieved and whether or not remedial actions are required. If structural changes are deemed necessary to achieve ecological success, the USACE would implement appropriate adaptive management measures in accordance with the contingency plan and subject to cost-sharing requirements, availability of funding, and current budgetary and other guidance.

List of Acronyms and Abbreviations

AC	Acre
AHHU	Average Annual Habitat Unit
BA	Borrow Area
CEM	Conceptual Ecopolitical Model
CY	Cubic Yards
DNR	Do Not Relocate
EC	Engineering Circular
ER	Engineering Regulation
FT	Feet
GPS	Global Positioning System
H	Horizontal
IET	Interagency Environmental Team
LA	Louisiana
Lbs	Pounds
LF	Linear Feet
MCA	Marsh Creation Area
MM/YR	Millimeter per Year
MTG	Morganza to the Gulf
NCC	
NFS	Non-federal Sponsor
NAVD88	North American Vertical Datum 1988
PDT	Project Delivery Team
PSI	Pounds per Square Inch
ROM	Rough Order of Magnitude
SY	Square Yard
USACE	United States Army Corps of Engineers
V	Vertical

Mississippi Valley Division,
Regional Planning and Environment Division South

Hurricane and Storm Damage Risk Reduction Project Morganza to the Gulf, Terrebonne Parish, Louisiana

Appendix C - Attachment 8 - Monitoring and Adaptive Management – Constructed Brackish and Saline Marsh Project

October 2025

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SECTION 1

Brackish and Saline Marsh Restoration Sites

West Terrebonne Marsh Creation Site

This study is for the mitigation efforts required for the anticipated marsh impacts resulting from the construction of the Morganza to the Gulf (MTG) Project. This alternative consists of proposed brackish/saline marsh creation areas (MCAs) at a location identified as West Terrebonne (Figure C8:1-1). The design to address the construction impacts consist of the following acreage:

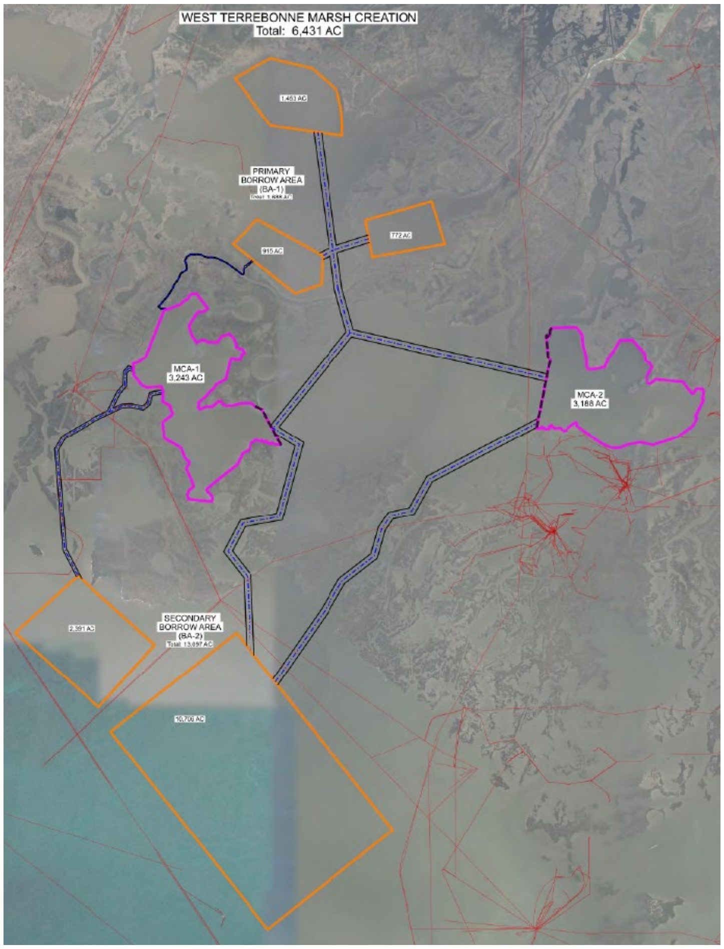

Figure C8:1-1. Project Location

1.1 PROJECT DESCRIPTION

This project alternative consists of a brackish and saline marsh creation project. The project area is located in Terrebonne Parish approximately 8 miles south of Theriot, LA traveling down Bayou Dularge. The larger sites designed for the Overall MTG mitigation plan consists of two marsh creation areas separated by Caillou Lake. The first site, west of Caillou Lake, spans across Bay Voisin and King Lake (MCA-1). The second site is on the east side of Caillou Lake, primarily located in Moncleuse Bay and extending north into Bay de L'Ouest (MCA-2).

Two borrow areas were considered, each consisting of multiple cells in an attempt to avoid known pipelines and oyster seed grounds. The identified borrow area (BA-1) located to the north of the MCAs, consists of three cells situated within Lake Mechant and Mud Lake. Access corridors from BA-1 to the two MCAs traverse Grand Pass and Caillou Lake. The second borrow area (BA-2) south of the MCAs, consists of two cells identified in Caillou Bay. Access corridors from BA-2 traverse open water and through the following bayous to reach the MCAs: Grand Bayou du Large, Bayou Banan, and Bayou Grand Caillou.

The smaller mitigation area developed for Reach F impacts is located in northeast portion of King Lake within the MCA-1 footprint. The targeted borrow area will be from BA-1, in the southern cell of Lake Mechant. The site can be accessed from Bayou Du Large or through Grand Pass and Caillou Lake.

1.2 DESIGN AND CONSTRUCTION

1.2.1 Containment Dikes

Earthen perimeter dikes will be fully-confined, constructed from onsite/interior borrow adjacent to the dikes. This alternative requires two dike sections, classified as front and back dikes, due to the project’s exposure to wave/fetch action in the areas adjacent to open water. The front containment dikes will be constructed with an 8-foot crown width and the back dikes, located against existing marsh, will have a 5-foot crown width. Both sections have a 1V:5H side slope that transition down to existing grade.

The perimeter dike crown elevation varies per site; MCA-1 will be constructed to a crown elevation of +5.5-ft NAVD88 and MCA-2 to elevation +6.0-ft NAVD88 to contain dredge slurry and provided a minimum 2-foot freeboard. Settlement assumptions were applied to the dike heights and incorporated in the volumetric calculations. The front dike parameters included a 30% settlement estimate, considering the larger sections required along the open water areas and a 20% settlement assumption was factored into the back dike calculations. The estimated borrow material required for the initial perimeter dike construction for the Reach F specific area requires 392,000 CY, detailed in Table C8:1-1.

Table C8:1-1. Summary of Dike Parameter

Reach F Site	
Total Perimeter Length (LF):	9,992
Crown Width (FT):	5
Slope Run (1V: **X-ft** H):	5
Top of Dike Elevation (FT NAVD88):	5.5
Base Elevation (FT NAVD88):	-2.8
Assumed Settlement (FT):	2.4
Dike Volume (CY):	392,000

1.2.2 Discharge Monitoring

Grade stakes will be placed throughout the project areas. Discharge location will be monitored against grade stakes to determine movement needed within the marsh platform to achieve the most uniform platform possible with little mechanical relocation of high points post construction.

Spill boxes will be strategically located along the limits of the perimeter dike adjacent to open water areas to serves as the effluent discharge points at each MCA. The intent is to capture most sediment suspended in the effluent discharge, but some material will still likely deposit in the adjacent open water locations. After marsh fill operations are completed and sufficient dewatering and compaction has occurred, the spill boxes will be removed.

1.2.3 Marsh Platform Lift

Once all perimeter containment dikes, cross dikes, and spill boxes are constructed, the marsh platform lift for each site will commence. To build the marsh platforms, it is proposed that sediment will be dredged from designated borrow areas in Lake Mechant and Caillou Bay using a hydraulic cutterhead. The sediment will then be pumped as slurry into the marsh creation area through a floating pipeline.

The contractor will be directed to fill the marsh creation area from the varying existing ground elevation to the max constructed fill elevation (final target elevation with the anticipated settlement), with the expectation the platform will ultimately settle into the necessary target elevation of +1.25-ft NAVD88. A +/- 0.5-foot tolerance during the fill operations will be allowable.

It's assumed only one (1) lift will be required for this project at this design stage, however this will need to be confirmed through field investigations and future geotechnical analysis.

Subsidence, foundation settlement, fill compaction/shrinkage, dewatering, and construction losses were accounted for in the quantity calculations.

The selected parameters for the marsh fill operations vary per sites; a summary of each MCA is included in the table below. The estimated total quantity of fill material includes the backfilling of internal dike borrow areas. In total, the Reach F marsh platforms require 1,846,000 cubic yards (CY). See Table C8:1-2 below for details on the marsh platform lift.

Table C8:1-2. Summary of Marsh Platform Lift

Reach F Site	
Area (AC):	116
Max Slurry Elevation (FT NAVD88):	3.5
Target Elevation (FT NAVD88):	1.25
Water Bottom Elevation (FT NAVD88):	-2.8
Intermediate Subsidence (MM/YR):	12.09
Assumed Settlement (FT):	1.0
Marsh Fill Volume (CY):	1,846,000

1.2.4 Borrow Plan

Given the uncertainties at this design stage, several borrow areas were identified as potential sources of dredge material to achieve the required elevations for the marsh platforms and meet habitat goals.

The material for the construction of the MCAs is to be hydraulically dredged sediment obtained at the following proposed borrow locations: Lake Mechant (BA-1) and Caillou Bay (BA-2). It is assumed these borrow area will provide suitable material for the construction of the marsh platform(s), as the material is assumed to have mixed sediment content according to the Louisiana Sand Resources Database (LA-0161) and other neighboring projects in the region.

The proposed borrow sites total to approximately 14,548 acres, and satisfies the overall volume needed by 186%. It is assumed that Lake Mechant will not meet the required amount of material on its own, therefore Alternative 1 evaluates the option of both Lake Mechant and Caillou Bay borrow. Alternative 2 solely considers borrow from Caillou Bay, as this area is large enough to fill the full marsh platform. The most cost effective of the two alternatives detailed below is Alternative 1, therefore this is the proposed borrow plan for this project.

The smaller area developed for Reach F impacts will use hydraulically dredged borrow material from the closest site in the Lake Mechant borrow site. The proposed borrow site totals

to approximately 915 acres, and satisfies the overall volume needed by 400%. The cost estimate considered the required volume rather than the borrow site acreage. However, a reduced footprint within the selected site will likely be established in future analysis.
Required Contract Borrow Quantity for the Reach F Area: 3,691,000 CY. See Table C8:1-3 below for the details on each borrow area.

Table C8:1-3. Summary of Borrow

Reach F Borrow (Lake Mechant)	
Area (AC):	915
Max Allowable BEC (FT NAVD88):	-20
Assumed Depth of Material (FT):	10
Available Borrow Volume (CY):	14,770,000
Percentage of Need Met:	400%

1.2.5 Dike Degrade/ Gapping

One to three years post-construction of the marsh platform, it is assumed that the sites will settle down to the desired target elevation. At this time the dikes will be degraded down to elevation +1.25-ft NAVD88 (+/- 0.5-foot), in attempt to align with the surrounding marsh elevation. Gapping locations will also be included in this effort to enhance tidal exchange across the MCAs. Excavated material will be disposed of within the marsh creation areas at any low locations within the project footprint. The estimated excavation quantity for Reach F is approximately 13,000 CY.

1.2.6 Relocations

This study did not conduct an in-depth pipeline locations/identification. Pipeline data for this marsh creation area and borrow location is assumed at a face value of what was shown on the DNR pipeline database. In addition, the proposed borrow area and marsh creation area within Lake Salvador may encounter wells and flowlines which have not been identified. Prior to any formal design or construction, the proposed project site and borrow area will require an in-depth pipeline, well, and flowline review and identification.

SECTION 2
USACE Guidance

U.S. Army Corps of Engineers (USACE) monitoring and adaptive management policy is required by the Water Resources Development Act of 2007 and presented in planning guidance (Engineering Regulation (ER) 1105-2-100, Engineering Circular (EC) 1105-2-409, and Memorandum on Implementation Guidance for Section 2036 of the Water Resources Development Act of 2007). Monitoring includes the systematic collection and analysis of data that provides information useful for assessing project performance, determining whether ecological success has been achieved, or whether adaptive management will be needed to attain project benefits. Adaptive management addresses the uncertainties about a project’s actual performance that exist when implementation decisions are made to undertake a water resources project. This technique allows decision making and implementation to proceed with the understanding that outputs will be assessed and evaluated and that some structural or operational changes to the project may be necessary to achieve desired results. At the heart of adaptive management is an appropriate monitoring program to determine if the outputs/results meet the required mitigation need, and to determine if any adjustments are needed.

The purpose of this plan is to demonstrate ecological success of the project. This success is determined by monitoring metrics that are specifically tied to project objectives, and success criteria. In addition, the plan identifies what adaptive management (contingency) is proposed if the performance targets are not met. This plan presents the framework for the above methodology and will be refined as the project proceeds into Pre-construction, Engineering, and Design (PED) phase in collaboration with the non-Federal sponsors, as well as other stakeholders who may take responsibility for monitoring ecological variables in the watershed.

SECTION 3
Mitigation Success Criteria

The success (performance) criteria described herein are applicable to all proposed marsh habitats (fresh marsh, intermediate marsh, and brackish marsh restoration features), unless otherwise indicated.

3.1 GENERAL CONSTRUCTION

A. Complete all initial mitigation construction activities (e.g. construction of temporary retention/perimeter dikes, placement of fill (borrow material/dredged material), construction of permanent dikes if applicable, etc.) in accordance with the mitigation work plan and final project plans and specifications. Upon completion of construction, USACE or its contractor shall provide construction surveys to include all project features. These activities are classified as “initial construction requirements.”

B. Approximately 1 year following completion of all initial mitigation construction activities (when the restored marsh feature has stabilized to the point that the containment berms are no longer required to prevent the loss of fill material from the project site), USACE or its contractor shall complete all final mitigation construction activities, in accordance with the mitigation work plan and final project plans and specifications. Such activities may include, but are not limited to: degrading temporary retention/perimeter dikes; completion of armoring of permanent dikes; “gapping” or installation of “fish dips”; soil testing; completion of plantings; and construction of terrasses or similar features within marsh features as a means of establishing shallow water interspersion areas within the marsh. Finishing the aforementioned construction activities will be considered as the “completion of final construction requirements”.

3.2 TOPOGRAPHY[1]

A. Initial Success Criteria:

1. One year after completion of fill placement:
   - Demonstrate that at least 80% of each mitigation feature has a surface elevation that is within +0.5 to – 0.5 feet of the desired target surface elevation as determined by the settlement curve for that year.
2. Two years after completion of fill placement:

- Demonstrate that at least 80% of the mitigation site has a surface elevation that is within +0.5 feet to – 0.25 of the desired target surface elevation as determined by the settlement curve for that year.

B. Intermediate Success Criteria:

1. Two years following achievement of Topography Criteria A.2. —
   - Demonstrate that at least 80% of the mitigation site has a surface elevation that is within the functional marsh elevation range[2].
   - There are no additional monitoring or attainment requirements for topography beyond meeting the Intermediate Success Criteria for topography.

Notes:

[1]Elevation survey data and report will be provided to the IET for review in order to determine concurrence. The surveys must include water levels inside and outside the marsh creation site at locations representative of site conditions.

[2]The "functional marsh elevation range", i.e. the range of the marsh surface elevation that is considered adequate to achieve proper marsh functions and values, is determined during the final design phase.

3.3 NATIVE VEGETATION

A. Intermediate marsh and brackish marsh:

1. <u>Initial Success Criteria</u> (2 growing seasons following completion of initial construction activities in General Construction A.):
   - Initial plantings must attain at least 80% survival of planted species, or achieve a minimum average cover of 25% native herbaceous species (includes planted species and volunteer species). If site self-vegetates, the site must achieve a minimum average cover of at least 50% native herbaceous species.
   - Demonstrate that vegetation satisfies USACE hydrophytic vegetation criteria.

2. <u>Intermediate Criteria (2 years following attainment of Native Vegetation Criteria A.1):</u>
   - Achieve a minimum average cover of 60 percent, comprised of native herbaceous species (includes planted species and volunteer species).
   - Demonstrate that native vegetation satisfies USACE hydrophytic vegetation criteria.

3. <u>Long-Term Success Criteria</u>[3] (Every monitoring event after attainment of

Native Vegetation Criteria A.2.):

- Achieve a minimum average cover of 60 percent, comprised of native herbaceous species (includes planted species and volunteer species).
- Demonstrate that native vegetation satisfies USACE hydrophytic vegetation criteria.

Note:

[1]There is not a minimum average cover requirement for years 21 – 50. However, vegetation data will be collected throughout the 50-year project life[2].

[2]The 50-year period of monitoring begins once final construction of the project is complete.

- For projects that are NOT planted - at NCC if, at the end of the first growing season after all final construction activities are completed, the colonization of appropriate vegetation has begun to the satisfaction of USACE Environmental Branch (such that it is anticipated that the site is on track to meet initial success criteria).
- For projects that are planted - at NCC if, at the end of the first growing season after all final construction activities are completed (including planting), planting has been conducted to the satisfaction of USACE Environmental Branch (such that it is anticipated that the site is on track to meet initial success criteria).

3.4 INVASIVE AND NUISANCE VEGETATION (FOR ALL MARSH TYPES)

A. Initial, Intermediate, and Long-term[1] Success Criteria

- Maintain the project area such that the total average vegetative cover accounted for by invasive species and the total average vegetative cover accounted nuisance species each constitute less than 5 percent of the total average plant cover each throughout the 50- year project life. The list of invasive and nuisance species is found in Appendix A and will be tailored to reflect specific site needs.

Note:

[1]Yearly inspections to determine the need for invasive/nuisance control would be conducted until the long term success criteria for vegetation is achieved. After it is achieved, the frequency of inspections to determine the need for invasive/nuisance control would be adjusted based on site conditions.

SECTION 4

Mitigation Monitoring Guidelines

The guidelines for mitigation monitoring provided herein are applicable to all types of marshes being restored unless otherwise indicated.

4.1 BASELINE MONITORING REPORT (FIRST MONITORING REPORT)

A “baseline” monitoring report will be prepared upon completion of Final Construction Requirements B. and upon any re-plantings associated with construction. Information provided will typically include the following:

- A detailed discussion of all mitigation activities completed.
- A plan view drawing of the mitigation site showing the approximate boundaries of the restored marsh, significant interspersion features established within the marsh features (as applicable), proposed monitoring transect locations, proposed sampling plot locations, photo station locations and water level survey locations.
- Initial and final construction surveys of all project features (including but not limited to the fill area, fish dips, weirs, culverts, etc.) and an analysis of the survey data will be provided addressing attainment of topographic success criteria. If a project is immediately adjacent to existing marsh habitat, the topographic survey will include spot elevations collected within the existing marsh habitat near the restored marsh.
- Photographs documenting conditions in the project area will be taken at the time of monitoring. Photos will be taken at permanent photo stations within the restored marsh. At least two photos will be taken at each station with the view of each photo always oriented in the same general direction from one monitoring event to the next. The number of photo stations required and the locations of these stations will vary depending on the mitigation site. The USACE will make this determination in coordination with the Interagency Team and will specify the requirements in the Mitigation Monitoring Plan. At a minimum, 4 photo stations will be established within each marsh cell.
- For planted marsh only - A detailed inventory of all species planted, including the number of each species planted, the stock size planted, and where the species were planted will be documented. For mitigation sites that include more than one planted marsh cell/feature, provide a breakdown itemization indicating the number of each species planted in

each feature and correlate this itemization to the marsh features depicted on the plan view drawing of the mitigation site.

- As part of the as-built/final construction survey, water level surveys will be taken inside and outside the marsh creation site at predetermined locations identified in coordination with the IET and NFS. Each interior water level elevation should have a corresponding exterior water level elevation taken consecutively and within close proximity. If there appears to be disparity in water levels within the marsh creation site, additional shots may be required. The baseline monitoring report will provide the surveyed water level data and will compare it to mean high and mean low water elevation data collected from a tidal elevation recording station in the general vicinity of the mitigation site. The report will further address estimated mean high and mean low water elevations at the mitigation site based on field indicators.

- Various qualitative observations will be made in the mitigation site to help assess the status and success of mitigation and maintenance activities. These observations will include: general estimate of the average percent cover by native plant species; general estimates of the average percent cover by invasive and nuisance plant species; general observations concerning colonization of the mitigation site by volunteer native plant species; general condition of native vegetation; trends in the composition of the plant community; wildlife utilization as observed during monitoring (including fish species and other aquatic organisms); the condition of interspersion features (tidal channels, terrasses, depressions, etc.) constructed within the marsh features, noting any excessive scouring and/or siltation occurring within such features; the natural formation of interspersion features within restored marshes; observations regarding general surface water flow characteristics within marsh interspersion features; the general condition of “gaps,” “fish dips,” or similar features constructed in permanent dikes; if present, the general condition of any armoring installed on permanent dikes. General observations made during the course of monitoring will also address potential problem zones and other factors deemed pertinent to the success of the mitigation project.

- A summary assessment of all data and observations along with recommendations as to actions necessary to help meet mitigation and management/maintenance goals and mitigation success criteria.

- A brief description of anticipated maintenance/management work to be conducted during the period from the current monitoring report to the next monitoring report.

4.2 ADDITIONAL MONITORING REPORTS

All monitoring reports generated after the Baseline Monitoring Report will be called either Initial, Intermediate or Long-Term Monitoring Reports and shall include the year in which the monitoring occurred (i.e. Monitoring Report 2019). All Monitoring Reports shall provide the following information unless otherwise noted:

- All items listed for the Baseline Monitoring Report with the exception of: (a) the topographic surveys, although additional topographic surveys are required for specific monitoring reports (see below); and (b) the inventory of species and location map for all planted species.

- Quantitative data for all plants in each stratum. Data will be collected from permanent sampling quadrats established at approximately equal intervals along permanent monitoring transects established within each marsh feature. Each sampling quadrat will be approximately 1 meter X 1 meter in size (although the dimensions of each quadrat may be increased, if necessary, to provide better data in planted marsh features). The number of monitoring transects and number of sampling quadrats per transect will vary depending on size of the mitigation site and will be determined by the IET during the final design phase of the project. The resulting requirements, including quadrat dimensions, will be specified in the Final Mitigation Monitoring Plan for the project. Data recorded from the sampling quadrats will include but not be limited to: average total percent cover by native plant species; average total percent cover by invasive plant species; average total percent cover by nuisance plant species; percent cover of each plant species; the wetland indicator status of each species; and the average percent survival of each planted species (i.e. number of living planted species as a percentage of total number of plants installed), if discernable at the time of monitoring.

- One photograph shall be taken from the SE corner of each sampling plot to clearly capture the vegetation plot and must include a sign that indicates the plot number and sampling date.

- A brief description of maintenance and/or management work performed since the previous monitoring report along with a discussion of any other significant occurrences.

Topographic surveys of each marsh restoration feature for initial and intermediate monitoring events (at approximately 2 years and 4 years following completion of final construction activities (General Construction B.)). These surveys will cover the same components as described for the topographic survey conducted for the Baseline Monitoring Report. In addition to the surveys themselves, each of the two monitoring reports will include an analysis of the topographic data in regard to the attainment of applicable topographic success criteria. If the surveys indicate topographic success criteria have not been achieved and supplemental topographic alterations are necessary, then another topographic survey will be required following completion of the supplemental alterations. This determination will be made by USACE and the IET.

4.3 MONITORING REPORTS FOLLOWING PLANTING OR RE-PLANTING ACTIVITIES

Planting or re-planting of certain areas within restored marsh habitats may be necessary to ensure attainment of applicable native vegetation success criteria. Any monitoring report submitted following completion of a planting event must include an inventory of the number of each species planted, the stock size used, and the locations for each species planted. It must also include a depiction of the areas re-planted or those planted, as applicable, cross-referenced to a listing of the species and number of each species planted in each area. The perimeter of re-planted area should be documented with GPS coordinates. If single rows are replanted, then GPS coordinates should be taken at the end of the transect.

SECTION 5

Mitigation Monitoring Schedule and Responsibilities

Monitoring will typically take place in mid to late summer during the required years for monitoring, but may be delayed until later in the growing season due to site conditions or other unforeseen circumstances. Monitoring Reports will be submitted by December 31 of each year of monitoring to the USACE, NFS, and the IET. The various monitoring and reporting responsibilities addressed in this section are all subject to the provisions set forth in the Introduction section.

The USACE will be responsible for conducting the monitoring events and preparing the associated monitoring reports until such time that the following mitigation success criteria are achieved (criteria follow numbering system used in success criteria section):

1. General Construction – A. and B.
2. Topography – A.1 and A.2.
3. Native Vegetation –For intermediate marsh and brackish marsh features, criteria A.1
4. Invasive & Nuisance Vegetation – A. until such time as monitoring responsibilities are transferred to the NFS.

The USACE will be responsible for conducting Baseline and Initial Success Monitoring events and preparing the associated monitoring reports.

The NFS will be responsible for conducting the required monitoring events and preparing the associated monitoring reports for all other required years after the USACE has achieved the initial success criteria listed above. The responsibility for management, maintenance, and monitoring of the non-structural components of the mitigation project (i.e. vegetation) will typically be transferred to the NFS during the first quarter of the year immediately following submittal of the monitoring report that demonstrates attainment of the initial success criteria. Once monitoring responsibilities have been transferred to the NFS, the next monitoring event (Intermediate) should take place 2 growing seasons after Initial Success (Topography A.2 and Native Vegetation A.1) has been met. After Intermediate Success Criteria (Topography B and Native Vegetation A.2) has been met, Long-Term Success Criteria monitoring will be conducted every 5 years throughout the remaining 50- year period of analysis.

In certain cases, it is possible that the marsh mitigation features may be established along with other mitigation features, like swamp or bottomland hardwood habitats, at the same mitigation site. This scenario could require some adjustments to the typical monitoring schedule described above to develop a reasonable and efficient monitoring schedule that covers all the mitigation features. Such adjustments, if necessary, would be made at the time final mitigation plans are generated. This schedule must be in general accordance with the guidance provided above and will be prepared by the USACE and the IET.

If certain success criteria are not achieved, failure to attain these criteria would trigger the need for additional monitoring events not addressed in the preceding paragraphs. The USACE would be responsible for conducting such additional monitoring and preparing the associated monitoring reports in the following instances:

A. For intermediate and brackish marsh features –
    - If the initial survival criteria for planted species or the initial vegetative cover criterion (A.1) are not achieved a monitoring report will be required for each consecutive year until two sequential annual reports indicate that the applicable survival criteria or vegetative cover criteria have been satisfied. The USACE would be responsible for the purchase and installation of supplemental plants needed to attain the success criteria.

B. For all types of marsh features–
    - If initial topographic success criteria (A.1 and A.2) are not achieved, the IET would convene to determine whether corrective actions are necessary. If corrective actions are necessary additional surveys and a monitoring report will be required to indicate whether applicable criteria have been satisfied. The USACE would also be responsible for performing the necessary corrective actions.
    - If initial invasive and nuisance species criteria (A) are not achieved a monitoring report will be required for each consecutive year until two sequential annual reports indicate that the applicable criteria have been satisfied. The USACE would be responsible for the irradiation activities needed to attain the success criteria.

There could also be cases where failure to attain certain success criteria would trigger the need for additional monitoring events for which the NFS would be responsible:

A. For intermediate and brackish marsh features –
    - If the native vegetation intermediate success criteria (B.2) are not achieved, a monitoring report will be required for each consecutive year until two sequential annual reports indicate that the native vegetation intermediate success criteria has been satisfied. The Sponsor would also be responsible for the purchase and installation of supplemental plants needed to attain the success criteria.

B. For all types of marsh features –
    - If the topographic intermediate success criteria (B.1) are not achieved, the IET would convene to determine whether corrective actions are

necessary. If corrective actions are necessary, additional surveys and a monitoring report will be required to indicate whether applicable criteria have been satisfied. The NFS would also be responsible for performing the necessary corrective actions if the IET determines such corrective actions are necessary.

- If the native vegetation long term success criteria (A.3) are not achieved, the IET would convene to discuss whether corrective actions would be necessary. If corrective actions are necessary, a monitoring report will be required for each consecutive year following completion of the corrective actions until two sequential annual reports indicate that the native vegetative cover criteria have been attained. The NFS would be responsible for performing the corrective actions, conducting the additional monitoring events, and preparing the associated monitoring reports.
- If the intermediate and long term invasive and nuisance species criteria (4.A) are not achieved a monitoring report will be required for each consecutive year until two sequential annual reports indicate that the applicable criteria have been satisfied. The NFS would be responsible for the irradiation activities needed to attain the success criteria.

Once monitoring responsibilities have been transferred to the NFS, the NFS will retain the ability to modify the monitoring plan and the monitoring schedule should this become necessary due to unforeseen events or to improve the information provided through monitoring. Fifteen years following achievement of Long-Term Success Criteria, the number of monitoring transects and/or quadrats that must be sampled during monitoring events may be reduced substantially if it is clear that mitigation success is proceeding as anticipated. Any significant modifications to the monitoring plan or the monitoring schedule must first be approved by the USACE and the IET.

SECTION 6
Adaptive Management Plan

6.1 BRACKISH/SALINE MARSH

6.1.1 Adaptive Management Planning

Adaptive management planning elements included: 1) development of a Conceptual Ecological Model (CEM), 2) identification of key project uncertainties and associated risks, 3) evaluation of the mitigation projects as a candidate for adaptive management and 4) the identification of potential adaptive management actions (contingency plan) to better ensure the mitigation project meets identified success criteria. The adaptive management plan is a living document and will be refined as necessary as new mitigation project information becomes available.

6.1.1.1 Sources of Uncertainty and Associated Risks

A fundamental tenet underlying adaptive management is decision making and achieving desired project outcomes in the face of uncertainties. There are many uncertainties associated with restoration of the coastal systems. The project delivery team (PDT) identified the following uncertainties during the planning process.

- Climate change, such as relative sea level rise, drought conditions, and variability of tropical storm frequency, intensity, and timing
- Subsidence and water level trends
- Uncertainty relative to achieving ecological success
- Long-term sustainability of project benefits
- Adaptability

6.1.1.2 Adaptive Management Evaluation

The project site was evaluated and planned to develop a project with minimal risk and uncertainty. The items listed below were incorporated into the mitigation project implementation plan and Operation, Maintenance, Repair, Replacement, and Rehabilitation (OMRR&R) plan to minimize project risks.

- Detailed planting guidelines for intermediate marsh
- General monitoring guidelines for project success
- Specified success criteria (i.e., mitigation targets)
- Invasive species control
- Supplementary plantings as necessary (contingency)
- Corrective actions to meet topographic success as required (contingency)

Subsequently, as part of the adaptive management planning effort the project features were re-evaluated against the CEM and sources of uncertainty and risk were identified to determine if there was any need for additional adaptive management actions.

Based on the uncertainties and risks associated with the project implementation the following contingency/adaptive management actions have been identified to be implemented if needed to ensure the required AAHUs are met (Table B8:6-1).

Table C8:6-1. Adaptive Management Actions Marsh

Element	Expected Condition	Potential Issue	Potential Corrective Action
Landscape characteristics	Bathymetry appropriate for sustainable growth of marsh vegetation	Water that is deeper or shallower than ideal conditions for targeted vegetations.	Modify land elevation; marsh renourishment to obtain elevations necessary for marsh establishment and maintenance
Connectivity	Obtain necessary hydrology	Limited water exchange or excessive flooding, wave action or salinity.	Modify channels to obtain necessary connectivity. adjust gapping in dikes in the future to maintain sufficient marsh hydrology and connectivity. Construction feature to reduce wave and salinity influences on the marsh restoration feature.
Vegetation community composition	Healthy vegetative communities free of invasive species, assuming natural colonization	Invasive species dominance, native species do not establish, poor marsh survival,	Invasive species control, marsh plantings

The USACE would be responsible for the proposed mitigation construction and monitoring until the initial success criteria are met. Initial construction and monitoring would be funded in accordance with all applicable cost-share agreements with the NFS. The USACE would monitor (on a cost-shared basis) the completed mitigation to determine whether additional construction, invasive/nuisance plant species control, and/or plantings are necessary to achieve initial mitigation success criteria. Once the USACE determines that the mitigation has met the initial success criteria, monitoring would be performed by the NFS as part of its OMRR&R obligations. If after meeting initial success criteria, the mitigation fails to meet its intermediate and/or long-term ecological success criteria, the USACE would consult with other agencies and the NFS to determine the appropriate management or remedial actions required to achieve ecological success. The USACE would retain the final decision on whether or not the project's required mitigation benefits are being achieved and whether or not remedial actions are required. If structural changes are deemed necessary to achieve ecological success, the USACE would implement appropriate adaptive management measures in accordance with the contingency plan and subject to cost-sharing requirements, availability of funding, and current budgetary and other guidance.

List of Acronyms and Abbreviations

AC	Acre
AHHU	Average Annual Habitat Unit
BA	Borrow Area
CEM	Conceptual Ecopolitical Model
CY	Cubic Yards
DNR	Do Not Relocate
EC	Engineering Circular
ER	Engineering Regulation
FT	Feet
GPS	Global Positioning System
H	Horizontal
IET	Interagency Environmental Team
LA	Louisiana
Lbs	Pounds
LF	Linear Feet
MCA	Marsh Creation Area
MM/YR	Millimeter per Year
MTG	Morganza to the Gulf
NCC	Notice of Construction Completion
NFS	Non-federal Sponsor
NAVD88	North American Vertical Datum 1988
PDT	Project Delivery Team
PSI	Pounds per Square Inch
ROM	Rough Order of Magnitude
SY	Square Yard
USACE	United States Army Corps of Engineers
V	Vertical

Mississippi Valley Division,
Regional Planning and Environment Division South

Morganza to the Gulf of Mexico, Louisiana, Hurricane and Storm Damage Risk Reduction Project

Draft Supplemental Programmatic Environmental Impact Statement

Appendix C - Attachment 9 – Monitoring and Adaptive Management – Constructed Fresh and Intermediate Marsh Project

October 2025

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SECTION 1

Fresh and Intermediate Marsh Restoration Sites

Lake Salvador Marsh Creation Site

The proposed Lake Salvador marsh creation area is located at an open water site along the southern edge of Lake Salvador and north of the Gulf Intercoastal Waterway (GIWW), approximate Mile 26, within Lafourche Parish, Louisiana. This project consists of a proposed intermediate/fresh marsh creation area at a location identified as Lake Salvador. The required Reach-A acres for marsh creation at this location is approximately 255 acres. The requested level of engineering and cost estimation for this study is a Rough Order of Magnitude (ROM) level, 5% to 10% level design. To provided approximately 255 acres of marsh at this location, the proposed construction footprint is 261 acres, assuming approximately 2.5% of the constructed marsh platform will not meet the required marsh target elevation. The assumed 2.5% area not meeting the target marsh elevation is a placeholder for this study and will be adjusted once geotechnical investigations are conducted and the actual extent of internal dike borrow needed is verified.

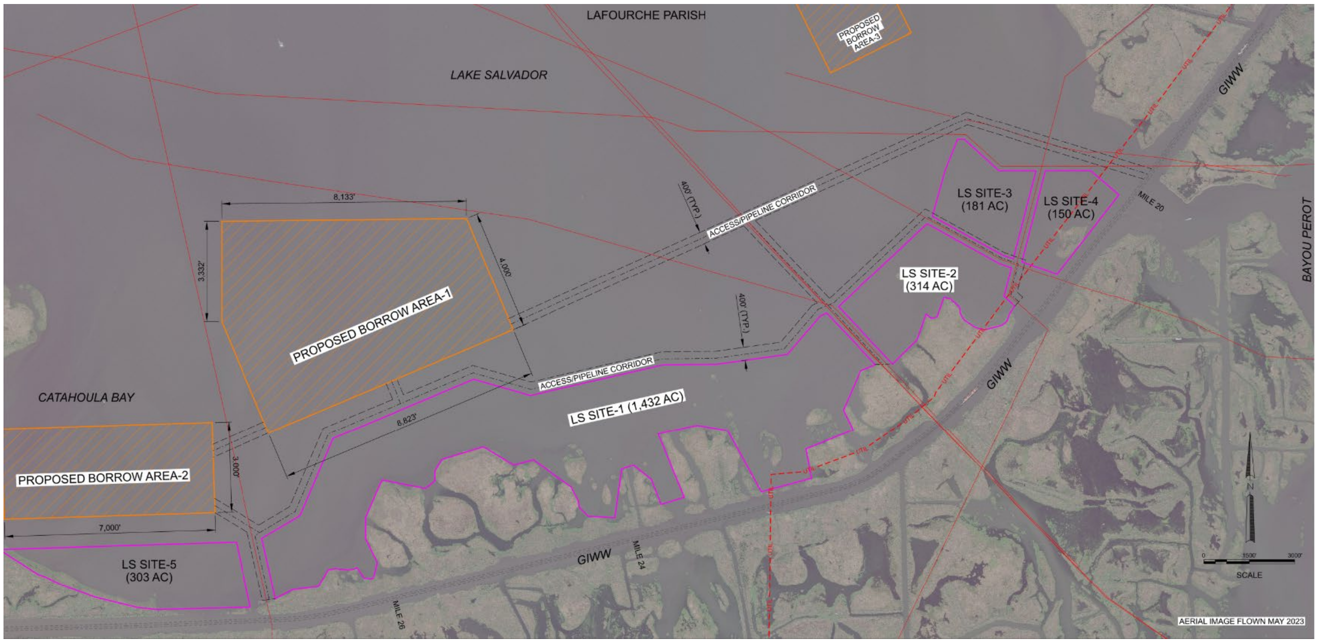

Figure C9:1-1. Project Location

1.1 PROJECT DESCRIPTION

This project alternative (Figure C9:1-1) currently consists of 255 acres of marsh creation. The assumed existing elevation is -2.0 feet NAVD88. Initial target elevation for dredge fill will be to approximate elevation +1.0 to +1.5 NAVD88, to ultimately hit a target marsh elevation of +1.0 NAVD88. The dike will be built with borrow from a borrow area within Lake Salvador, 1,000 feet from the marsh creation site. The borrow material will be dredged via hydraulic cutterhead, and the dredged slurry will be pumped into the marsh creation area. The dike will be built with a 5 feet crown width to elevation +4.0 feet NAVD88, to provide a minimum 1.5 ft of freeboard during pumping operation and allow for settlement. This dike will be degraded in year 1, upon settlement and dewatering of the created marsh platform. This site will require two more lifts following the first ending with the third lift being degraded in year 4. The degraded material can be disposed of in the original borrow canal if settlement allows or cast into the open water immediately outside of the project footprint. Spill boxes or weirs will be constructed at pre-determined locations within the retention dike to allow for effluent water release from within the marsh creation area. 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.

1.1.1 Borrow Requirements

Marsh creation would require borrow of approximately 6,528,000 cubic yards of material. The borrow site is approximately 413 acres. The borrow plan is to obtain material from Lake Salvador. Borrow would not be allowed greater than 20 ft below the existing lake bottom. To assure adequate borrow, the fill quantity was doubled account for unsuitable materials, unknown utilities, unidentified anomalies, and/or unsighted cultural finds. Access corridors for construction equipment will transit through existing open water that convey to the project site from the GIWW navigation channel. It is assumed that dredging for flotation outside of the federal navigation channels may be required, but not verified at this level of design. It is assumed that any associated costs for flotation will be covered under the 25% contingency provided with the ROM estimate for this project study. Prior to any formal design or construction, the proposed project site and access to Lake Salvador will require surveys and pipeline verification to determine if alternate access corridors will be required.

1.1.2 Relocations

This study did not conduct an in-depth pipeline locations/identification. Pipeline data for this marsh creation area and borrow location is assumed at a face value of what was shown on the DNR pipeline database. In addition, the proposed borrow area and marsh creation area within Lake Salvador may encounter wells and flowlines which have not been identified. Prior to any formal design or construction, the proposed project site and borrow area will require an in-depth pipeline, well, and flowline review and identification.

SECTION 2
USACE Guidance

U.S. Army Corps of Engineers (USACE) monitoring and adaptive management policy is required by the Water Resources Development Act of 2007 and presented in planning guidance (Engineering Regulation (ER) 1105-2-100, Engineering Circular (EC) 1105-2-409, and Memorandum on Implementation Guidance for Section 2036 of the Water Resources Development Act of 2007). Monitoring includes the systematic collection and analysis of data that provides information useful for assessing project performance, determining whether ecological success has been achieved, or whether adaptive management will be needed to attain project benefits. Adaptive management addresses the uncertainties about a project's actual performance that exist when implementation decisions are made to undertake a water resources project. This technique allows decision making and implementation to proceed with the understanding that outputs will be assessed and evaluated and that some structural or operational changes to the project may be necessary to achieve desired results. At the heart of adaptive management is an appropriate monitoring program to determine if the outputs/results meet the required mitigation need, and to determine if any adjustments are needed.

The purpose of this plan is to demonstrate ecological success of the project. This success is determined by monitoring metrics that are specifically tied to project objectives, and success criteria. In addition, the plan identifies what adaptive management (contingency) is proposed if the performance targets are not met. This plan presents the framework for the above methodology and will be refined as the project proceeds into Pre-construction, Engineering, and Design (PED) phase in collaboration with the non-Federal sponsors, as well as other stakeholders who may take responsibility for monitoring ecological variables in the watershed.

SECTION 3

Mitigation Success Criteria

The success (performance) criteria described herein are applicable to all proposed marsh habitats (fresh marsh, intermediate marsh, and brackish marsh restoration features), unless otherwise indicated.

3.1 GENERAL CONSTRUCTION

A. Complete all initial mitigation construction activities (e.g. construction of temporary retention/perimeter dikes, placement of fill (borrow material/dredged material), construction of permanent dikes if applicable, etc.) in accordance with the mitigation work plan and final project plans and specifications. Upon completion of construction, USACE or its contractor shall provide construction surveys to include all project features. These activities are classified as "initial construction requirements."

B. Approximately 1 year following completion of all initial mitigation construction activities (when the restored marsh feature has stabilized to the point that the containment berms are no longer required to prevent the loss of fill material from the project site), USACE or its contractor shall complete all final mitigation construction activities, in accordance with the mitigation work plan and final project plans and specifications. Such activities may include, but are not limited to, degrading temporary retention/perimeter dikes; completion of armoring of permanent dikes; "gapping" or installation of "fish dips;" soil testing; completion of plantings; and construction of terrasses or similar features within marsh features as a means of establishing shallow water interspersion areas within the marsh. Finishing the construction activities will be considered as the "completion of final construction requirements."

3.2 TOPOGRAPHY[1]

A. Initial Success Criteria:

1. Two years after completion of fill placement or one year after final construction (whichever is later):
   - Demonstrate that at least 80 percent of each mitigation feature has a surface elevation that is within +0.5 to – 0.5 feet of the desired target surface elevation as determined by the settlement curve for that year.

2. Three years after completion of fill placement or two years after final construction (whichever is later):
   - Demonstrate that at least 80 percent of the mitigation site has a surface elevation that is within +0.5 feet to – 0.25 of the desired target surface elevation as determined by the settlement curve for that year.

B. Intermediate Success Criteria:
1. Two years following achievement of Topography Criteria 2.A.2. —
   - Demonstrate that at least 80 percent of the mitigation site has a surface elevation that is within the functional marsh elevation range[2].
   - There are no additional monitoring or attainment requirements for topography beyond meeting the Intermediate Success Criteria for topography.

Notes: [1]Elevation survey data and report will be provided to the IET for review in order to determine concurrence. The surveys must include water levels inside and outside the marsh creation site at locations representative of site conditions.

[2]The “functional marsh elevation range,” i.e. the range of the marsh surface elevation that is considered adequate to achieve proper marsh functions and values, is determined during the final design phase.

3.3 NATIVE VEGETATION

A. Fresh marsh:
1. Initial Success Criteria (2 growing seasons following completion of initial construction activities in General Construction 1.A.):
   - Achieve a minimum average cover of 50 percent comprised of native herbaceous species.
   - Demonstrate that vegetation satisfies USACE hydrophytic vegetation criteria. (USACE 2010)

2. Intermediate Criteria (2 years following attainment of Native Vegetation Criteria 3.A.1.):
   - Achieve a minimum average cover of 60 percent comprised of native herbaceous species.
   - Demonstrate that vegetation satisfies USACE hydrophytic vegetation criteria.

3. Long-Term Success Criteria[3] (Every monitoring event after attainment of Native Vegetation Criteria 3.A.2.):

   - Achieve a minimum average cover of 60 percent comprised of native herbaceous species.

- Demonstrate that vegetation satisfies USACE hydrophytic vegetation criteria.

Notes:

[1]Fresh marsh is typically not planted due to the expectation that it will naturally vegetate more quickly than intermediate or brackish marsh.

However, if percent cover success criteria are not met, plantings may become necessary in the absence of other recommended actions

A. Intermediate marsh and brackish marsh:

1. Initial Success Criteria (2 growing seasons following completion of initial construction activities in General Construction 1.A.):
   - Initial plantings must attain at least 80% survival of planted species, or achieve a minimum average cover of 25% native herbaceous species (includes planted species and volunteer species). If site self-vegetates, the site must achieve a minimum average cover of at least 50% native herbaceous species.
   - Demonstrate that vegetation satisfies USACE hydrophytic vegetation criteria.

2. Intermediate Criteria (2 years following attainment of Native Vegetation Criteria 3.B.1):
   - Achieve a minimum average cover of 60 percent, comprised of native herbaceous species (includes planted species and volunteer species).
   - Demonstrate that native vegetation satisfies USACE hydrophytic vegetation criteria.

3. Long-Term Success Criteria[3] (Every monitoring event after attainment of Native Vegetation Criteria 3.B.2.):
   - Achieve a minimum average cover of 60 percent, comprised of native herbaceous species (includes planted species and volunteer species).
   - Demonstrate that native vegetation satisfies USACE hydrophytic vegetation criteria.

Note:

[1]There is not a minimum average cover requirement for years 21 – 50. However, vegetation data will be collected throughout the 50-year project life[2].

[2]The 50-year period of monitoring begins once final construction of the project is complete.

- For projects that are NOT planted - at NCC if, at the end of the first growing season after all final construction activities are completed, the colonization of appropriate vegetation has begun to the satisfaction of

USACE Environmental Branch (such that it is anticipated that the site is on track to meet initial success criteria).
- For projects that are planted - at NCC if, at the end of the first growing season after all final construction activities are completed (including planting), planting has been conducted to the satisfaction of USACE Environmental Branch (such that it is anticipated that the site is on track to meet initial success criteria).

3.4 INVASIVE AND NUISANCE VEGETATION (FOR ALL MARSH TYPES)

A. Initial, Intermediate, and Long-term[1] Success Criteria
- Maintain the project area such that the total average vegetative cover accounted for by invasive species and the total average vegetative cover accounted nuisance species each constitute less than 5 percent of the total average plant cover each throughout the 50- year project life. The list of invasive and nuisance species is found in Appendix A and will be tailored to reflect specific site needs.

Note:

[1]Yearly inspections to determine the need for invasive/nuisance control would be conducted until the long-term success criteria for vegetation is achieved. After it is achieved, the frequency of inspections to determine the need for invasive/nuisance control would be adjusted based on site conditions.

SECTION 4

Mitigation Monitoring Guidelines

The guidelines for mitigation monitoring provided herein are applicable to all types of marshes being restored unless otherwise indicated.

4.1 BASELINE MONITORING REPORT (FIRST MONITORING REPORT)

A "baseline" monitoring report will be prepared upon completion of Final Construction Requirements 1.B. and upon any re-plantings associated with construction. Information provided will typically include the following:

- A detailed discussion of all mitigation activities completed.
- A plan view drawing of the mitigation site showing the approximate boundaries of the restored marsh, significant interspersion features established within the marsh features (as applicable), proposed monitoring transect locations, proposed sampling plot locations, photo station locations and water level survey locations.
- Initial and final construction surveys of all project features (including but not limited to the fill area, fish dips, weirs, culverts, etc.) and an analysis of the survey data will be provided addressing attainment of topographic success criteria. If a project is immediately adjacent to existing marsh habitat, the topographic survey will include spot elevations collected within the existing marsh habitat near the restored marsh.
- Photographs documenting conditions in the project area will be taken at the time of monitoring. Photos will be taken at permanent photo stations within the restored marsh. At least two photos will be taken at each station with the view of each photo always oriented in the same general direction from one monitoring event to the next. The number of photo stations required, and the locations of these stations will vary depending on the mitigation site. The USACE will make this determination in coordination with the Interagency Team and will specify the requirements in the Mitigation Monitoring Plan. At a minimum, 4 photo stations will be established within each marsh cell.
- For planted marsh only - A detailed inventory of all species planted, including the number of each species planted, the stock size planted, and where the species were planted will be documented. For mitigation sites that include more than one planted marsh cell/feature, provide a breakdown itemization indicating the number of each species planted in

each feature and correlate this itemization to the marsh features depicted on the plan view drawing of the mitigation site.

- As part of the as-built/final construction survey, water level surveys will be taken inside and outside the marsh creation site at predetermined locations identified in coordination with the IET and NFS. Each interior water level elevation should have a corresponding exterior water level elevation taken consecutively and within close proximity. If there appears to be disparity in water levels within the marsh creation site, additional shots may be required. The baseline monitoring report will provide the surveyed water level data and will compare it to mean high and mean low water elevation data collected from a tidal elevation recording station in the general vicinity of the mitigation site. The report will further address estimated mean high and mean low water elevations at the mitigation site based on field indicators.

- Various qualitative observations will be made in the mitigation site to help assess the status and success of mitigation and maintenance activities. These observations will include: general estimate of the average percent cover by native plant species; general estimates of the average percent cover by invasive and nuisance plant species; general observations concerning colonization of the mitigation site by volunteer native plant species; general condition of native vegetation; trends in the composition of the plant community; wildlife utilization as observed during monitoring (including fish species and other aquatic organisms); the condition of interspersion features (tidal channels, terrasses, depressions, etc.) constructed within the marsh features, noting any excessive scouring and/or siltation occurring within such features; the natural formation of interspersion features within restored marshes; observations regarding general surface water flow characteristics within marsh interspersion features; the general condition of “gaps,” “fish dips,” or similar features constructed in permanent dikes; if present, the general condition of any armoring installed on permanent dikes. General observations made during the course of monitoring will also address potential problem zones and other factors deemed pertinent to the success of the mitigation project.

- A summary assessment of all data and observations along with recommendations as to actions necessary to help meet mitigation and management/maintenance goals and mitigation success criteria.

- A brief description of anticipated maintenance/management work to be conducted during the period from the current monitoring report to the next monitoring report.

4.2 ADDITIONAL MONITORING REPORTS

All monitoring reports generated after the Baseline Monitoring Report will be called either Initial, Intermediate or Long-Term Monitoring Reports and shall include the year in which the monitoring occurred (i.e. Monitoring Report 2019). All Monitoring Reports shall provide the following information unless otherwise noted:

- All items listed for the Baseline Monitoring Report with the exception of: (a) the topographic surveys, although additional topographic surveys are required for specific monitoring reports (see below); and (b) the inventory of species and location map for all planted species.

- Quantitative data for all plants in each stratum. Data will be collected from permanent sampling quadrats established at approximately equal intervals along permanent monitoring transects established within each marsh feature. Each sampling quadrat will be approximately 1 meter X 1 meter in size (although the dimensions of each quadrat may be increased, if necessary, to provide better data in planted marsh features). The number of monitoring transects and number of sampling quadrats per transect will vary depending on size of the mitigation site and will be determined by the IET during the final design phase of the project. The resulting requirements, including quadrat dimensions, will be specified in the Final Mitigation Monitoring Plan for the project. Data recorded from the sampling quadrats will include but not be limited to: average total percent cover by native plant species; average total percent cover by invasive plant species; average total percent cover by nuisance plant species; percent cover of each plant species; the wetland indicator status of each species; and the average percent survival of each planted species (i.e. number of living planted species as a percentage of total number of plants installed), if discernable at the time of monitoring.

- One photograph shall be taken from the SE corner of each sampling plot to clearly capture the vegetation plot and must include a sign that indicates the plot number and sampling date.

- A brief description of maintenance and/or management work performed since the previous monitoring report along with a discussion of any other significant occurrences.

Topographic surveys of each marsh restoration feature for initial and intermediate monitoring events (at approximately 2 years and 4 years following completion of final construction activities (General Construction 1.B.)). These surveys will cover the same components as described for the topographic survey conducted for the Baseline Monitoring Report. In addition to the surveys themselves, each of the two monitoring reports will include an analysis of the topographic data in regards to the attainment of applicable topographic success criteria.

If the surveys indicate topographic success criteria have not been achieved and supplemental topographic alterations are necessary, then another topographic survey will be required following completion of the supplemental alterations. This determination will be made by USACE and the IET.

4.3 MONITORING REPORTS FOLLOWING PLANTING OR RE-PLANTING ACTIVITIES

Planting or re-planting of certain areas within restored marsh habitats may be necessary to ensure attainment of applicable native vegetation success criteria. Any monitoring report submitted following completion of a planting event must include an inventory of the number of each species planted, the stock size used, and the locations for each species planted. It must also include a depiction of the areas re-planted or those planted, as applicable, cross-referenced to a listing of the species and number of each species planted in each area. The perimeter of re-planted area should be documented with GPS coordinates. If single rows are replanted, then GPS coordinates should be taken at the end of the transect.

SECTION 5

Mitigation Monitoring Schedule and Responsibilities

Monitoring will typically take place in mid to late summer during the required years for monitoring but may be delayed until later in the growing season due to site conditions or other unforeseen circumstances. Monitoring Reports will be submitted by December 31 of each year of monitoring to the USACE, NFS, and the IET. The various monitoring and reporting responsibilities addressed in this section are all subject to the provisions set forth in the Introduction section.

The USACE will be responsible for conducting the monitoring events and preparing the associated monitoring reports until such time that the following mitigation success criteria are achieved (criteria follow numbering system used in success criteria section):

1. General Construction – 1.A. and 1.B.
2. Topography – 2.A.1 and 2.A.2.
3. Native Vegetation – For fresh marsh features, criteria 3.A.1; for intermediate marsh and brackish marsh features, criteria 3.B.1.
4. Invasive & Nuisance Vegetation – 4.A. until such time as monitoring responsibilities are transferred to the NFS.

The USACE will be responsible for conducting Baseline and Initial Success Monitoring events and preparing the associated monitoring reports.

The NFS will be responsible for conducting the required monitoring events and preparing the associated monitoring reports for all other required years after the USACE has achieved the initial success criteria listed above. The responsibility for management, maintenance, and monitoring of the non-structural components of the mitigation project (i.e. vegetation) will typically be transferred to the NFS during the first quarter of the year immediately following submittal of the monitoring report that demonstrates attainment of the initial success criteria. Once monitoring responsibilities have been transferred to the NFS, the next monitoring event (Intermediate) should take place 2 growing seasons after Initial Success (Topography 2.A.2 and Native Vegetation 3.A.1 or 3.B.1) has been met. After Intermediate Success Criteria (Topography 2B and Native Vegetation 3.A.2 or 3.B.2) has been met, Long-Term Success Criteria monitoring will be conducted every 5 years throughout the remaining 50-year period of analysis.

In certain cases, it is possible that the marsh mitigation features may be established along with other mitigation features, like swamp or bottomland hardwood habitats, at the same mitigation site. This scenario could require some adjustments to the typical monitoring schedule described above to develop a reasonable and efficient monitoring schedule that covers all the mitigation features. Such adjustments, if necessary, would be made at the time final mitigation plans are generated. This schedule must be in general accordance with the guidance provided above and will be prepared by the USACE and the IET.

If certain success criteria are not achieved, failure to attain these criteria would trigger the need for additional monitoring events not addressed in the preceding paragraphs. The USACE would be responsible for conducting such additional monitoring and preparing the associated monitoring reports in the following instances:

A. For fresh marsh features –
    - If the initial vegetative cover success criteria (3.A.1) are not achieved, a monitoring report will be required for each consecutive year until two sequential annual reports indicate that the applicable vegetative cover criteria have been satisfied. This requirement only exists if planting the marsh mitigation feature is required to meet the success criteria, the USACE would be responsible for the purchase and installation of the required plants.

B. For intermediate and brackish marsh features –
    - If the initial survival criteria for planted species or the initial vegetative cover criterion (3.B.1) are not achieved a monitoring report will be required for each consecutive year until two sequential annual reports indicate that the applicable survival criteria or vegetative cover criteria have been satisfied. The USACE would be responsible for the purchase and installation of supplemental plants needed to attain the success criteria.

C. For all types of marsh features–
    - If initial topographic success criteria (2.A.1 and 2.A.2) are not achieved, the IET would convene to determine whether corrective actions are necessary. If corrective actions are necessary additional surveys and a monitoring report will be required to indicate whether applicable criteria have been satisfied. The USACE would also be responsible for performing the necessary corrective actions.
    - If initial invasive and nuisance species criteria (4.A) are not achieved a monitoring report will be required for each consecutive year until two sequential annual reports indicate that the applicable criteria have been satisfied. The USACE would be responsible for the irradiation activities needed to attain the success criteria.

There could also be cases where failure to attain certain success criteria would trigger the need for additional monitoring events for which the NFS would be responsible:

A. For fresh marsh features –
    - If the native vegetation intermediate success criteria (3.A.2) are not achieved, a monitoring report will be required for each consecutive year

until two sequential annual reports indicate that the success criteria have been satisfied. The Sponsor would also be responsible for the purchase and installation of supplemental plants needed to attain the success criteria.

B. For intermediate and brackish marsh features –
   - If the native vegetation intermediate success criteria (3.B.2) are not achieved, a monitoring report will be required for each consecutive year until two sequential annual reports indicate that the native vegetation intermediate success criteria has been satisfied. The Sponsor would also be responsible for the purchase and installation of supplemental plants needed to attain the success criteria.

C. For all types of marsh features –
   - If the topographic intermediate success criteria (2.B.) are not achieved, the IET would convene to determine whether corrective actions are necessary. If corrective actions are necessary, additional surveys and a monitoring report will be required to indicate whether applicable criteria have been satisfied. The NFS would also be responsible for performing the necessary corrective actions if the IET determines such corrective actions are necessary.
   - If the native vegetation long term success criteria (3.A.3 and 3.B.3) are not achieved, the IET would convene to discuss whether corrective actions would be necessary. If corrective actions are necessary, a monitoring report will be required for each consecutive year following completion of the corrective actions until two sequential annual reports indicate that the native vegetative cover criteria have been attained. The NFS would be responsible for performing the corrective actions, conducting the additional monitoring events, and preparing the associated monitoring reports.
   - If the intermediate and long term invasive and nuisance species criteria (4.A) are not achieved a monitoring report will be required for each consecutive year until two sequential annual reports indicate that the applicable criteria have been satisfied. The NFS would be responsible for the irradiation activities needed to attain the success criteria.

Once monitoring responsibilities have been transferred to the NFS, the NFS will retain the ability to modify the monitoring plan, and the monitoring schedule should this become necessary due to unforeseen events or to improve the information provided through monitoring. Fifteen years following achievement of long-term Success Criteria, the number of monitoring transects and/or quadrats that must be sampled during monitoring events may be reduced substantially if it is clear that mitigation success is proceeding as anticipated. Any significant modifications to the monitoring plan or the monitoring schedule must first be approved by the USACE and the IET.

SECTION 6

Adaptive Management Plan

6.1 FRESH/INTERMEDIATE MARSH

6.1.1 Adaptive Management Planning

Adaptive management planning elements included: 1) development of a Conceptual Ecological Model (CEM), 2) identification of key project uncertainties and associated risks, 3) evaluation of the mitigation projects as a candidate for adaptive management and 4) the identification of potential adaptive management actions (contingency plan) to better ensure the mitigation project meets identified success criteria. The adaptive management plan is a living document and will be refined as necessary as new mitigation project information becomes available.

6.1.1.1 Sources of Uncertainty and Associated Risks

A fundamental tenet underlying adaptive management is decision making and achieving desired project outcomes in the face of uncertainties. There are many uncertainties associated with restoration of the coastal systems. The project delivery team (PDT) identified the following uncertainties during the planning process.

- Climate change, such as relative sea level rise, drought conditions, and variability of tropical storm frequency, intensity, and timing
- Subsidence and water level trends
- Uncertainty relative to achieving ecological success
- Long-term sustainability of project benefits
- Adaptability

6.1.1.2 Adaptive Management Evaluation

The project site was evaluated and planned to develop a project with minimal risk and uncertainty. The items listed below were incorporated into the mitigation project implementation plan and Operation, Maintenance, Repair, Replacement, and Rehabilitation (OMRR&R) plan to minimize project risks.

- Detailed planting guidelines for intermediate marsh
- General monitoring guidelines for project success
- Specified success criteria (i.e., mitigation targets)
- Invasive species control
- Supplementary plantings as necessary (contingency)
- Corrective actions to meet topographic success as required (contingency)

Subsequently, as part of the adaptive management planning effort the project features were re-evaluated against the CEM and sources of uncertainty and risk were identified to determine if there was any need for additional adaptive management actions.

Based on the uncertainties and risks associated with the project implementation the following contingency/adaptive management actions have been identified to be implemented if needed to ensure the required AAHUs are met (Table C9:6-1).

Table C9:6-1. Adaptive Management Actions Marsh

Element	Expected Condition	Potential Issue	Potential Corrective Action
Landscape characteristics	Bathymetry appropriate for sustainable growth of marsh vegetation	Water that is deeper or shallower than ideal conditions for targeted vegetations.	Modify land elevation; marsh renourishment to obtain elevations necessary for marsh establishment and maintenance
Connectivity	Obtain necessary hydrology	Limited water exchange or excessive flooding, wave action or salinity.	Modify channels to obtain necessary connectivity adjust gapping in dikes in the future to maintain sufficient marsh hydrology and connectivity Construction feature to reduce wave and salinity influences on the marsh restoration feature.
Vegetation community composition	Healthy vegetative communities free of invasive species, assuming natural colonization	Invasive species dominance, native species do not establish, poor marsh survival,	Invasive species control, marsh plantings

The USACE would be responsible for the proposed mitigation construction and monitoring until the initial success criteria are met. Initial construction and monitoring would be funded in accordance with all applicable cost-share agreements with the NFS. The USACE would monitor (on a cost-shared basis) the completed mitigation to determine whether additional construction, invasive/nuisance plant species control, and/or plantings are necessary to achieve initial mitigation success criteria. Once the USACE determines that the mitigation has met the initial success criteria, monitoring would be performed by the NFS as part of its OMRR&R obligations. If after meeting initial success criteria, the mitigation fails to meet its intermediate and/or long-term ecological success criteria, the USACE would consult with other agencies and the NFS to determine the appropriate management or remedial actions required to achieve ecological success. The USACE would retain the final decision on whether the project's required mitigation benefits are being achieved and whether or not remedial actions are required. If structural changes are deemed necessary to achieve ecological success, the USACE would implement appropriate adaptive management measures in accordance with the contingency plan and subject to cost-sharing requirements, availability of funding, and current budgetary and other guidance.

List of Acronyms and Abbreviations

AC	Acre
AHHU	Average Annual Habitat Unit
BA	Borrow Area
CEM	Conceptual Ecopolitical Model
CY	Cubic Yards
DNR	Do Not Relocate
EC	Engineering Circular
ER	Engineering Regulation
FT	Feet
GIWW	Gulf Intracoastal Waterway
GPS	Global Positioning System
H	Horizontal
IET	Interagency Environmental Team
LA	Louisiana
Lbs	Pounds
LF	Linear Feet
MCA	Marsh Creation Area
MM/YR	Millimeter per Year
MTG	Morganza to the Gulf
NCC	Notice of Construction Completion
NFS	Non-federal Sponsor
NAVD88	North American Vertical Datum 1988
PDT	Project Delivery Team
PED	Pre-construction Engineering Design
PSI	Pounds per Square Inch
ROM	Rough Order of Magnitude
SY	Square Yard
USACE	United States Army Corps of Engineers
V	Vertical

Mississippi Valley Division,
Regional Planning and Environment Division South

Morganza to the Gulf of Mexico, Louisiana, Hurricane and Storm Damage Risk Reduction Project

Appendix C – Attachment 10 – Wetland Value Assessment Assumptions - BLH and Swamp

November 2025

CONTENTS

SECTION 1

Bottomland Hardwood Forest

1.1 BACKGROUND

Napoleonville and Supreme BLH are two potential mitigation sites to mitigate for bottomland hardwood impacts caused by the Morganza to the Gulf Levee alignment. These sites were selected as potential sites for mitigation because they are both on the flood side, in the coastal zone, in the EPA ecoregions 73N and 73K, have preferred elevations for bottomland hardwoods, next to a large tract of forested habitat, and suitable soil series for bottomland hard reforestation in southeastern Louisiana. Both sites are currently being used for sugarcane production and have typical sugarcane drainage features such as berms, and ditches to prevent flooding of the fields during storm surges. Since, the sites are so similar and within a few miles of each other only one WVA was conducted for both sites.

Mitigation Potential: 0.62

1.2 V1 – SPECIES ASSOCIATION

FWOP:

Since the current land use is a sugarcane field there is no potential habitat value that can be obtained from this. If this project did not exist, more than likely the field will remain in sugarcane production for the next 50 years. Similar assumptions will be made for variable 2, 3, and 5 since they are concerning vegetation over time.

FWP:

Of the total trees initially planted, 60% will be hard mast-producing species and 40% will be soft mast-producing species. Assume this species composition ratio (i.e. 60% of trees are hard mast-producing and 40% are soft mast-producing) will remain static over the entire period of analysis (i.e. remains the same from time of planting throughout all subsequent model target years).

Assume Class 5 is achieved once the planted trees are 10 years old. This class remains the same thereafter (i.e. Class 5 for all subsequent target years). Note that trees will be approximately 1 year old at the time they are initially planted. Thus, Class 5 is achieved 9 years after the time of initial planting.

1.3 V2 - STAND MATURITY

FWOP: See assumption for V1

FWP: Age or average DBH can be used for this variable. Age was selected to be a better representation of habitat value over time. Trees planted will be approximately 1 year old when installed.

1.4 V3 – UNDERSTORY/MIDSTORY (PERCENT COVER)

FWOP: See assumption for V1

FWP:

TY	Assumption
0	Understory=0% // Midstory = 0%
1	Understory = 100% // Midstory = 0%
2	Understory = 100% // Midstory = 10%
8	Understory = 50% // Midstory = 50%
20	Understory = 20% // Midstory = 50%
50	Understory = 35% // Midstory = 30%

1.5 V4 – HYDROLOGY

FWOP: The land currently is conducive to supporting sugarcane production, and has many different drainage features to ensure that the crops do not get flooded, and sheet flow can quickly remove off of the field. Therefore, the flooding duration was selected as temporary, and flow exchange as low.

FWP: To support a more conducive BLH hydrology several shallow swales will be made across the site and leveling of the field will be done. This action will make the site have a much greater flow exchange. Sea level change analysis was performed and showed that the sites hydrology would remain relatively the same over time.

1.6 V5 – FOREST SIZE

FWOP: See assumption for V1

FWP: The mitigation site was not classified as a forest until year 10.

1.7 V6 – SURROUNDING LAND USE

FWP/FWOP: NLCD land cover class 2021 was used for determining surrounding land use in this determination. A 2% increase in urban development was used over time and 2% reduction in forested habitat.

1.8 V7 – DISTURBANCE

FWP/FWOP: NLCD land cover class 2021 was used for determining surrounding land use in this determination.

1.9 WVA RESUTS:

NET CHANGE IN AAHUs DUE TO PROJECT	
A. Future Without Prokect AAHUs =	0.00
B. Future With Prokect AAHUs =	328.86
Net Change (FWP - FWOP) =	**328.86**

SECTION 2

Swamp

2.1 BACKGROUND

Napoleonville and Supreme Swamp are two potential mitigation sites to mitigate for swamp impacts caused by the Morganza to the Gulf Levee alignment. These sites were selected as potential sites for mitigation because they are both on the flood side, in the coastal zone, in the EPA ecoregions 73N and 73 K, have preferred elevations for swamp, next to a large tract of forested habitat, and suitable soil series for swamp in southeastern Louisiana. Both sites are currently being used for sugarcane production and have typical sugarcane drainage features such as berms, and ditches to prevent flooding of the fields during storm surges. Since, the sites are so similar and within a few miles of each other only one WVA was conducted for both sites.

Mitigation Potential: 0.42 AAHUS per acre

2.2 V1 – SPECIES ASSOCIATION

FWOP:

Since the current land use is a sugarcane field there is no potential habitat value that can be obtained from this. If this project did not exist, more than likely the field will remain in sugarcane production for the next 50 years. Similar assumptions will be made for variable 2, and 5 since they are concerning vegetation over time.

FWP:

Of the total trees initially planted, 50% will be Bald Cypress, and the rest will be water tupelo, and some other obligate swamp tree species.

Assume Class 6 is achieved once the planted trees are 10 years old. This class remains the same thereafter (i.e. Class 6 for all subsequent target years). Note that trees will be approximately 1 year old at the time they are initially planted. Thus, Class 6 is achieved 9 years after the time of initial planting.

2.3 V2 - STAND MATURITY

FWOP: See assumption for V1

FWP: Cypress and Tupelo DBH and Basal area overtime were calculated using a growth spreadsheet that uses CRMS tree growth data from the unmanaged swamp forests in the Pontchartrain, Barataria, and Terrebonne Basins.

2.4 V3- HYDROLOGY

FWOP: The land currently is conducive to supporting sugarcane production, and has many different drainage features to ensure that the crops do not get flooded, and sheet flow can quickly remove off of the field. Also, in some areas it is even being impacted by a small drainage pump.

FWP: To support a more conducive Swamp hydrology gaps will dug in the existing ag field berms after 1-2 years of planting and leveling of the field will be done. This action will make the site have a much greater flow exchange. Sea level change analysis was performed and showed that the sites hydrology would remain relatively the same over time.

2.5 V4- SALINITY

FWOP: Nearby CRMS stations were used to assess mean high salinity during the growing season.

FWP: Nearby CRMS stations were used to assess mean high salinity during the growing season.

2.6 V5- FOREST SIZE

FWOP: See assumption for V1

FWP: The mitigation site was not classified as a forest until year 10.

2.7 V6 - SURROUNDING LAND USE

FWP/FWOP: NLCD land cover class 2021 was used for determining surrounding land use in this determination. A 2% increase in urban development was used over time and 2% reduction in forested habitat.

2.8 V7 – DISTURBANCE

FWP/FWOP: NLCD land cover class 2021 was used for determining surrounding land use in this determination.

2.9 WVA RESUTS:

NET CHANGE IN AAHUs DUE TO PROJECT	
A. Future With Project AAHUs =	413.15
B. Future Without Project AAHUs =	0.00
Net Change (FWP - FWOP) =	**413.15**

SECTION 3

List of Acronyms and Abbreviations

BLH	Bottomland Hardwood
EPA	Environmental Protection Agency
FWP	Future With Project
FWOP	Future Without Project
MTG	Morganza to the Gulf
TY	Target Year
WVA	Wetland Value Assessment

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Regional Planning and Environment Division South

Morganza to the Gulf of Mexico, Louisiana, Hurricane and Storm Damage Risk Reduction Project

Appendix C – Attachment 10 – Fresh and Intermediate Marsh Project Information Sheets

November 2025

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SECTION 1

Three Mile Bay Mitigation Site

Construction of the Morganza to the Gulf project including levees and water control structures is expected to impact thousands of acres of coastal marshes. To mitigate for those impacts, several sites are being investigated for use as marsh creation areas. The Three Mile Bay Project Group was evaluated with one WVA for brackish/saline marsh impacts mitigation and details of the WVA process are presented in this project information sheet (PIS). USDA images dated 2023, together with field observations in summer 2024 were used to determine mitigation project construction net benefits. According to USACE, mitigation project construction would begin in 2035, therefore, TY0 (baseline year) would be 2034, and the end of the project life is target year TY50 in 2084. The USACE certified Brackish and Saline Marsh Wetland Value Assessment Marsh Community Model for Civil works (Version 2.0) (WVA Model) was used for this habitat analysis.

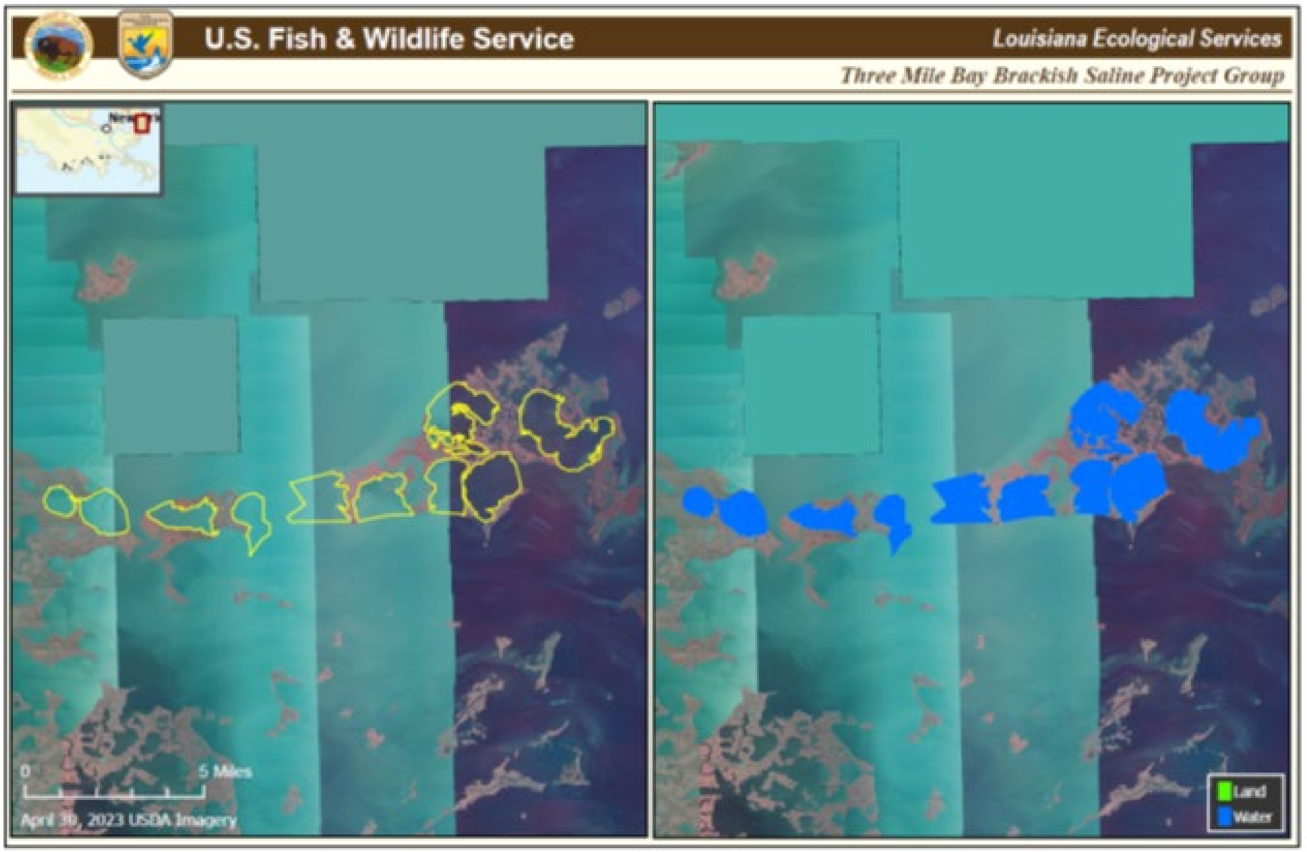

Figure C10:1-1. Map of Brackish and Saline Marsh Mitigation Project – Three Mile Bay

1.1 FIELD DATA COLLECTION

WVA field data collection took place on June 24, 2024, within the area delineated by polygons that make up the Three Mile Bay WVA (Figures C10:1-1 and C10:2-1). Transects were established across the marsh creation areas (MCA) that attempted to capture a representative portion of the project area. A soil rake marked in tenths of feet was used to measure water depth along the transect and to document the presence/absence of submerged aquatic vegetation (SAV) approximately every 100 ft. If depths exceeded the length of the rake (4.5 ft), a stadia rod was used, or the depth was noted as greater than 4.5 ft. The dominant species of emergent vegetation were noted at the start and end of each transect in order to confirm marsh type, and the transect start and end time were recorded for use in water depth correction.

1.2 MARSH WVA VARIABLE DETERMINATIONS

1.2.1.1 Target Year selection:

FWOP: Much of the project area is open water and will remain open water through TY50; therefore, only TY1, TY40, and TY50, were included.

FWP: Along with TY1, TY40, and TY50 from FWOP, we included TYs 3, 5, 6, as recommended in the HSDRSS 2012 assumptions guidance. TYs 1-6 are assumed to represent major changes in the area. TY1 is the first year of project construction when the area is filled with material to supratidal conditions with no inputs from the surrounding environment (0% functional marsh). By TY3 the created marsh platform is still considered, in part, non-functioning marsh (15%) even if retention dikes may have been gapped or degraded. By TY5 the created marsh is 50% functional. AT TY6 the marsh is now fully functional (100%), and it is assumed that SAV (V2) and interspersion (V3) would become more optimal than TY5.

1.3 V1 PERCENT MARSH

1.3.1.1 TY0 conditions:

Current acres of land/water within each MCA were classified in ArcGIS Pro based on 2023 USDA imagery. The percent of existing marsh acres within each MCA were calculated and entered as the TY0 (Target year) value for V1 (Table C10:1-1.).

1.3.1.2 TY 1-50 conditions:

The Marsh Impact Mitigation (MIMs) 3.11 spreadsheet is used to project marsh and water acres and percentages in the Future Without Project (FWOP) and Future With Project (FWP) TYs. The main inputs into the MIMs 3.11 spreadsheet are land loss, SLC, subsidence, and accretion.

1.3.1.3 Land loss:

Acres of land within the Coastal Master Plan (CMP) Integrated Compartment model (ICM) polygons were calculated by USGS (1985-2020) (Figure C10:1-2). ICM polygons were selected based on proximity to the MCA location. Compartment 67 was chosen for the Three Mile Bay WVA. Future land loss was calculated using a linear regression of historic land acres from selected ICM polygons (1985 – 2020) (Figure C10:1-3). The equation of each regression line along with the TY0 marsh and water acres was entered in the FWOP and FWP TYs to project land loss.

1.3.1.4 SLC:

Sea level change equations from the USACE Engineering Regulation (ER) 1100-2-8162 are used for all three scenarios in the MIMs 3.11 spreadsheet. The equation for medium SLC, which was used for the WVA analysis, is below. See ER 1100-2-8162 for more information.

$E(t) = 0.0017t + bt^2$

where *E(t)* is the eustatic sea level change, in meters, as a function of *t*. The Eustatic sea level change for the medium sea level change is -1.7 mm/year. *b* is a constant for the modified National Research Council Curve I, which is 2.71×10^{-5}.

1.3.1.5 Accretion data:

Mean accretion data were obtained from CRMS sites in the vicinity (mean of CRMS 4572, 4596, and 0003). Feldspar data from each CRMS site were examined, and feldspar set series with the greatest historical consistency were selected. The selected series were averaged and applied to the model.

1.3.1.6 Subsidence:

Totals Subsidence (TS) was calculated using the sum of Deep Subsidence (DS) and Shallow Subsidence (SS).

DS values were obtained from the Louisiana 2023 CMP Data Access Portal (https://mpdap.coastal.la.gov/dataset/shallow-subsidence#map=12.57/29.95051/-93.21243&geography=extraction_point&time=annual&year=52&scenario=A&selected=QAQC2101-QAQC2127&chart=2-52). SS values were calculated using the following formula (SS= Mean CRMS Accretion - mean surface elevation change). Surface Elevation Change (SEC) data was obtained from CRMS RSET data (mean of CRMS 4572, 4596, 1069, and 003). Mean accretion and TS were both used as inputs into the MIMS RSLC tab to estimate the effects of RSLC on the rate of land loss in the project area.

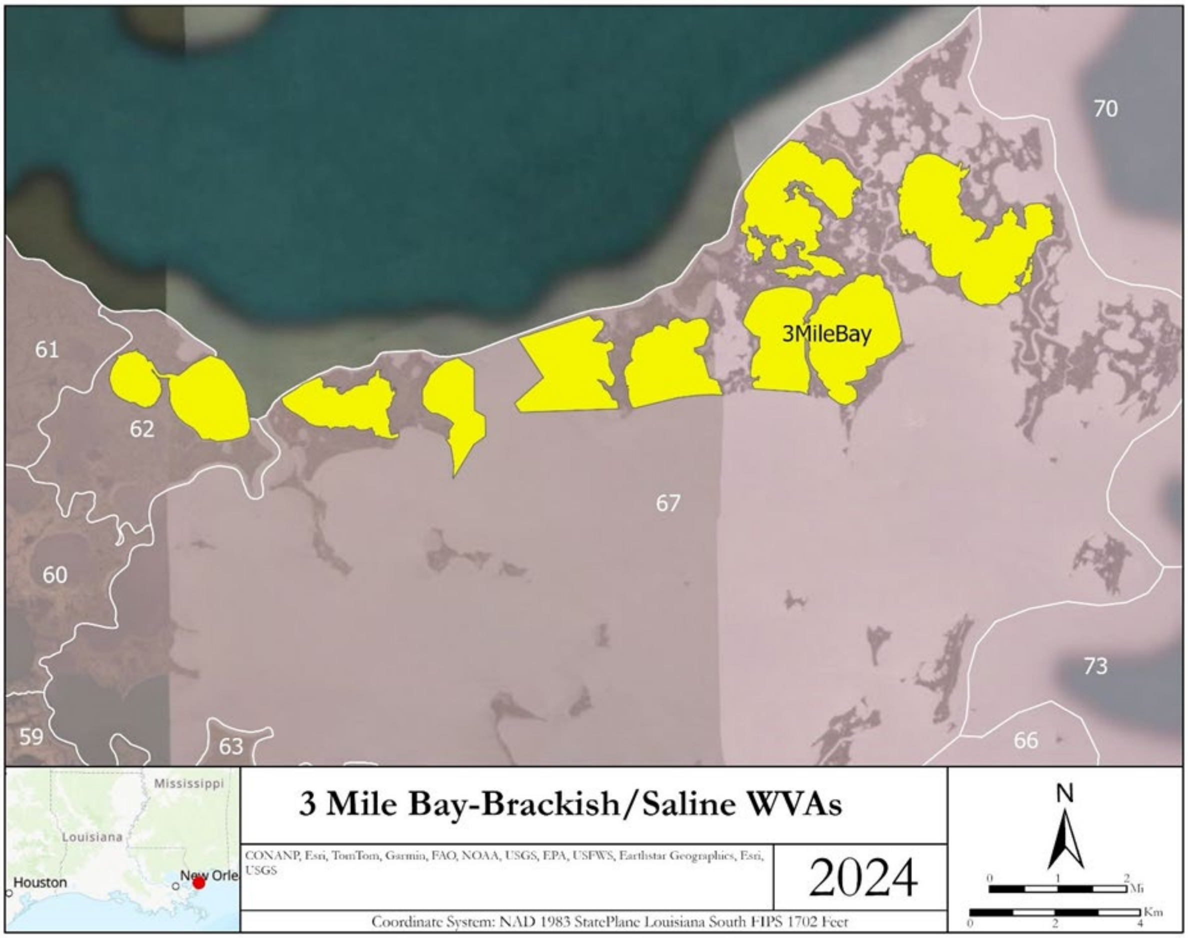

Figure C10:1-2. Hydro Compartment 67 from LA state Master Plan/USGS and Three Mile Bay WVA area

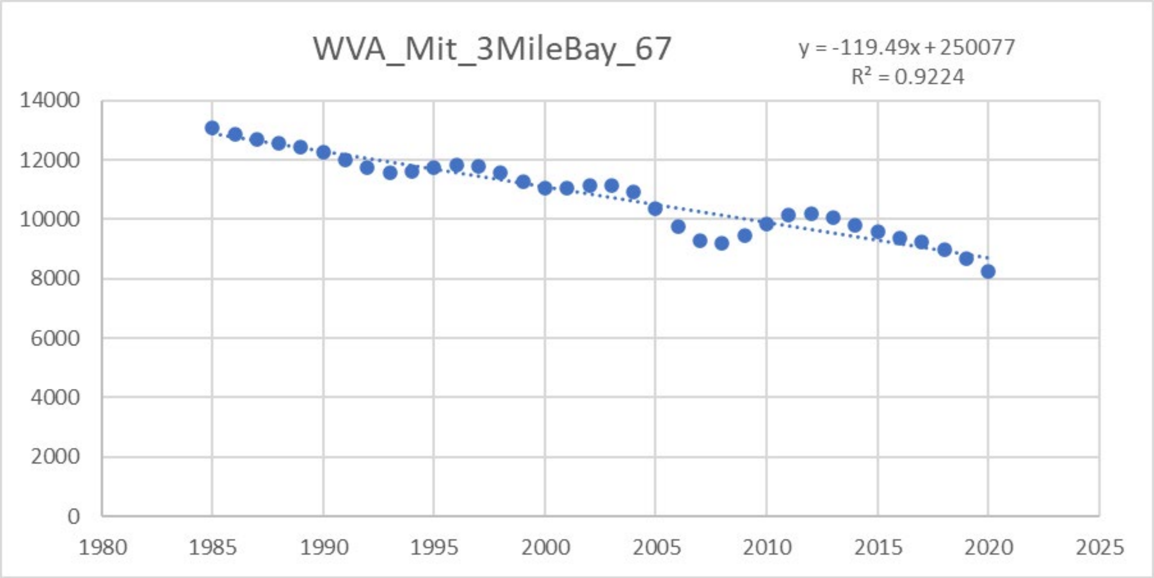

Figure C10:1-3 Acres of marsh each year from 1985 to 2020 with regression line.

Table C10:1-1. Marsh percentages under the Intermediate SLC scenario for FWOP and FWP TY 0-50

Target Year	FWOP Percent Marsh	FWP Percent Marsh
0	0.7%	1%
1	0.7%	1%
3	N/A	15%
5	N/A	50%
6	N/A	100%
40	0%	N/A
50	0%	48.6%

1.4 V2 PERCENT SUBMERGED AQUATIC VEGETATION (SAV)

The number of samples with SAV present was divided by the total number of samples for all of the transects combined within the WVA area to give the percentage of SAV coverage. That number is used as the TY0 value. No SAV was detected in the Three Mile Bay project area and thus, baseline TY0 is 0% (Table C10:1-2). Following the 2012 HSDRSS guidelines, it was assumed that no SAV would occur in other TYs for either FWOP or FWP.

Table C10:1-2. SAV percentages with future values estimated using HSDRSS guidelines

Target Year	FWOP Percent SAV	FWP Percent SAV
0	0%	0%
1	0%	0%
3	N/A	0%
5	N/A	0%
6	N/A	0%
40	0%	N/A
50	0%	0%

1.5 V3 INTERSPERSION

Interspersion was estimated for TY0 by visually comparing the project area marsh condition in GIS to the guidance images in the WVA Model documentation. When the project contains multiple areas with very different interspersion values, we may report multiple classes with the corresponding percentage of the project area for which they apply. For FWOP we assume that V3 will not change because for mitigation project areas the interspersion is usually already Class 5 due to extensive open water. For FWP, assumptions for projections of interspersion in TYs 1-6 relied on the 2012 HSDRSS along with consideration for the percentage of marsh indicated by V1. Interspersion increases for TY50 because of the projected loss of almost two thirds of the land existing in TY6 and the known exposure to wave energy (Table C10:1-3.).

Table C10:1-3. Interspersion values estimated using GIS and HSDRSS guidelines for TY0-TY50

Target Year	FWOP	FWP
0	Class 5 - 100%	Class 5 - 100%
1	Class 5 - 100%	Class5 - 100%
3	N/A	Class 3 – 100%
5	N/A	Class 3 – 50% Class 2 – 50%
6	N/A	Class 2 – 100%
40	Class 5 - 100%	N/A
50	Class 5 - 100%	Class 3 – 50% Class 4 – 50%

1.6 V4 PERCENT SHALLOW OPEN WATER

Water depths were corrected using data from the USGS gauge in Mississippi Sound near Grand Pass (300722089150100) to account for variability at the time of sampling due to tides, weather, etc. To calculate a correction factor, the water level at the start and end of sampling was averaged, and this value was subtracted from the 10-year mean water level. This correction factor was subtracted from all the water depths collected in the field to get the adjusted water depth value. The number of adjusted water depth values that were equal to 1.5 feet or less were divided by the total number of water depth samples. That percentage was recorded in the WVA model as the value of Shallow Open Water (SOW) for TY0. For subsequent TYs, the amount of RSLC calculated in the MIMs 3.11 (V1 earlier) spreadsheet was applied to the TY0 water depths and the percentage of shallow open water was recalculated. For FWP, we assumed that initially 100% of open water formed after marsh creation would be less than or equal to 1.5 feet. Over time some of that shallow water would become deeper. Based on the 2012 HSDRSS guidelines that 15% of shallow open water will become deep water by TY50, we are assuming that 20% shallow open water will become deep by TY50 (Table C10:1-4.).

Table C10:1-4. Percentage of SOW from TY0-50 based on MIMS 3.11 calculations and HSDRSS guidelines

Target Year	FWOP Percent SOW	FWP Percent SOW
0	0%	0%
1	0%	100%
3	N/A	100%
5	N/A	100%
6	N/A	100%
40	0%	N/A
50	0%	80%

1.7 V5 AVERAGE ANNUAL SALINITY

Information from the Louisiana 2023 CMP Data Access Portal (https://mpdap.coastal.la.gov/dataset/salinity#map=12.57/29.95051/-93.21243&geography=extraction_point&aggregate=mean&time=annual&year=52&scenario=A&selected=QAQC2101-QAQC2127&chart=2-52) was used to determine the average annual salinity projections for the project area for all TYs based on the CMP ICM. The model provides a 52-year projection that begins in 2019. Projected annual mean salinity for CRMS station(s) near the project area were downloaded and charted. A linear regression was performed on the data, and the resulting values from the regression were used as the annual salinity mean values for the appropriate target years (Table C10:1-5.). For Three Mile Bay, the project area is located between two CRMS stations with very different annual average salinities because of their position along a salinity gradient. One station is influenced by the output of the Pearl River, while the other one is closer to the Gulf of Mexico. To better represent the salinity for the majority of the project area, we averaged the projected average annual salinities for each station and then used that average for the regression (Figure C10:1-4).

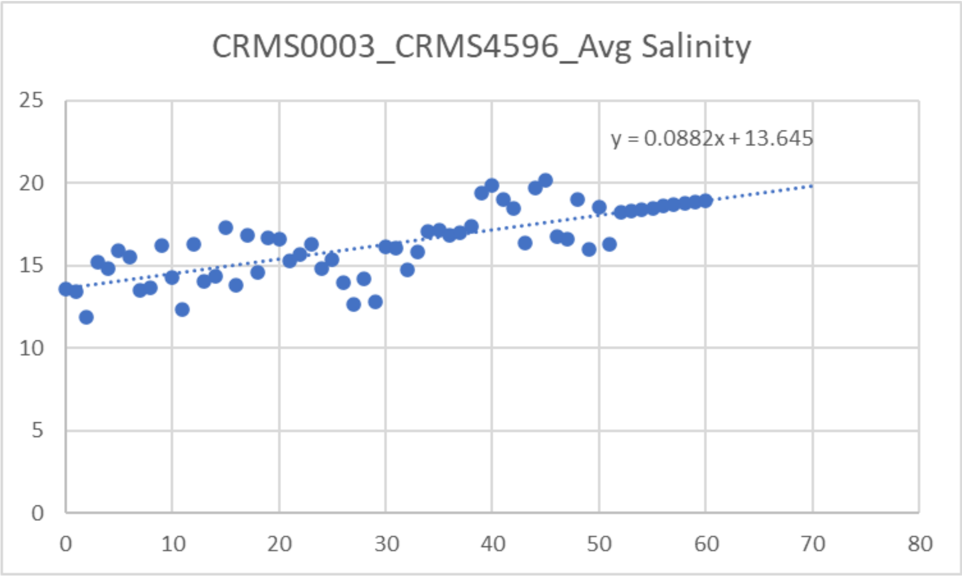

Figure C10:1-4. Average of projected average annual salinities for CRMS0003 and CRMS4596 stations with regression line.

Table C10:1-5. Mean annual salinity values based on CMP ICM salinity regression equation

Target Year	FWOP	FWP
0	14.2	14
1	14.3	14.3
3	N/A	14.4
5	N/A	14.6
6	N/A	14.7
40	19.5	N/A
50	19.5	19.5

1.8 V6 ACCESS VALUE

The V6 Calculator tab in the model was used to assign structure ratings to all impediments to water flow in or out of the WVA area to get a total access value from 1 (open system) to 0.0001 (solid plug; no water flow). The Three Mile Bay site is an open system with no impediments to water and materials exchange. Thus, V6 is 1.0 for all TYs under FWOP. HSDRSS 2012 assumptions for marsh creation were followed for FWP. Access value in FWP is assumed to be 0.0001 for TYs 1-3 due to retention dikes, etc. and 1 by TY 5 when dikes have been gapped or degraded and water is able to flow through the system (Table C10:1-6.).

Table C10:1-6. Total access values based on field/desktop observations and HSDRSS guidelines

Target Year	FWOP	FWP
0	1	1
1	1	0.0001
3	N/A	0.0001
5	N/A	1
6	N/A	1
40	1	N/A
50	1	1

1.9 WVA RESULTS:

Table C10:1-7. WVA Resultant AAHUs for Three Mile Bay Project Site.

TOTAL BENEFITS IN AAHUs DUE TO PROJECT	
A. Emergent Marsh Habitat Net AAHUs =	3948.14
B. Open Water Habitat Net AAHUs =	-2800.96
Net Benefits= (3.5xEMAAHUs+OWAAHUs)/4.5	2448.34

SECTION 2

Isle De Jean Charles Mitigation Site

Construction of the Morganza to the Gulf project including levees and water control structures is expected to impact thousands of acres of coastal marshes. To mitigate for those impacts, several sites are being investigated for use as marsh creation areas (MCA). The Isle de Jean Charles Project Group was evaluated with five separate WVAs for brackish/saline marsh impacts mitigation and details of the WVA process are presented in this project information sheet (PIS). USDA images dated 2023, together with field observations in summer 2024 were used to determine mitigation project construction net benefits. According to USACE, mitigation project construction would begin in 2035, therefore, TY0 (baseline year) would be 2034, and the end of the project life is target year TY50 in 2084. The USACE certified Brackish and Saline Marsh Wetland Value Assessment Marsh Community Model for Civil works (Version 2.0) (WVA Model) was used for this habitat analysis.

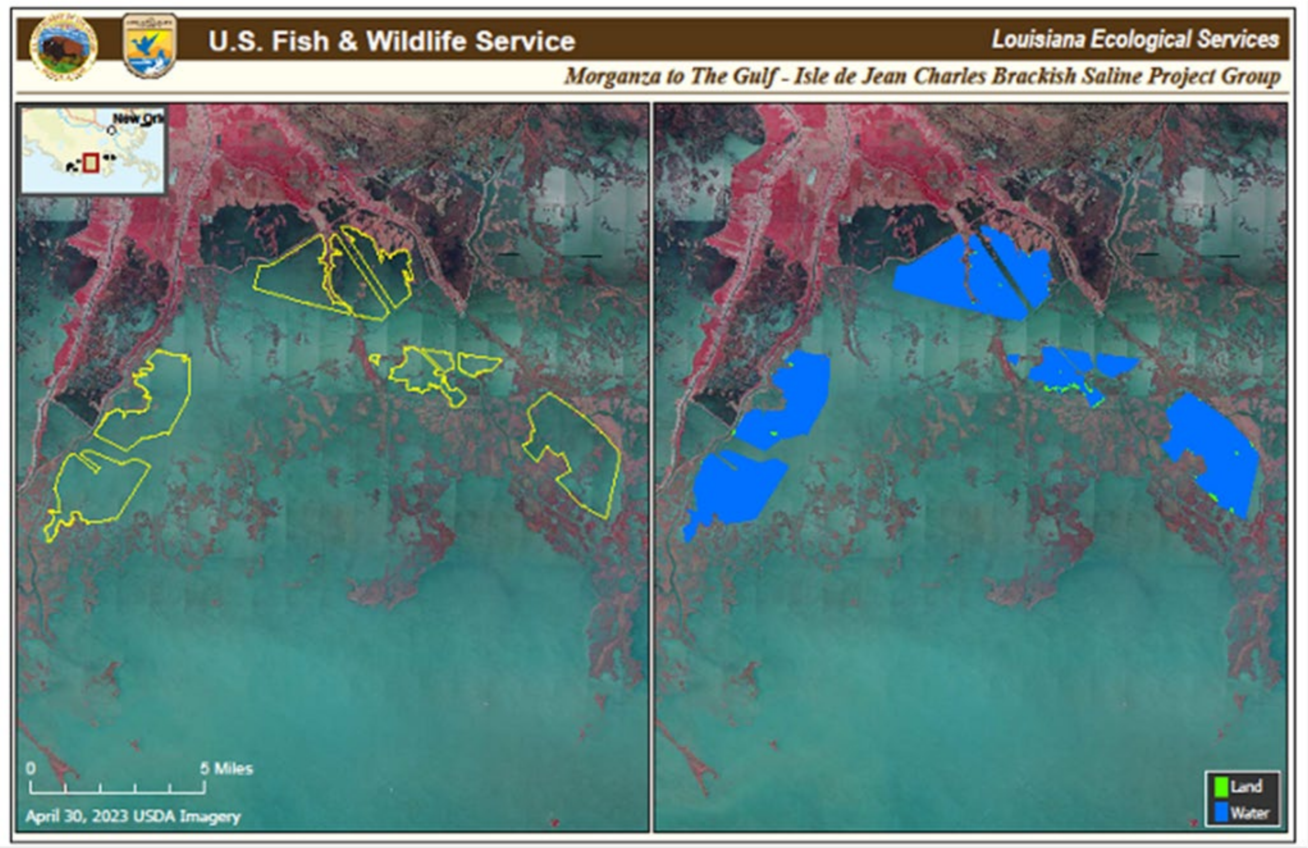

Figure C10:2-1. Map of Brackish and Saline Marsh Mitigation Project – Isle de Jean Charles.

2.1 FIELD DATA COLLECTION

WVA field data collection was conducted within the area delineated by polygons that make up the Isle de Jean Charles WVA areas (East Lower 540, East Middle 509, East Upper 1 711, East Upper 2 512, West 703) between June 24-26, 2024 (Figures C10:2-1 and C10:2-2). Transects were established across the MCAs that attempted to capture a representative portion of the project area. A soil rake marked in tenths of feet was used to measure water depth and to document the presence/absence of submerged aquatic vegetation (SAV) approximately every 100 ft. If depths exceeded the length of the rake (4.5 ft) the depth was noted as over 4 ft. The dominant species of emergent vegetation were noted at the start and end of each transect in order to confirm marsh type, and the transect start and end time were recorded for use in water depth correction.

2.2 MARSH WVA VARIABLE DETERMINATIONS

2.2.1.1 Target Year selection:

FWOP: Much of the project area is open water and will remain open water through TY50; therefore, only TY1 and TY50, the start and end of the project, were included.

FWP: Along with TY1 and TY50 from FWOP, we included TYs 3, 5, 6, as recommended in the HSDRSS 2012 assumptions guidance. TYs 1-6 are assumed to represent major changes in the area. TY1 is the first year of project construction when the area is filled with material to supratidal conditions with no inputs from the surrounding environment (0% functional marsh). By TY3 the created marsh platform is still considered, in part, non-functioning marsh (15%) even if retention dikes may have been gapped or degraded. By TY5 the created marsh is 50% functional. AT TY6 the marsh is now fully functional (100%), and it is assumed that SAV (V2) and interspersion (V3) would become more optimal than TY5.

2.3 V1 PERCENT EMERGENT MARSH

2.3.1.1 TY0 conditions:

Current acres of land/water within each MCA were classified in ArcGIS Pro based on 2023 USDA imagery (Figure C10:2-1). The percent of existing marsh acres within each MCA were calculated and entered as the TY0 (Target year) value for V1 (Tables C10:2-1 through C10:2-5).

2.3.1.2 TY 1-50 conditions:

The Marsh Impact Mitigation (MIMs) 3.11 spreadsheet is used to project marsh and water acres and percentages in the Future Without Project (FWOP) and Future With Project (FWP) TYs. The main inputs into the MIMs 3.11 spreadsheet are land loss, SLC, subsidence, and accretion.

2.3.1.3 Land loss:

Acres of land within the Coastal Master Plan (CMP) Integrated Compartment model (ICM) polygons were calculated by USGS (1985-2020) (Figure C10:2-1). ICM polygons were selected based on proximity to the MCA location as follows: Compartment 540 was chosen for the East Lower WVA, compartment 509 for the East Middle WVA, compartment 711 for the East Upper 1 WVA, compartment 512 for the East Upper 2 WVA, and compartment 703 for the West WVA. Future land loss was calculated using a linear regression of historic land acres from the selected ICM polygon (1985 – 2020) (Figure C10:2-2). The equation of each regression line along with the TY0 marsh and water acres was entered in the FWOP and FWP TYs to project land loss.

2.3.1.4 SLC:

Sea level change equations from the USACE Engineering Regulation (ER) 1100-2-8162 are used for all three scenarios in the MIMs 3.11 spreadsheet. The equation for medium SLC, which was used for the WVA analysis, is below. See ER 1100-2-8162 for more information.

E(t) = 0.0017t + bt2

where E(t) is the eustatic sea level change, in meters, as a function of t. The Eustatic sea level change for the medium sea level change is -1.7 mm/year. b is a constant for the modified National Research Council Curve I, which is 2.71 x 10-5.

2.3.1.5 Accretion data:

Mean accretion data were obtained from CRMS sites in the vicinity (mean of CRMS 3296, 338, 341, and 336). Feldspar data from each CRMS site were examined, and feldspar set series with the greatest historical consistency were selected. The selected series were averaged and applied to the model.

2.3.1.6 Subsidence:

Totals Subsidence (TS) was calculated using the sum of Deep Subsidence (DS) and Shallow Subsidence (SS).

DS values were obtained from the Louisiana 2023 CMP Data Access Portal (https://mpdap.coastal.la.gov/dataset/shallow-subsidence#map=12.57/29.95051/-93.21243&geography=extraction_point&time=annual&year=52&scenario=A&selected=QAQC2101-QAQC2127&chart=2-52). SS values were calculated using the following formula (SS= Mean CRMS Accretion - mean surface elevation change). Surface Elevation Change (SEC) data was obtained from CRMS RSET data (mean of CRMS 3296, 338, 341, and 336). Mean accretion and TS were both used as inputs into the MIMS RSLC tab to estimate the effects of RSLC on the rate of land loss in the project area.

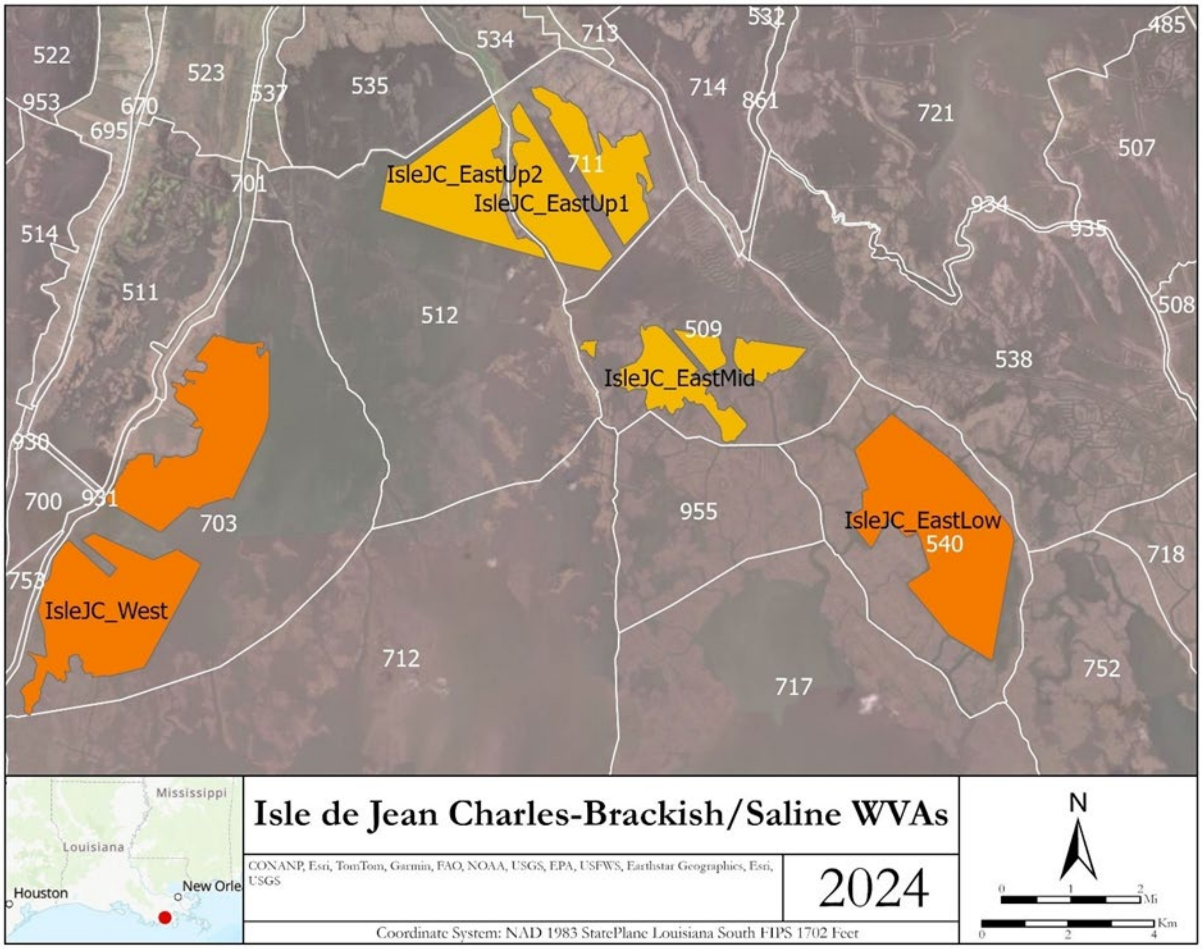

Figure C10:2-2. ICM Compartments 703, 512, 711, 509, 540 from LA state Master Plan/USGS and Isle de Jean Charles: West 703, East Upper 2 512, East Upper 1 711, East Middle 509, and East lower 540 WVA areas.

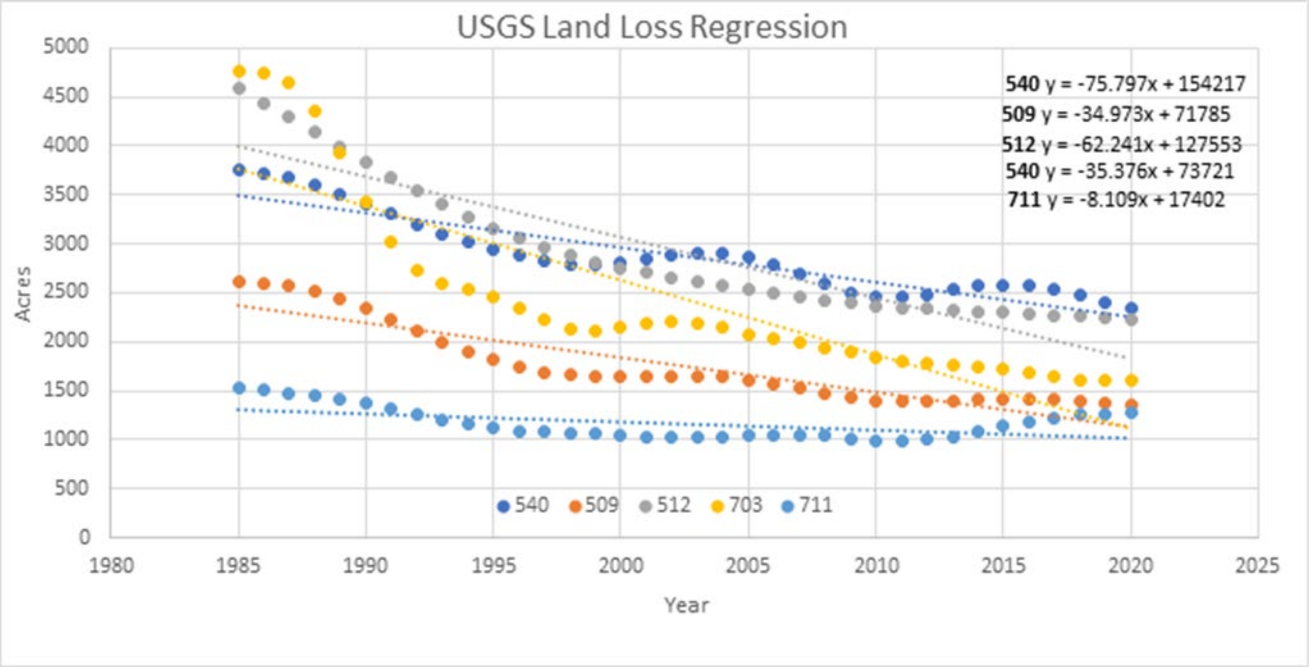

Figure C10:2-3 Isle de Jean Charles acres of marsh each year from 1985 to 2020 with regression line

Table C10:2-1. Isle de Jean Charles East Lower 540 marsh percentages under the Intermediate SLC scenario for FWOP and FWP TY 0-50

Target Year	FWOP Percent Marsh	FWP Percent Marsh
0	7.9%	8%
1	7.7%	7.8%
3	N/A	20.8%
5	N/A	51%
6	N/A	94.1%
35	0%	N/A
50	0%	36.4%

Table C10:2-2. Isle de Jean Charles East Middle 509 marsh percentages under the Intermediate SLC scenario for FWOP and FWP TY 0-50

Target Year	FWOP Percent Marsh	FWP Percent Marsh
0	1.3%	1%
1	1.2%	1.2%
3	N/A	15.4%
5	N/A	47.9%
6	N/A	93.3%
14	0%	N/A
50	0%	21%

Table C10:2-3. Isle de Jean Charles East Upper 1 711 marsh percentages under the Intermediate SLC scenario for FWOP and FWP TY 0-50

Target Year	FWOP Percent Marsh	FWP Percent Marsh
0	5.4%	5%
1	5.3%	5.3%
3	N/A	19.2%
5	N/A	51.2%
6	N/A	97%
50	1.2%	54.5%

Table C10:2-4. Isle de Jean Charles East Upper 2 512 marsh percentages under the Intermediate SLC scenario for FWOP and FWP TY 0-50

Target Year	FWOP Percent Marsh	FWP Percent Marsh
0	1.5%	2%
1	1.4%	1.4%
3	N/A	15.4%
5	N/A	47.7%
6	N/A	93.4%
11	0%	N/A
50	0%	17.9%

Table C10:2-5. Isle de Jean Charles East West 703 marsh percentages under the Intermediate SLC scenario for FWOP and FWP TY 0-50

Target Year	FWOP Percent Marsh	FWP Percent Marsh
0	0%	0%
1	0%	0%
3	N/A	14.4%
5	N/A	41.7%
6	N/A	92.7%
50	0%	0%

2.4 V2 PERCENT SUBMERGED AQUATIC VEGETATION

The number of samples with SAV present was divided by the total number of samples for all of the transects combined within the WVA area to give the percentage of SAV coverage. That number is used as the TY0 value. We detected no SAV in any of the Isle de Jean Charles WVA areas so TY0 is 0% for all (Tables C10:2-2 to C10:2-5). Following the 2012 HSDRSS guidelines, it was assumed that no SAV would occur in other TYs for either FWOP or FWP (Tables C10:2-6 to C10:2-10).

Table C10:2-6. Isle de Jean Charles East Lower 540 SAV percentages with future values estimated using HSDRSS guidelines

Target Year	FWOP Percent SAV	FWP Percent SAV
0	0%	0%
1	0%	0%
3	N/A	0%
5	N/A	0%
6	N/A	0%
35	0%	N/A
50	0%	0%

Table C10:2-7. Isle de Jean Charles East Middle 509 SAV percentages with future values estimated using HSDRSS guidelines

Target Year	FWOP Percent SAV	FWP Percent SAV
0	0%	0%
1	0%	0%
3	N/A	0%
5	N/A	0%
6	N/A	0%
14	0%	N/A
50	0%	0%

Table C10:2-8. Isle de Jean Charles East Upper 1 711 SAV percentages with future values estimated using HSDRSS guidelines

Target Year	FWOP Percent SAV	FWP Percent SAV
0	0%	0%
1	0%	0%
3	N/A	0%
5	N/A	0%
6	N/A	0%
50	0%	0%

Table C10:2-9. Isle de Jean Charles East Upper 2 512 SAV percentages with future values estimated using HSDRSS guidelines

Target Year	FWOP Percent SAV	FWP Percent SAV
0	0%	0%
1	0%	0%
3	N/A	0%
5	N/A	0%
6	N/A	0%
11	0%	N/A
50	0%	0%

Table C10:2-10. Isle de Jean Charles West 703 SAV percentages with future values estimated using HSDRSS guidelines

Target Year	FWOP Percent SAV	FWP Percent SAV
0	0%	0%
1	0%	0%
3	N/A	0%
5	N/A	0%
6	N/A	0%
50	0%	0%

2.5 V3 INTERSPERSION

Interspersion was estimated for TY0 by visually comparing the project area marsh condition in GIS to the guidance images in the WVA Model documentation. When the project contains multiple areas with very different interspersion values, we may report multiple classes with the corresponding percentage of the project area for which they apply. For FWOP we assume that V3 will not change because for mitigation project areas the interspersion is usually already Class 5 due to extensive open water. For FWP, assumptions for projections of interspersion in TYs 1-6 relied on the 2012 HSDRSS along with consideration for the percentage of marsh indicated by V1 (Tables C10:2-11 to C10:2-15).

Isle de Jean Charles East Lower 540: interspersion increases somewhat for TY50 because of the projected loss of about 75% of the land existing in TY6 and protection from wave energy (Table C10:2-11).

Isle de Jean Charles East Middle 509: interspersion increases substantially for TY50 because of the projected loss of over 95% of the land existing in TY6 even with protection from wave energy (Table C10:2-12).

Isle de Jean Charles East Upper 1 711: interspersion increases somewhat for TY50 because of the projected loss of about 50% of the land existing in TY6 and some protection from wave energy Table C10:2-13).

Isle de Jean Charles East Upper 2 512: interspersion increases substantially for TY50 because of the projected loss of nearly 100% of the land existing in TY6 and minimal protection from wave energy Table C10:2-14).

Isle de Jean Charles West 703: interspersion increases substantially for TY50 because of the projected loss of 100% of the land existing in TY6 and minimal protection from wave energy (Table C10:2-15).

Table C10:2-11. Isle de Jean Charles East Lower 540 interspersion values estimated using GIS and HSDRSS guidelines for TY0-TY50.

Target Year	FWOP	FWP
0	Class 3 - 25% Class 5-75%	Class 3 - 25% Class 5-75%
1	Class 3 - 25% Class 5-75%	Class 5 - 100%
3	N/A	Class 3 – 100%
5	N/A	Class 3 – 50% Class 2 – 50%
6	N/A	Class 2 – 100%
35	Class 5 - 100%	N/A
50	Class 5 - 100%	Class 3 – 25% Class 4 – 75%

Table C10:2-12. Isle de Jean Charles East Middle 509 interspersion values estimated using GIS and HSDRSS guidelines for TY0-TY50.

Target Year	FWOP	FWP
0	Class 5 - 100%	Class 5 - 100%
1	Class 5 - 100%	Class5 - 100%
3	N/A	Class 3 – 100%
5	N/A	Class 3 – 50% Class 2 – 50%
6	N/A	Class 2 – 100%
14	Class 5 - 100%	N/A
50	Class 5 - 100%	Class 4 – 100%

Table C10:2-13. Isle de Jean Charles East Upper 1 711 interspersion values estimated using GIS and HSDRSS guidelines for TY0-TY50.

Target Year	FWOP	FWP
0	Class 5 - 80% Class 3 – 20%	Class 5 - 80% Class 3 – 20%
1	Class 5 - 80% Class 3 – 20%	Class 5 - 100%
3	N/A	Class 3 – 100%

5	N/A	Class 3 – 50% Class 2 – 50%
6	N/A	Class 2 – 100%
50	Class 5 - 85% Class 3 – 15%	Class 3 – 50% Class 4 – 50%

Table C10:2-14. Isle de Jean Charles East Upper 2 512 interspersion values estimated using GIS and HSDRSS guidelines for TY0-TY50.

Target Year	FWOP	FWP
0	Class 5 - 100%	Class 5 - 100%
1	Class 5 - 100%	Class5 - 100%
3	N/A	Class 3 – 100%
5	N/A	Class 3 – 50% Class 2 – 50%
6	N/A	Class 2 – 100%
11	Class 5 - 100%	N/A
50	Class 5 - 100%	Class 5 – 100%

Table C10:2-15. Isle de Jean Charles West 703 interspersion values estimated using GIS and HSDRSS guidelines for TY0-TY50.

Target Year	FWOP	FWP
0	Class 5 - 100%	Class 5 - 100%
1	Class 5 - 100%	Class5 - 100%
3	N/A	Class 3 – 100%
5	N/A	Class 3 – 50% Class 2 – 50%
6	N/A	Class 2 – 100%
50	Class 5 - 100%	Class 5 – 100%

2.6 V4 PERCENT SHALLOW OPEN WATER

Water depths for Isle de Jean Charles Project Group were corrected using data from the USGS gauge "Bayou Grand Caillou at Dulac, LA - 07381324" to account for variability at the time of sampling due to tides, weather, etc. To calculate a correction factor, the water level at the start and end of sampling was averaged, and this value was subtracted from the 10-year mean water level. This correction factor was subtracted from all the water depths collected in the field to get the adjusted water depth value. The number of adjusted water depth values that were equal to 1.5 feet or less were divided by the total number of water depth samples. That percentage was recorded in the WVA model as the value of Shallow Open Water (SOW) for TY0. For subsequent TYs, the amount of RSLC calculated in the MIMs 3.11 (V1 earlier) spreadsheet was applied to the TY0 water depths and the percentage of shallow open water was recalculated. For FWP, we assumed that initially 100% of open water formed after marsh creation would be less than or equal to 1.5 feet. Over time some of that shallow water would become deeper. Based on the 2012 HSDRSS guidelines that 15% of shallow open water will become deep water by TY50, we are assuming that 20% shallow open water will become deep by TY50 (Tables C10:2-16 to C10:2-20).

Table C10:2-16. Isle de Jean Charles East Lower 540 percentage of SOW from TY0-50 based on MIMS 3.11 calculations and HSDRSS guidelines.

Target Year	FWOP Percent SOW	FWP Percent SOW
0	1%	1%
1	1%	100%
3	N/A	100%
5	N/A	100%
6	N/A	100%
35	0%	N/A
50	0%	80%

Table C10:2-17. Isle de Jean Charles East Middle 509 percentage of SOW from TY0-50 based on MIMS 3.11 calculations and HSDRSS guidelines.

Target Year	FWOP Percent SOW	FWP Percent SOW
0	1%	1%
1	1%	100%
3	N/A	100%
5	N/A	100%
6	N/A	100%
14	0%	N/A
50	0%	80%

Table C10:2-18. Isle de Jean Charles East Upper 1 711 percentage of SOW from TY0-50 *based on MIMS 3.11 calculations and HSDRSS guidelines.*

Target Year	FWOP Percent SOW	FWP Percent SOW
0	3%	3%
1	3%	100%
3	N/A	100%
5	N/A	100%
6	N/A	100%
50	0%	80%

Table C10:2-19. Isle de Jean Charles East Upper 2 512 percentage of SOW from TY0-50 based on MIMS 3.11 calculations and HSDRSS guidelines.

Target Year	FWOP Percent SOW	FWP Percent SOW
0	0%	0%
1	0%	100%
3	N/A	100%
5	N/A	100%
6	N/A	100%
11	0%	N/A
50	0%	80%

Table C10:2-20. Isle de Jean Charles West 703 percentage of SOW from TY0-50 based on MIMS 3.11 calculations and HSDRSS guidelines.

Target Year	FWOP Percent SOW	FWP Percent SOW
0	1%	1%
1	0%	100%
3	N/A	100%
5	N/A	100%
6	N/A	100%
50	0%	80%

2.7 V5 AVERAGE GROWING SEASON SALINITY

Information from the Louisiana 2023 CMP Data Access Portal (https://mpdap.coastal.la.gov/dataset/salinity#map=12.57/29.95051/-

93.21243&geography=extraction_point&aggregate=mean&time=annual&year=52&scenario=A&selected=QAQC2101-QAQC2127&chart=2-52) was used to determine the average annual salinity projections for the project area for all TYs based on the CMP ICM. The model provides a 52-year projection that begins in 2019. Projected annual mean salinity data for the CRMS stations near the WVA project areas were downloaded and charted (Figures C10:2-8 to C10:2-12) A linear regression was performed on the data, and the resulting values from the regression line were used as the annual salinity mean values for the appropriate target years (Tables C10:2-21 to C10:2-25).

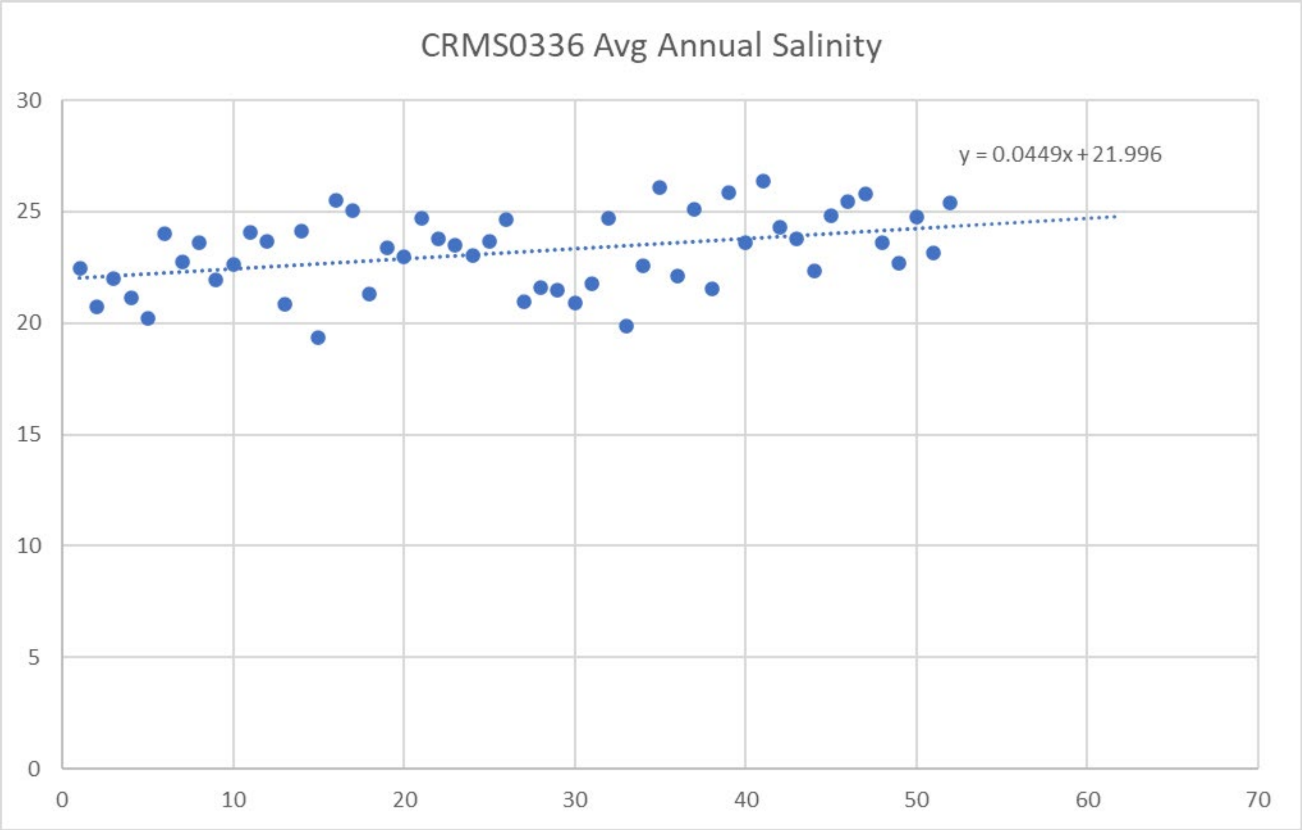

Figure C10:2-4. Projected average annual salinities for CRMS0336 station with regression line.

Table C10:2-21. Mean annual salinity values for Isle de Jean Charles East Lower 540 based on CMP ICM CRMS0336 salinity regression equation

Target Year	FWOP	FWP
0	22.3	22
1	22.3	22.3
3	N/A	22.4

5	N/A	22.5
6	N/A	22.5
35	24.9	N/A
50	24.9	24.9

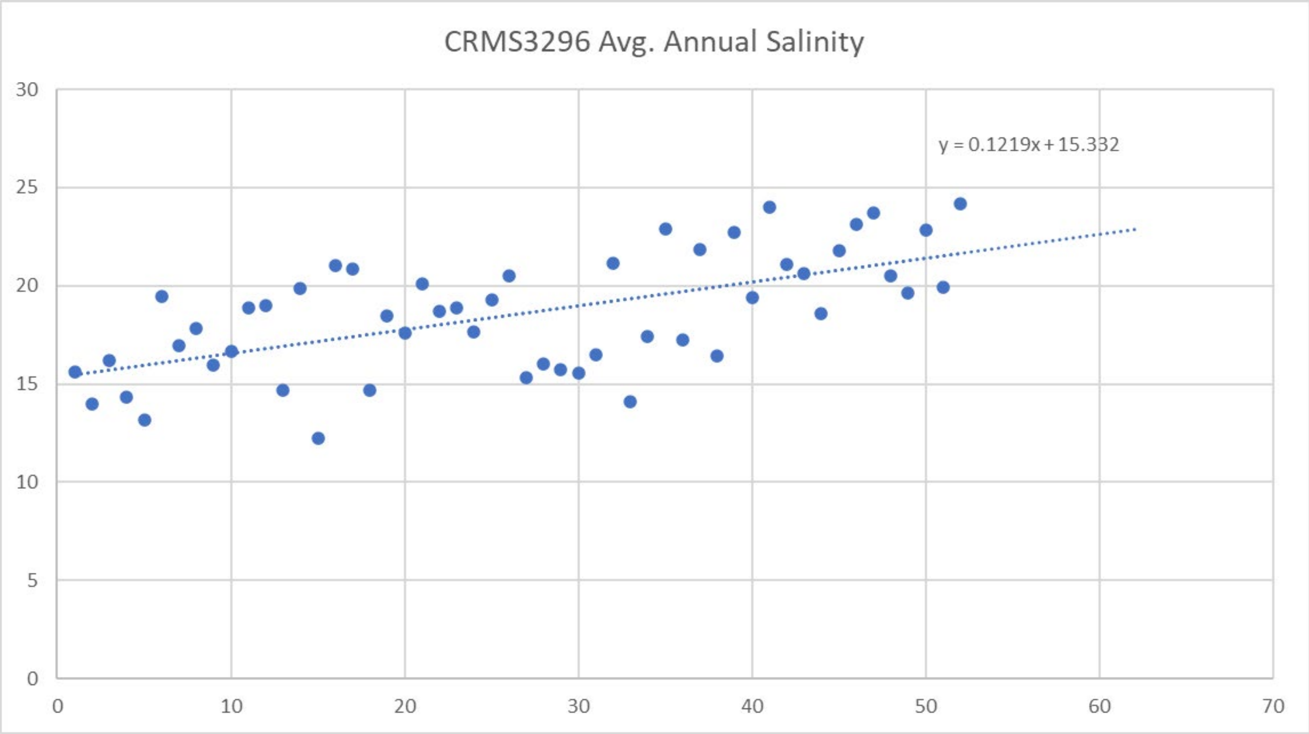

Figure C10:2-5. Projected average annual salinities for CRMS3296 station with regression line.

Table C10:2-22. Mean annual salinity values for Isle de Jean Charles East Middle 509 based on CMP ICM CRMS3296 salinity regression equation.

Target Year	FWOP	FWP
0	16.1	16
1	16.2	16.2
3	N/A	16.4
5	N/A	16.7
6	N/A	16.8
14	18.2	N/A
50	23.4	23.4

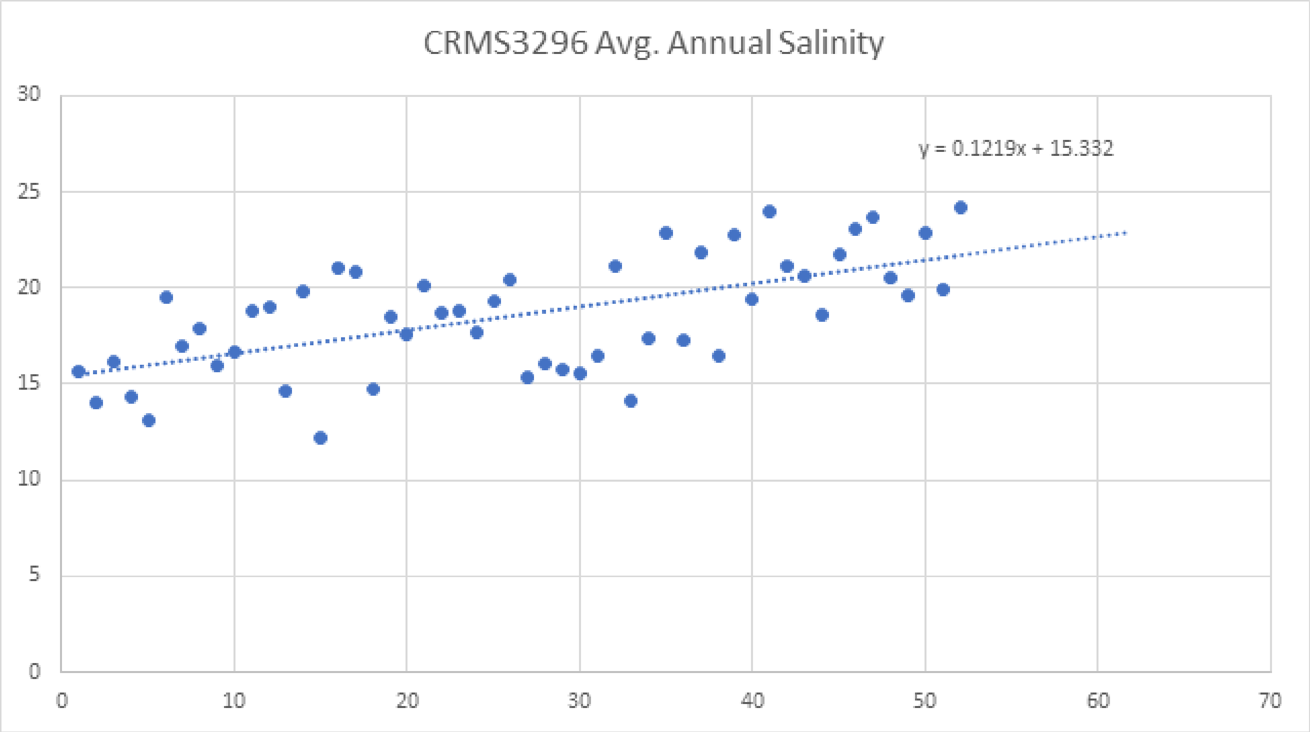

Figure C10:2-6. Projected average annual salinities for CRMS3296 station with regression line.

Table C10:2-23. Mean annual salinity values for Isle de Jean Charles East Upper 1 711 based on CMP ICM CRMS3296 salinity regression equation.

Target Year	FWOP	FWP
0	16.1	16
1	16.2	16.2
3	N/A	16.4
5	N/A	16.7
6	N/A	16.8
50	23.4	23.4

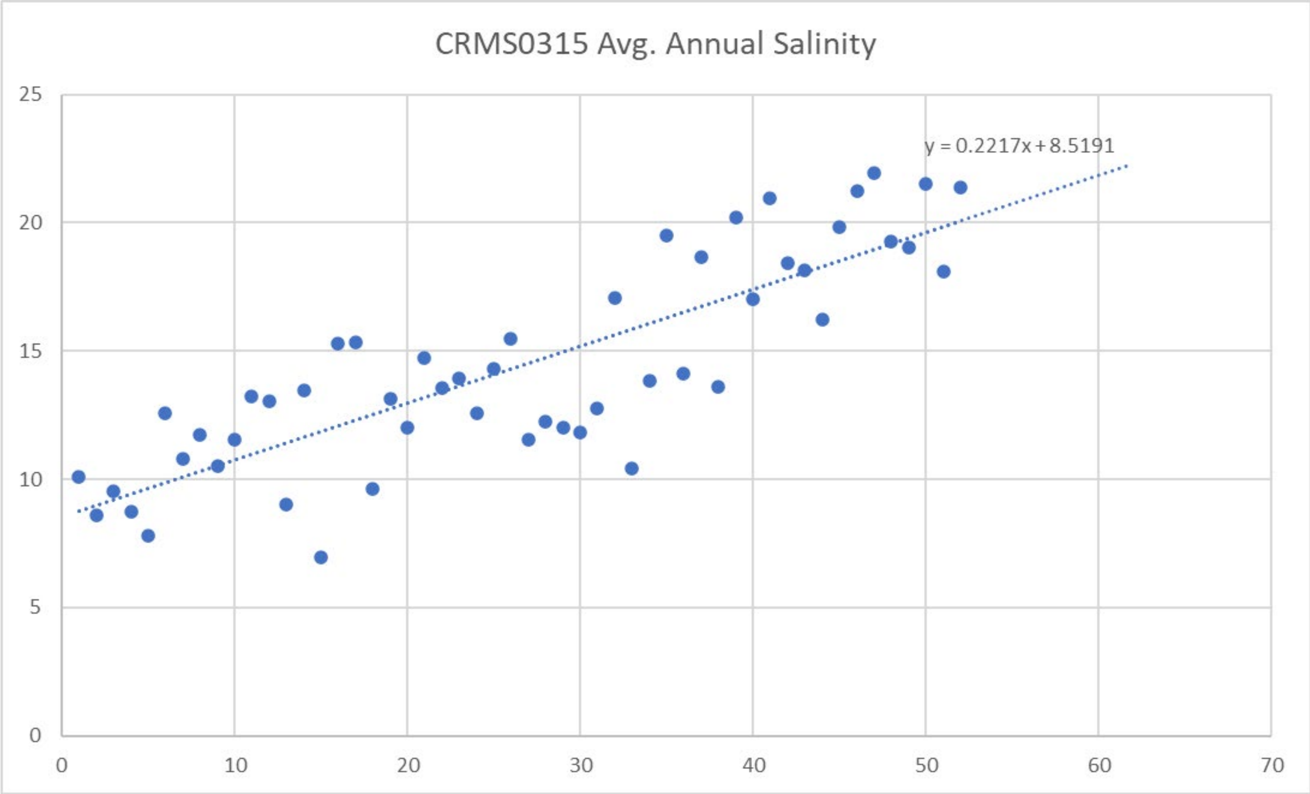

Figure C10:2-7. Projected average annual salinities for CRMS0315 station with regression line.

Table C10:2-24. Mean annual salinity values for Isle de Jean Charles East Upper 2 512 based on CMP ICM CRMS0315 salinity regression equation.

Target Year	FWOP	FWP
0	9.8	10
1	10.1	10.1
3	N/A	10.5
5	N/A	11.0
6	N/A	11.2
11	14.7	N/A
50	23.2	23.2

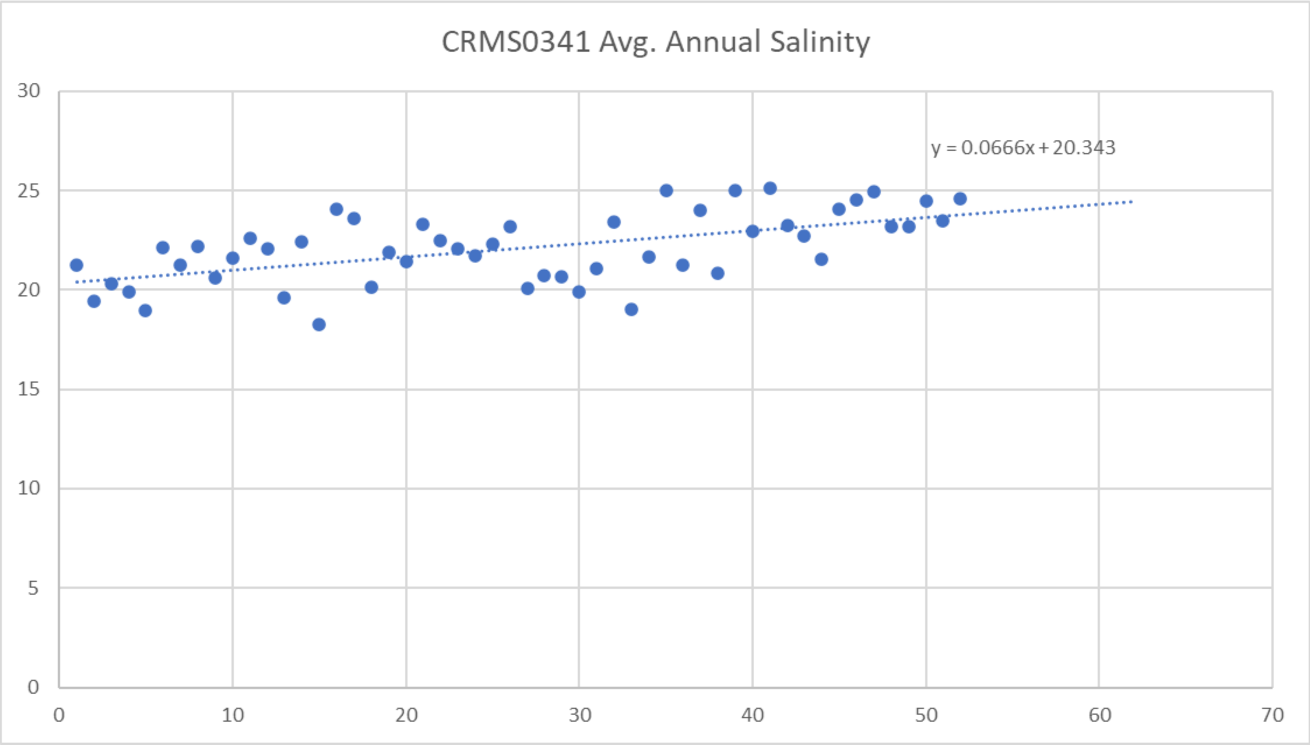

Figure C10:2-8. Projected average annual salinities for CRMS3565 station with regression line.

Table C10:2-25. Mean annual salinity values for Isle de Jean Charles West 703 based on CMP ICM salinity regression equation.

Target Year	FWOP	FWP
0	20.7	21
1	20.8	20.8
3	N/A	20.9
5	N/A	21.1
6	N/A	N/A
50	24.7	24.7

2.8 V6 ACCESS VALUE

The V6 Calculator tab in the model was used to assign structure ratings to all impediments to water flow in or out of the WVA area to get a total access value from 1 (open system) to 0.0001 (solid plug; no water flow). The Isle de Jean Charles: East Lower 540, East Middle 509, East Upper 2 512, and West 703 sites are open systems with no impediments to water and materials exchange. Thus, V6 is 1.0 for all TYs under FWOP, HSDRSS 2012 assumptions for marsh creation were followed for FWP. Access value in FWP is assumed to be 0.0001 for TYs 1-3 due to retention dikes, etc. and 1 by TY 5 when dikes have been gapped or degraded, and water is able to flow through the system (Tables C10:2-26 to C10:2-30). Isle de Jean Charles East Upper 1 711 is in an enclosed system within a wildlife management area. The water level in this area is managed through multiple culverts. Therefore, the access value is 0.3 for TYs 0-50 for FWOP and 0.3 for FWP TYs 0 and TYs 5-50. FWP TYs 3-4 follow HSDRSS guidelines.

Table C10:2-26. Isle de Jean Charles East Lower 540 total access values based on field/desktop observations and HSDRSS guidelines

Target Year	FWOP	FWP
0	1	1
1	1	0.0001
3	N/A	0.0001
5	N/A	1
6	N/A	1
35	1	N/A
50	1	1

Table C10:2-27. Isle de Jean Charles East Middle 509 total access values based on field/desktop observations and HSDRSS guidelines

Target Year	FWOP	FWP
0	1	1
1	1	0.0001
3	N/A	0.0001
5	N/A	1
6	N/A	1
14	1	N/A
50	1	1

Table C10:2-28. Isle de Jean Charles East Upper 1 711 total access values based on field/desktop observations and HSDRSS guidelines

Target Year	FWOP	FWP
0	.3	.3

1	.3	0.0001
3	N/A	0.0001
5	N/A	.3
6	N/A	.3
50	.3	.3

Table C10:2-29. Isle de Jean Charles East Upper 2 512 total access values based on field/desktop observations and HSDRSS guidelines

Target Year	FWOP	FWP
0	1	1
1	1	0.0001
3	N/A	0.0001
5	N/A	1
6	N/A	1
11	1	N/A
50	1	1

Table C10:2-30. Isle de Jean Charles West 703 total access values based on field/desktop observations and HSDRSS guidelines

Target Year	FWOP	FWP
0	1	1
1	1	0.0001
3	N/A	0.0001
5	N/A	1
6	N/A	1
50	1	1

2.9 WVA RESULTS:

Table C10:2-31. WVA Resultant AAHUs for Isle de Jean Charles East Lower 540 Project Site.

Isle de Jean Charles East Lower 540

TOTAL BENEFITS IN AAHUs DUE TO PROJECT

A. Emergent Marsh Habitat Net AAHUs =	1115.24
B. Open Water Habitat Net AAHUs =	-792.40
Net Benefits= (3.5xEMAAHUs+OWAAHUs)/4.5	**691.32**

Table C10:2-32. WVA Resultant AAHUs for Isle de Jean Charles East Middle 509 Project Site.

Isle de Jean Charles East Middle 509

TOTAL BENEFITS IN AAHUs DUE TO PROJECT

A. Emergent Marsh Habitat Net AAHUs =	400.25
B. Open Water Habitat Net AAHUs =	167.18
Net Benefits= (3.5xEMAAHUs+OWAAHUs)/4.5	**348.46**

Table C10:2-33. WVA Resultant AAHUs for Isle de Jean Charles East Upper 1 711 Project Site.

Isle de Jean Charles East Upper 1 711

TOTAL BENEFITS IN AAHUs DUE TO PROJECT

A. Emergent Marsh Habitat Net AAHUs =	831.36
B. Open Water Habitat Net AAHUs =	-387.95
Net Benefits= (3.5xEMAAHUs+OWAAHUs)/4.5	**560.40**

Table C10:2-34. WVA Resultant AAHUs for Isle de Jean Charles East Upper 2 512 Project Site.

Isle de Jean Charles East Upper 2 512

TOTAL BENEFITS IN AAHUs DUE TO PROJECT

A. Emergent Marsh Habitat Net AAHUs =	489.75
B. Open Water Habitat Net AAHUs =	-393.41
Net Benefits= (3.5xEMAAHUs+OWAAHUs)/4.5	**293.49**

Table C10:2-35. WVA Resultant AAHUs for Isle de Jean Charles West 703 Project Site.

Isle de Jean Charles West 703

TOTAL BENEFITS IN AAHUs DUE TO PROJECT

A. Emergent Marsh Habitat Net AAHUs =	1062.79
B. Open Water Habitat Net AAHUs =	-908.19
Net Benefits= (3.5xEMAAHUs+OWAAHUs)/4.5	**624.80**

SECTION 3
North Barataria Bay Mitigation Site

Construction of the Morganza to the Gulf project including levees and water control structures is expected to impact thousands of acres of coastal marshes. To mitigate for those impacts, several sites are being investigated for use as marsh creation areas (MCA). The North Barataria Project Group was evaluated with two WVAs for brackish/saline marsh impacts mitigation and details of the WVA process are presented in this project information sheet (PIS). USDA images dated 2023, together with field observations in summer 2024 were used to determine mitigation project construction net benefits. According to USACE, mitigation project construction would begin in 2035, therefore, TY0 (baseline year) would be 2034, and the end of the project life is target year TY50 in 2084. The USACE certified Brackish and Saline Marsh Wetland Value Assessment Marsh Community Model for Civil works (Version 2.0) (WVA Model) was used for this habitat analysis.

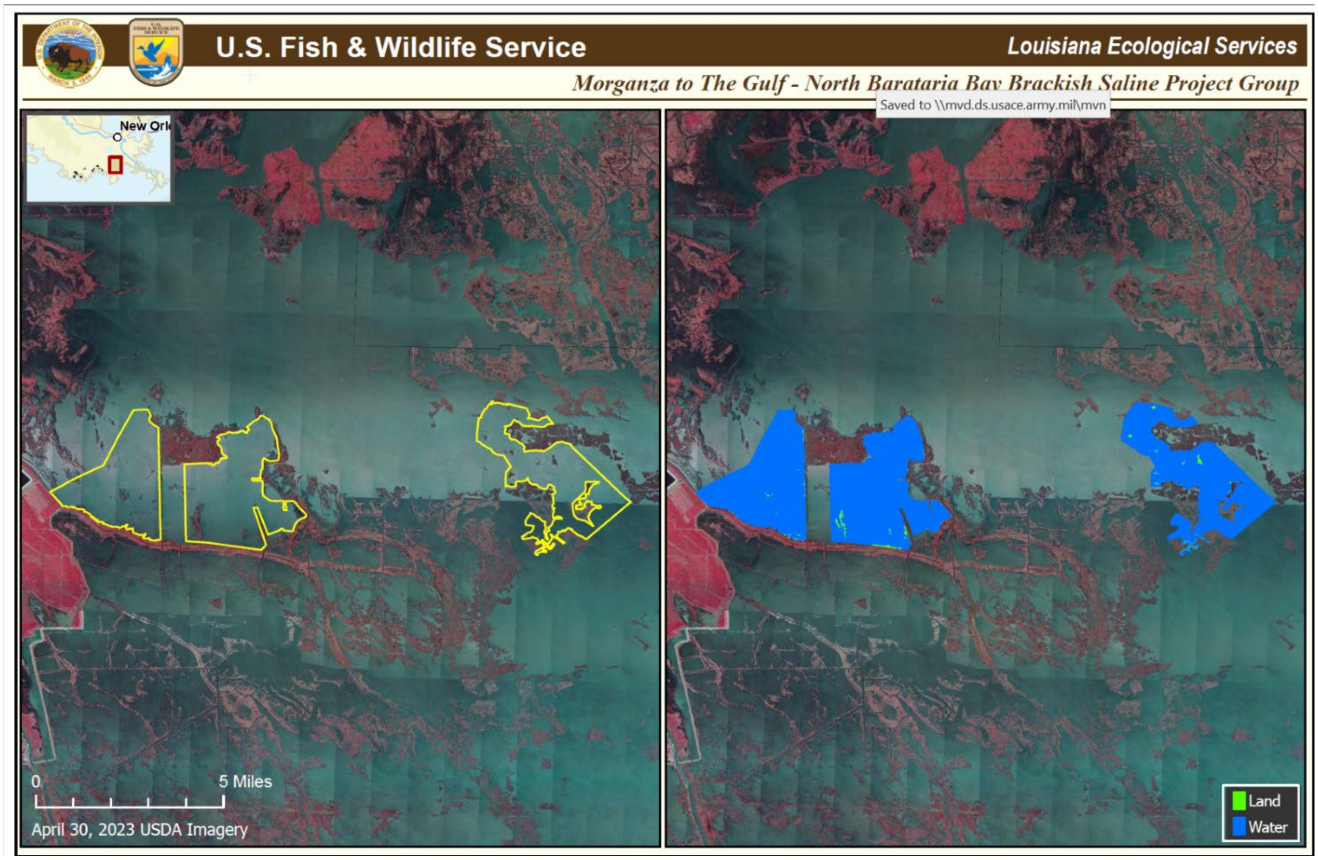

Figure C10:3-1. Map of Brackish and Saline Marsh Mitigation Project – North Barataria Bay.

3.1 FIELD DATA COLLECTION

WVA field data collection was conducted within the area delineated by polygons that make up the Barataria East 214 and Barataria West 213 WVA areas on June 27, 2024 (Figure C10:1-1). Transects were established across the MCAs that attempted to capture a representative portion of the project area. A soil rake marked in tenths of feet was used to measure water depth and to document the presence/absence of submerged aquatic vegetation (SAV) approximately every 100 ft. If depths exceeded the length of the rake (4.5 ft), a stadia rod was used, or depth was noted as over 4 ft. The dominant species of emergent vegetation were noted at the start and end of each transect in order to confirm marsh type, and the transect start and end time were recorded for use in water depth correction.

3.2 MARSH WVA VARIABLE DETERMINATIONS

3.2.1.1 Target Year selection:

FWOP: Much of the project area is open water and will remain open water through TY50; therefore, only TY1 and TY50, the start and end of the project, were included.

FWP: Along with TY1 and TY50 from FWOP, we included TYs 3, 5, 6, as recommended in the HSDRSS 2012 assumptions guidance. TYs 1-6 are assumed to represent major changes in the area. TY1 is the first year of project construction when the area is filled with material to supratidal conditions with no inputs from the surrounding environment (0% functional marsh). By TY3 the created marsh platform is still considered, in part, non-functioning marsh (15%) even if retention dikes may have been gapped or degraded. By TY5 the created marsh is 50% functional. AT TY6 the marsh is now fully functional (100%), and it is assumed that SAV (V2) and interspersion (V3) would become more optimal than TY5.

3.3 V1 PERCENT EMERGENT MARSH

3.3.1.1 TY0 conditions:

Current acres of land/water within each MCA were classified in ArcGIS Pro based on 2023 USDA imagery. The percent of existing marsh acres within each MCA were calculated and entered as the TY0 (Target year) value for V1 (Table C10:3-1. And Table C10:3-2).

3.3.1.2 TY 1-50 conditions:

The Marsh Impact Mitigation (MIMs) 3.11 spreadsheet is used to project marsh and water acres and percentages in the Future Without Project (FWOP) and Future With Project (FWP) TYs. The main inputs into the MIMs 3.11 spreadsheet are land loss, SLC, subsidence, and accretion.

3.3.1.3 Land loss:

Acres of land within the Coastal Master Plan (CMP) Integrated Compartment model (ICM) polygons were calculated by USGS (1985-2020) (Figure C10:3-2). ICM polygons were selected based on proximity to the MCA location. Compartment 214 was chosen for the Barataria East WVA. Compartment 213 was chosen for Barataria West WVA. Future land loss was calculated using a linear regression of historic land acres from the selected ICM polygon (1985 – 2020) (Figure C10:3-3). The equation of each regression line along with the TY0 marsh and water acres was entered in the FWOP and FWP TYs to project land loss.

3.3.1.4 SLC:

Sea level change equations from the USACE Engineering Regulation (ER) 1100-2-8162 are used for all three scenarios in the MIMs 3.11 spreadsheet. The equation for medium SLC, which was used for the WVA analysis, is below. See ER 1100-2-8162 for more information.

E(t) = 0.0017t + bt2

where E(t) is the eustatic sea level change, in meters, as a function of t. The Eustatic sea level change for the medium sea level change is -1.7 mm/year. b is a constant for the modified National Research Council Curve I, which is 2.71 x 10-5.

3.3.1.5 Accretion data:

Mean accretion data were obtained from CRMS sites in the vicinity (mean of CRMS 3503, 3565, 4690). Feldspar data from each CRMS site were examined, and feldspar set series with the greatest historical consistency were selected. The selected series were averaged and applied to the model.

3.3.1.6 Subsidence:

Totals Subsidence (TS) was calculated using the sum of Deep Subsidence (DS) and Shallow Subsidence (SS).

DS values were obtained from the Louisiana 2023 CMP Data Access Portal (https://mpdap.coastal.la.gov/dataset/shallow-subsidence#map=12.57/29.95051/-93.21243&geography=extraction_point&time=annual&year=52&scenario=A&selected=QAQC2101-QAQC2127&chart=2-52). SS values were calculated using the following formula (SS= Mean CRMS Accretion - mean surface elevation change). Surface Elevation Change (SEC) data was obtained from CRMS RSET data (mean of CRMS 3503, 3565, 4690). Mean accretion and TS were both used as inputs into the MIMS RSLC tab to estimate the effects of RSLC on the rate of land loss in the project area.

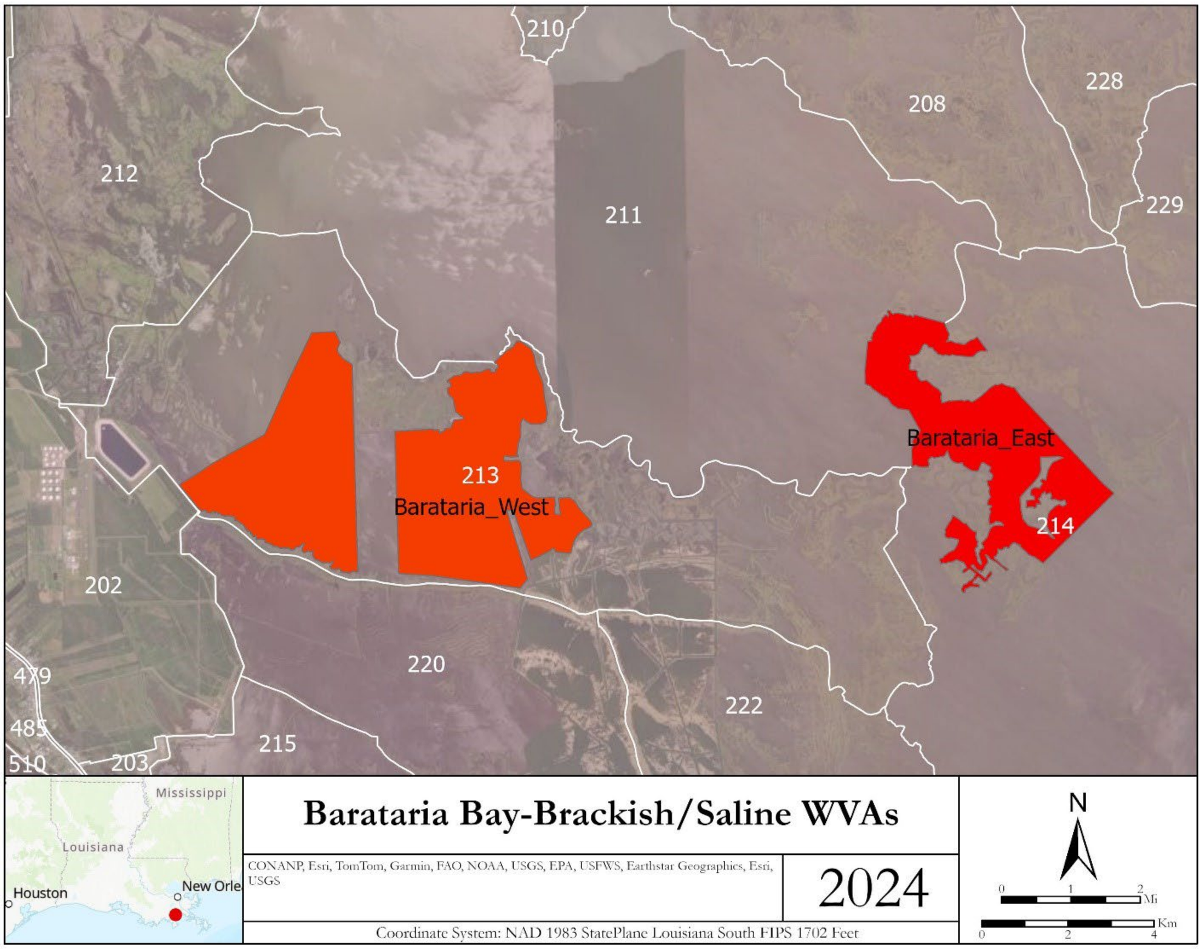

Figure C10:3-2. ICM Compartments 213 and 214 from LA state Master Plan/USGS and Barataria East and West WVA areas.

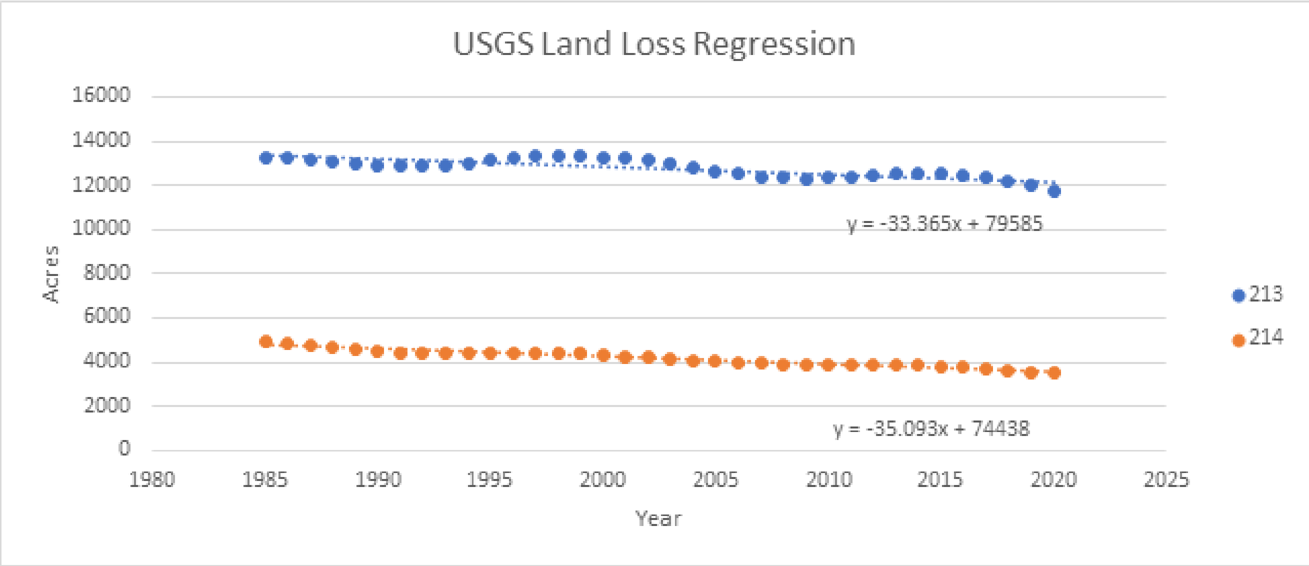

Figure C10:3-3 Barataria West 213 and Barataria East 214 acres of marsh each year from 1985 to 2020 with regression line.

Table C10:3-1. Barataria East 214 Marsh percentages under the Intermediate SLC scenario for FWOP and FWP TY 0-50

Target Year	FWOP Percent Marsh	FWP Percent Marsh
0	2.1%	2%
1	2%	2%
3	N/A	16.4%
5	N/A	49.7%
6	N/A	97.1%
50	0.1%	53.4%

Table C10:3-2. Barataria West 213 marsh percentages under the Intermediate SLC scenario for FWOP and FWP TY 0-50

Target Year	FWOP Percent Marsh	FWP Percent Marsh
0	2.1%	2%
1	2.1%	2.1%
3	N/A	16.7%
5	N/A	50.5%
6	N/A	98.8%
50	1.3%	71.9%

3.4 V2 PERCENT SUBMERGED AQUATIC VEGETATION

The number of samples with SAV present was divided by the total number of samples for all of the transects combined within the WVA area to give the percentage of SAV coverage. That number is used as the TY0 value. We detected no SAV in Barataria East 214 or in Barataria West 213 so TY0 is 0% for both (Tables C10:3-2 and C10:3-3). Following the 2012 HSDRSS guidelines, it was assumed that no SAV would occur in other TYs for either FWOP or FWP (Tables C10:3-3 and C10:3-4).

Table C10:3-3. Barataria East 214 SAV percentages with future values estimated using HSDRSS guidelines

Target Year	FWOP Percent SAV	FWP Percent SAV
0	0%	0%
1	0%	0%
3	N/A	0%
5	N/A	0%
6	N/A	0%
50	0%	0%

Table C10:3-4. Barataria West 213 SAV percentages with future values estimated using HSDRSS guidelines

Target Year	FWOP Percent SAV	FWP Percent SAV
0	0%	0%
1	0%	0%
3	N/A	0%
5	N/A	0%
6	N/A	0%
50	0%	0%

3.5 V3 INTERSPERSION

Interspersion was estimated for TY0 by visually comparing the project area marsh condition in GIS to the guidance images in the WVA Model documentation. When the project contains multiple areas with very different interspersion values, we may report multiple classes with the corresponding percentage of the project area for which they apply. For FWOP we assume that V3 will not change because for mitigation project areas the interspersion is usually already Class 5 due to extensive open water. For FWP, assumptions for projections of interspersion in TYs 1-6 relied on the 2012 HSDRSS along with consideration for the percentage of marsh indicated by V1 (Tables C10:3-5 and C10:3-6).

For Barataria East 214, interspersion increases for TY50 because of the projected loss of about half of the land existing in TY6 and the known exposure to wave energy (Table C10:3-5).

Table C10:3-5. Barataria East 214 interspersion values estimated using GIS and HSDRSS guidelines for TY0-TY50.

Target Year	FWOP	FWP
0	Class 5 - 100%	Class 5 - 100%
1	Class 5 - 100%	Class5 - 100%
3	N/A	Class 3 – 100%
5	N/A	Class 3 – 50% Class 2 – 50%
6	N/A	Class 2 – 100%
50	Class 5 - 100%	Class 3 – 50% Class 4 – 50%

For Barataria West 213, interspersion increases somewhat for TY50 because of the projected loss of about one third of the land existing in TY6 and the limited exposure to wave energy (Table C10:3-6).

Table C10:3-6. Barataria West 213 interspersion values estimated using GIS and HSDRSS guidelines for TY0-TY50.

Target Year	FWOP	FWP
0	Class 5 - 100%	Class 5 - 100%
1	Class 5 - 100%	Class5 - 100%
3	N/A	Class 3 – 100%
5	N/A	Class 3 – 50% Class 2 – 50%
6	N/A	Class 2 – 100%
50	Class 5 - 100%	Class 3 – 100%

3.6 V4 PERCENT SHALLOW OPEN WATER

Water depths for Barataria East 214 and Barataria West 213 were corrected using data from the USGS gauge “Hackberry Bay NW of Grand Isle, LA – 073802512” to account for variability at the time of sampling due to tides, weather, etc. To calculate a correction factor, the water level at the start and end of sampling was averaged, and this value was subtracted from the 10-year mean water level. This correction factor was subtracted from all the water depths collected in the field to get the adjusted water depth value. The number of adjusted water depth values that were equal to 1.5 feet or less were divided by the total number of water depth samples. That percentage was recorded in the WVA model as the value of Shallow Open Water (SOW) for TY0. For subsequent TYs, the amount of RSLC calculated in the MIMs 3.11 (V1 earlier) spreadsheet was applied to the TY0 water depths and the percentage of shallow open water was recalculated. For FWP, we assumed that initially 100% of open water formed after marsh creation would be less than or equal to 1.5 feet. Over time some of that shallow water would become deeper. Based on the 2012 HSDRSS guidelines that 15% of shallow open water will become deep water by TY50, we are assuming that 20% shallow open water will become deep by TY50 (Tables C10:3-7 and C10:3-8).

Table C10:3-7. Barataria East 214 percentage of SOW from TY0-50 based on MIMS 3.11 calculations and HSDRSS guidelines.

Target Year	FWOP Percent SOW	FWP Percent SOW
0	8%	8%
1	8%	100%
3	N/A	100%
5	N/A	100%
6	N/A	100%
50	0%	80%

Table C10:3-8. Barataria West 213 percentage of SOW from TY0-50 based on MIMS 3.11 calculations and HSDRSS guidelines.

Target Year	FWOP Percent SOW	FWP Percent SOW
0	29%	29%
1	26%	100%
3	N/A	100%
5	N/A	100%
6	N/A	100%
50	0%	80%

3.7 V5 AVERAGE GROWING SEASON SALINITY

Information from the Louisiana 2023 CMP Data Access Portal (https://mpdap.coastal.la.gov/dataset/salinity#map=12.57/29.95051/-93.21243&geography=extraction_point&aggregate=mean&time=annual&year=52&scenario=A&selected=QAQC2101-QAQC2127&chart=2-52) was used to determine the average annual salinity projections for the project area for all TYs based on the CMP ICM. The model provides a 52-year projection that begins in 2019. Projected annual mean salinity data for the CRMS6303 and CRMS3565 stations near the WVA project areas Barataria East 214 and Barataria West 213, respectively, were downloaded and charted (Figures C10:3-4 and C10:3-5). A linear regression was performed on the data, and the resulting values from the regression line were used as the annual salinity mean values for the appropriate target years (Tables C10:3-9 and C10:3-10).

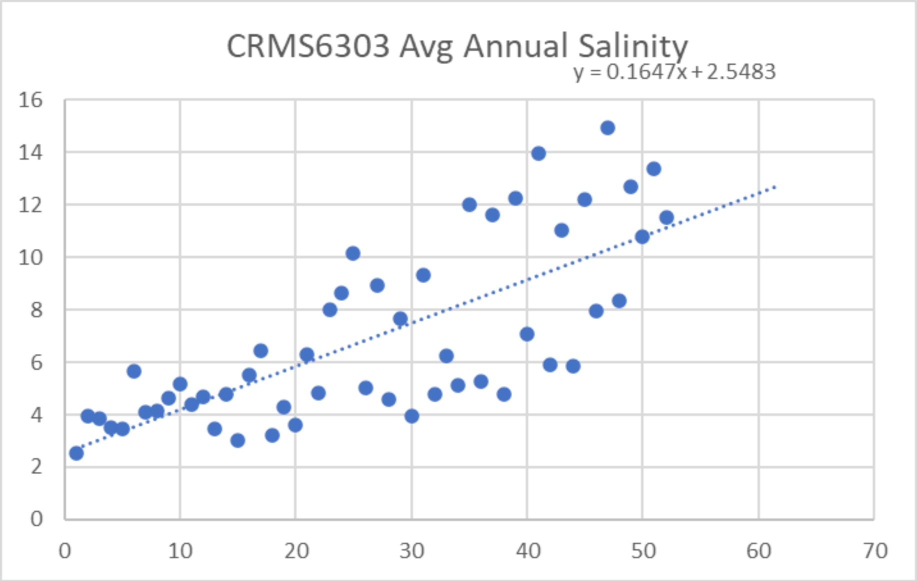

Figure C10:3-4. Projected average annual salinities for CRMS6303 station with regression line that were used for Barataria East 214.

Table C10:3-9. Mean annual salinity values for Barataria East 214 based on CMP ICM salinity regression equation

Target Year	FWOP	FWP
0	3.5	4.0
1	3.7	3.7
3	N/A	4.0
5	N/A	4.4
6	N/A	4.5
50	13.4	13.4

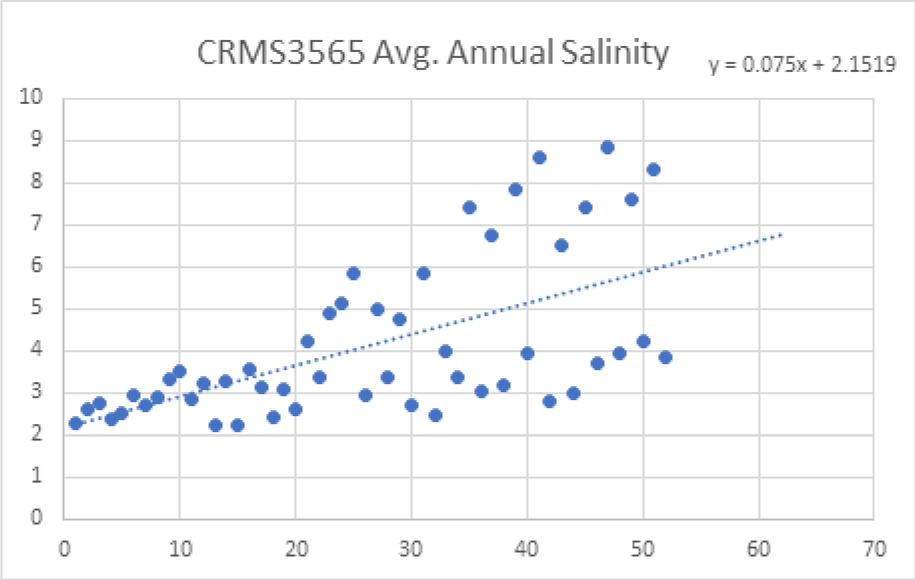

Figure C10:3-5. Projected average annual salinities for CRMS3565 station with regression line were that were used for Barataria East 213.

Table C10:3-10. Mean annual salinity values for ***Barataria West 213*** *based on CMP ICM salinity regression equation.*

Target Year	FWOP	FWP
0	2.6	3
1	2.7	2.7
3	N/A	2.8
5	N/A	3.0
6	N/A	3.1
50	7.1	7.1

3.8 V6 ACCESS VALUE

The V6 Calculator tab in the model was used to assign structure ratings to all impediments to water flow in or out of the WVA area to get a total access value from 1 (open system) to 0.0001 (solid plug; no water flow). The Barataria East 214 and Barataria West 213 sites are open systems with no impediments to water and materials exchange. Thus, V6 is 1.0 for all TYs under FWOP HSDRSS 2012 assumptions for marsh creation were followed for FWP. Access value in FWP is assumed to be 0.0001 for TYs 1-3 due to retention dikes, etc. and 1 by TY 5 when dikes have been gapped or degraded and water is able to flow through the system (Tables C10:3-11 and C10:3-12).

Table C10:3-11. Barataria East 214 total access values based on field/desktop observations and HSDRSS guidelines

Target Year	FWOP	FWP
0	1	1
1	1	0.0001
3	N/A	0.0001
5	N/A	1
6	N/A	1
50	1	1

Table C10:3-12. Barataria West 213 total access values based on field/desktop observations and HSDRSS guidelines

Target Year	FWOP	FWP
0	1	1
1	1	0.0001
3	N/A	0.0001
5	N/A	1
6	N/A	1
50	1	1

3.9 WVA RESULTS:

Table C10:3-13. WVA Resultant AAHUs for Barataria West Project Site.

TOTAL BENEFITS IN AAHUs DUE TO PROJECT

A. Emergent Marsh Habitat Net AAHUs =	3720.66
B. Open Water Habitat Net AAHUs =	-1591.15
Net Benefits= (2.6xEMAAHUs+OWAAHUs)/3.6	2245.16

Table C10:3-14. WVA Resultant AAHUs for Barataria East Project Site

TOTAL BENEFITS IN AAHUs DUE TO PROJECT	
A. Emergent Marsh Habitat Net AAHUs =	1661.16
B. Open Water Habitat Net AAHUs =	-1174.27
Net Benefits= (3.5xEMAAHUs+OWAAHUs)/4.5	**1031.07**

SECTION 4

West Terrebonne Mitigation Site

Construction of the Morganza to the Gulf project including levees and water control structures is expected to impact thousands of acres of coastal marshes. To mitigate for those impacts, several sites are being investigated for use as marsh creation areas (MCA). The West Terrebonne Project Group was evaluated with three separate WVAs for brackish/saline marsh impacts mitigation and details of the WVA process are presented in this project information sheet (PIS). USDA images dated 2023, together with field observations in summer 2024 were used to determine mitigation project construction net benefits. According to USACE, mitigation project construction would begin in 2035, therefore, TY0 (baseline year) would be 2034, and the end of the project life is target year TY50 in 2084. The USACE certified Brackish and Saline Marsh Wetland Value Assessment Marsh Community Model for Civil works (Version 2.0) (WVA Model) was used for this habitat analysis.

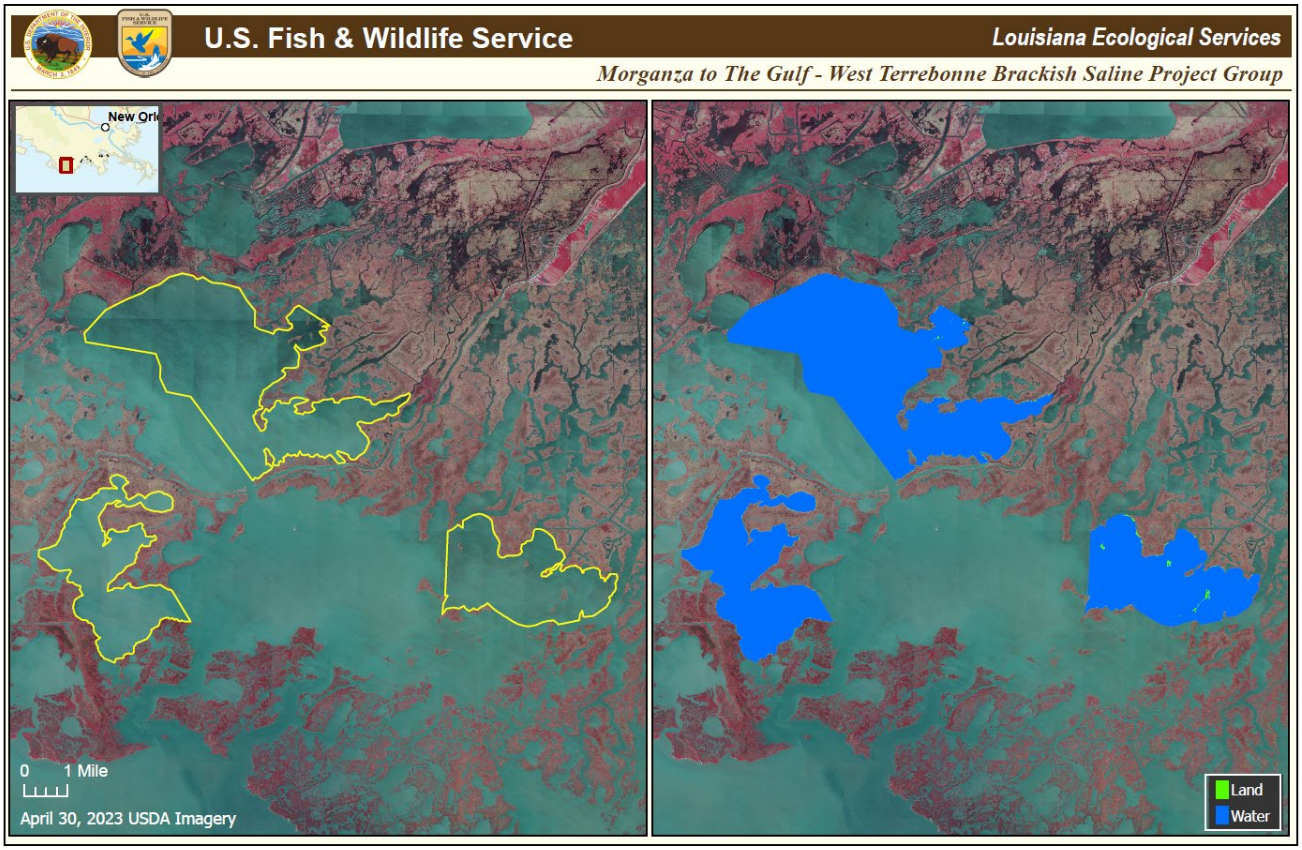

Figure C10:4-1. Map of Brackish and Saline Marsh Mitigation Project – West Terrebonne.

4.1 FIELD DATA COLLECTION

WVA field data collection was conducted within the area delineated by polygons that make up the West Terrebonne WVA areas (East, West, and Upper) on June 25, 2024 (Figures C10:4-1 and C10:4-2). Transects were established across the MCAs that attempted to capture a representative portion of the project area. A soil rake marked in tenths of feet was used to measure water depth and to document the presence/absence of submerged aquatic vegetation (SAV) approximately every 100 ft. If depths exceeded the length of the rake (4.5 ft) a stadia rod was used. The dominant species of emergent vegetation were noted at the start and end of each transect in order to confirm marsh type, and the transect start and end time were recorded for use in water depth correction.

4.2 MARSH WVA VARIABLE DETERMINATIONS

4.2.1.1 Target Year selection:

FWOP: Much of the project area is open water and will remain open water through TY50; therefore, only TY1 and TY50, the start and end of the project, were included.

FWP: Along with TY1 and TY50 from FWOP, we included TYs 3, 5, 6, as recommended in the HSDRSS 2012 assumptions guidance. TYs 1-6 are assumed to represent major changes in the area. TY1 is the first year of project construction when the area is filled with material to supratidal conditions with no inputs from the surrounding environment (0% functional marsh). By TY3 the created marsh platform is still considered, in part, non-functioning marsh (15%) even if retention dikes may have been gapped or degraded. By TY5 the created marsh is 50% functional. AT TY6 the marsh is now fully functional (100%), and it is assumed that SAV (V2) and interspersion (V3) would become more optimal than TY5.

4.3 V1 PERCENT MARSH

4.3.1.1 TY0 conditions:

Current acres of land/water within each MCA were classified in ArcGIS Pro based on 2023 USDA imagery (Figure C10:1-1). The percent of existing marsh acres within each MCA were calculated and entered as the TY0 (Target year) value for V1 (Table C10:1-1).

4.3.1.2 TY 1-50 conditions:

The Marsh Impact Mitigation (MIMs) 3.11 spreadsheet is used to project marsh and water acres and percentages in the Future Without Project (FWOP) and Future With Project (FWP) TYs. The main inputs into the MIMs 3.11 spreadsheet are land loss, SLC, subsidence, and accretion.

4.3.1.3 Land loss:

Acres of land within the Coastal Master Plan (CMP) Integrated Compartment model (ICM) polygons were calculated by USGS (1985-2020) (Figure C10:1-2). ICM polygons were selected based on proximity to the MCA location as follows: Compartment 696 for the Lower East WVA, compartment 956 for the Lower West WVA, and compartment 497 for the Upper West WVA. Future land loss was calculated using a linear regression of historic land acres from the selected ICM polygon (1985 – 2020) (Figure C10:1-3). The equation of each regression line along with the TY0 marsh and water acres was entered in the FWOP and FWP TYs to project land loss.

4.3.1.4 SLC:

Sea level change equations from the USACE Engineering Regulation (ER) 1100-2-8162 are used for all three scenarios in the MIMs 3.11 spreadsheet. The equation for medium SLC, which was used for the WVA analysis, is below. See ER 1100-2-8162 for more information.

$E(t) = 0.0017t + bt^2$

where E(t) is the eustatic sea level change, in meters, as a function of t. The Eustatic sea level change for the medium sea level change is -1.7 mm/year. b is a constant for the modified National Research Council Curve I, which is 2.71 x 10-5.

4.3.1.5 Accretion data:

Mean accretion data were obtained from CRMS sites in the vicinity as follows: CRMS 4455, 377, 307, 354 for East and West Terrebonne and CRMS4 455 for Upper Terrebonne. Feldspar data from each CRMS site were examined, and feldspar set series with the greatest historical consistency were selected. The selected series were averaged and applied to the model.

4.3.1.6 Subsidence:

Totals Subsidence (TS) was calculated using the sum of Deep Subsidence (DS) and Shallow Subsidence (SS).

DS values were obtained from the Louisiana 2023 CMP Data Access Portal (https://mpdap.coastal.la.gov/dataset/shallow-subsidence#map=12.57/29.95051/-93.21243&geography=extraction_point&time=annual&year=52&scenario=A&selected=QAQC2101-QAQC2127&chart=2-52). SS values were calculated using the following formula (SS= Mean CRMS Accretion - mean surface elevation change). Surface Elevation Change (SEC) data was obtained from CRMS RSET data (mean of CRMS 4455, 377, 307, 354 for East and West Terrebonne and CRMS4 455 for Upper Terrebonne). Mean accretion and TS were both used as inputs into the MIMS RSLC tab to estimate the effects of RSLC on the rate of land loss in the project area.

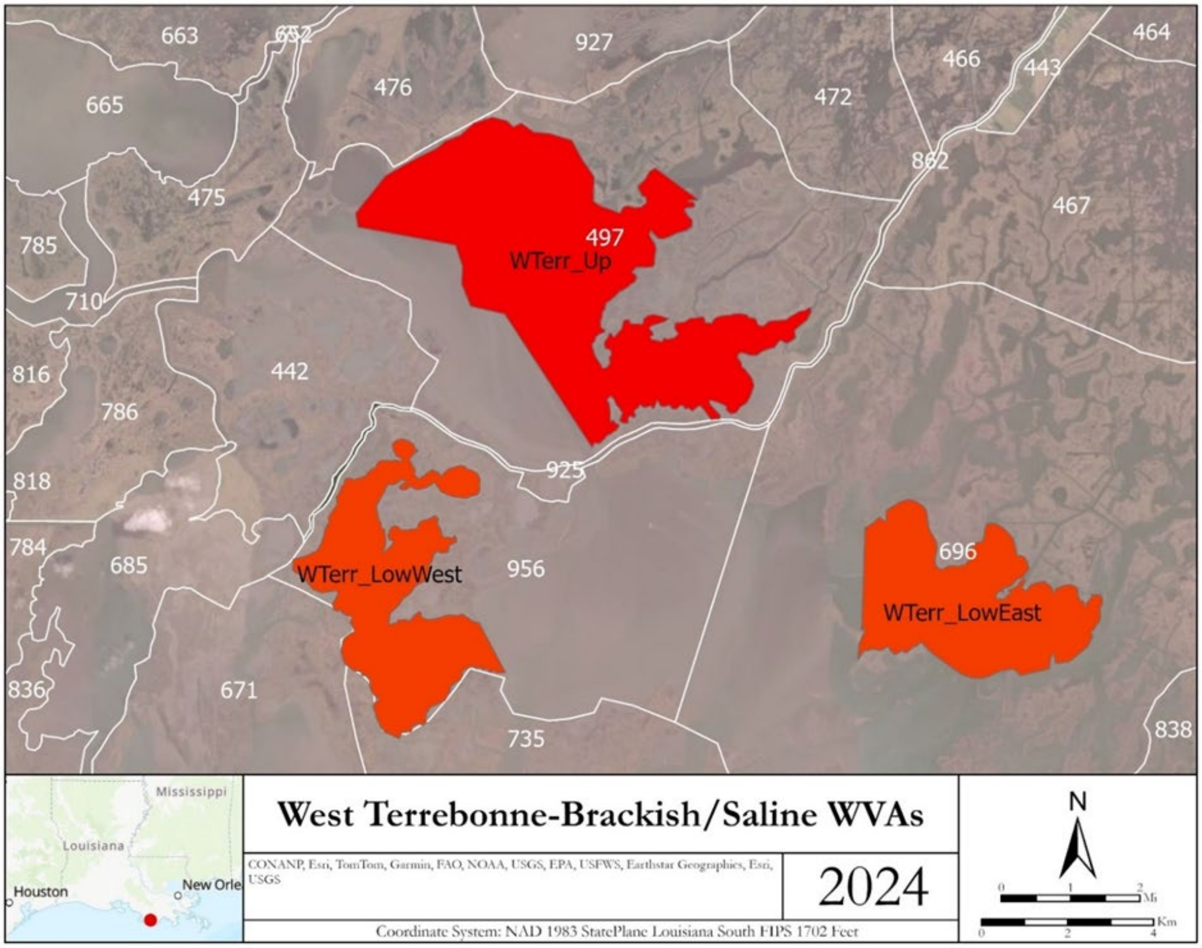

Figure C10:4-2. ICM Compartments from LA state Master Plan/USGS and West Terrebonne: Lower East 696, Lower West 956, and Upper West 497 WVA areas.

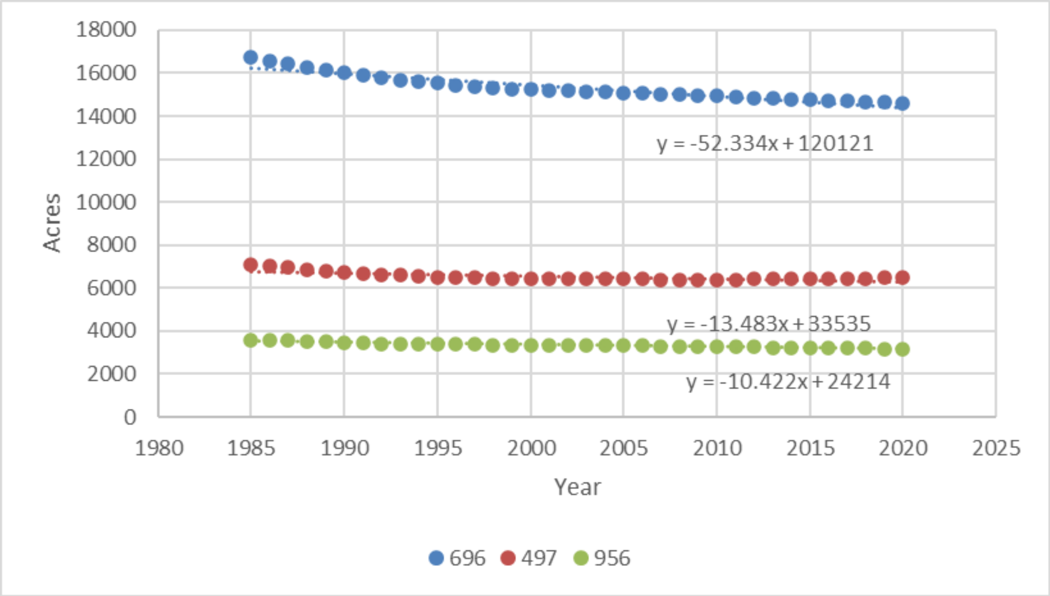

Figure C10:4-3 West Terrebonne: Lower East 696, Lower West 956, and Upper West 497acres of marsh each year from 1985 to 2020 with regression line.

Table C10:4-1. West Terrebonne Lower East 696 marsh percentages under the Intermediate SLC scenario for FWOP and FWP TY 0-50

Target Year	FWOP Percent Marsh	FWP Percent Marsh
0	1.6%	2%
1	1.6%	1.6%
3	N/A	16.2%
5	N/A	50.2%
6	N/A	98.6%
50	0.9%	69.7%

Table C10:4-2. West Terrebonne Lower West 956 marsh percentages under the Intermediate SLC scenario for FWOP and FWP TY 0-50

Target Year	FWOP Percent Marsh	FWP Percent Marsh
0	0.5%	1%
1	0.5%	0.5%
3	N/A	15.3%
5	N/A	49.7%
6	N/A	98.8%
50	0.3%	70.8%

Table C10:4-3: West Terrebonne Upper 497 marsh percentages under the Intermediate SLC scenario for FWOP and FWP TY 0-50

Target Year	FWOP Percent Marsh	FWP Percent Marsh
0	0.7%	1%
1	0.7%	0.7%
3	N/A	15.5%
5	N/A	49.9%
6	N/A	99.1%
50	0.5%	74.3%

4.4 V2 PERCENT SUBMERGED AQUATIC VEGETATION

The number of samples with SAV present was divided by the total number of samples for all of the transects combined within the WVA area to give the percentage of SAV coverage. That number is used as the TY0 value. We detected no SAV in any of the West Terrebonne WVA areas so TY0 is 0% for all (Tables C10:4-3 to C10:4-5). Following the 2012 HSDRSS guidelines, it was assumed that no SAV would occur in other TYs for either FWOP or FWP (Tables C10:4-6 to C10:4-10).

Table C10:4-4. West Terrebonne Lower East 696 SAV percentages with future values estimated using HSDRSS guidelines

Target Year	FWOP Percent SAV	FWP Percent SAV
0	0%	0%
1	0%	0%
3	N/A	0%
5	N/A	0%
6	N/A	0%
50	0%	0%

Table C10:4-5. West Terrebonne Lower West 956 SAV percentages with future values estimated using HSDRSS guidelines

Target Year	FWOP Percent SAV	FWP Percent SAV
0	0%	0%
1	0%	0%
3	N/A	0%
5	N/A	0%
6	N/A	0%
50	0%	0%

Table C10:4-6. West Terrebonne Upper 497 SAV percentages with future values estimated using HSDRSS guidelines

Target Year	FWOP Percent SAV	FWP Percent SAV
0	0%	0%
1	0%	0%
3	N/A	0%
5	N/A	0%
6	N/A	0%
50	0%	0%

4.5 V3 INTERSPERSION

Interspersion was estimated for TY0 by visually comparing the project area marsh condition in GIS to the guidance images in the WVA Model documentation. When the project contains multiple areas with very different interspersion values, we may report multiple classes with the corresponding percentage of the project area for which they apply. For FWOP we assume that V3 will not change because for mitigation project areas the interspersion is usually already Class 5 due to extensive open water. For FWP, assumptions for projections of interspersion in TYs 1-6 relied on the 2012 HSDRSS along with consideration for the percentage of marsh indicated by V1 (Tables C10:4-11 to C10:4-15).

West Terrebonne Lower East 696: interspersion increases for TY50 because of the projected loss of less than about 50% of the land existing in TY6 but likely exposed to Gulf of Mexico wave energy by then.

West Terrebonne Lower West 956: interspersion increases for TY50 because of the projected loss of only about 30% of the land existing in TY6 but likely exposed to Gulf of Mexico wave energy by then.

West Terrebonne Upper 497: interspersion increases for TY50 because of the projected loss of less than about 50% of the land existing in TY6 and but likely exposed to Gulf of Mexico wave energy by then.

Table C10:4-7. West Terrebonne Lower East 696 interspersion values estimated using GIS and HSDRSS guidelines for TY0-TY50.

Target Year	FWOP	FWP
0	Class 5 - 100%	Class 5 - 100%
1	Class 5 - 100%	Class5 - 100%
3	N/A	Class 3 – 100%
5	N/A	Class 3 – 50% Class 2 – 50%
6	N/A	Class 2 – 100%
50	Class 5 - 100%	Class 4 – 100%

Table C10:4-8. West Terrebonne Lower West 956 interspersion values estimated using GIS and HSDRSS guidelines for TY0-TY50.

Target Year	FWOP	FWP
0	Class 5 - 100%	Class 5 - 100%
1	Class 5 - 100%	Class5 - 100%
3	N/A	Class 3 – 100%
5	N/A	Class 3 – 50% Class 2 – 50%
6	N/A	Class 2 – 100%
50	Class 5 - 100%	Class 4 – 100%

Table C10:4-9. West Terrebonne Upper 497 interspersion values estimated using GIS and HSDRSS guidelines for TY0-TY50.

Target Year	FWOP	FWP
0	Class 5 - 100%	Class5 - 100%
1	Class 5 - 100%	Class5 - 100%
3	N/A	Class 3 – 100%
5	N/A	Class 3 – 50% Class 2 – 50%
6	N/A	Class 2 – 100%
50	Class 5 - 100%	Class 4 – 100%

4.6 V4 PERCENT SHALLOW OPEN WATER

Water depths for West Terrebonne Project Group were corrected using data from the USGS gauge "Caillou Lake (Sister Lake) SW of Dulac, LA - 07381349" to account for variability at the time of sampling due to tides, weather, etc. To calculate a correction factor, the water level at the start and end of sampling was averaged, and this value was subtracted from the 10-year mean water level. This correction factor was subtracted from all the water depths collected in the field to get the adjusted water depth value. The number of adjusted water depth values that were equal to 1.5 feet or less were divided by the total number of water depth samples. That percentage was recorded in the WVA model as the value of Shallow Open Water (SOW) for TY0. For subsequent TYs, the amount of RSLC calculated in the MIMs 3.11 (V1 earlier) spreadsheet was applied to the TY0 water depths and the percentage of shallow open water was recalculated. For FWP, we assumed that initially 100% of open water formed after marsh creation would be less than or equal to 1.5 feet. Over time some of that shallow water would become deeper. Based on the 2012 HSDRSS guidelines that 15% of shallow open water will become deep water by TY50, we are assuming that 20% shallow open water will become deep by TY50 (Tables C10:4-16 to C10:4-20).

Table C10:4-10. West Terrebonne Lower East 696 percentage of SOW from TY0-50 based on MIMS 3.11 calculations and HSDRSS guidelines.

Target Year	FWOP Percent SOW	FWP Percent SOW
0	0%	0%
1	0%	100%
3	N/A	100%
5	N/A	100%
6	N/A	100%
50	0%	80%

Table C10:4-11. West Terrebonne Lower West 956 percentage of SOW from TY0-50 based on MIMS 3.11 calculations and HSDRSS guidelines.

Target Year	FWOP Percent SOW	FWP Percent SOW
0	0%	0%
1	0%	100%
3	N/A	100%
5	N/A	100%
6	N/A	100%
50	0%	80%

Table C10:4-12. West Terrebonne Upper 497 percentage of SOW from TY0-50 based on MIMS 3.11 calculations and HSDRSS guidelines.

Target Year	FWOP Percent SOW	FWP Percent SOW
0	0%	0%
1	0%	100%
3	N/A	100%
5	N/A	100%
6	N/A	100%
50	0%	80%

4.7 V5 AVERAGE GROWING SEASON SALINITY

Information from the Louisiana 2023 CMP Data Access Portal (https://mpdap.coastal.la.gov/dataset/salinity#map=12.57/29.95051/-93.21243&geography=extraction_point&aggregate=mean&time=annual&year=52&scenario=A&selected=QAQC2101-QAQC2127&chart=2-52) was used to determine the average annual salinity projections for the project area for all TYs based on the CMP ICM. The model provides a 52-year projection that begins in 2019. Projected annual mean salinity data for the CRMS stations near the WVA project areas were downloaded and charted (Figures C10:4-9 to C10:4-13) A linear regression was performed on the data, and the resulting values from the regression line were used as the annual salinity mean values for the appropriate target years (Tables C10:4-21 to C10:4-25).

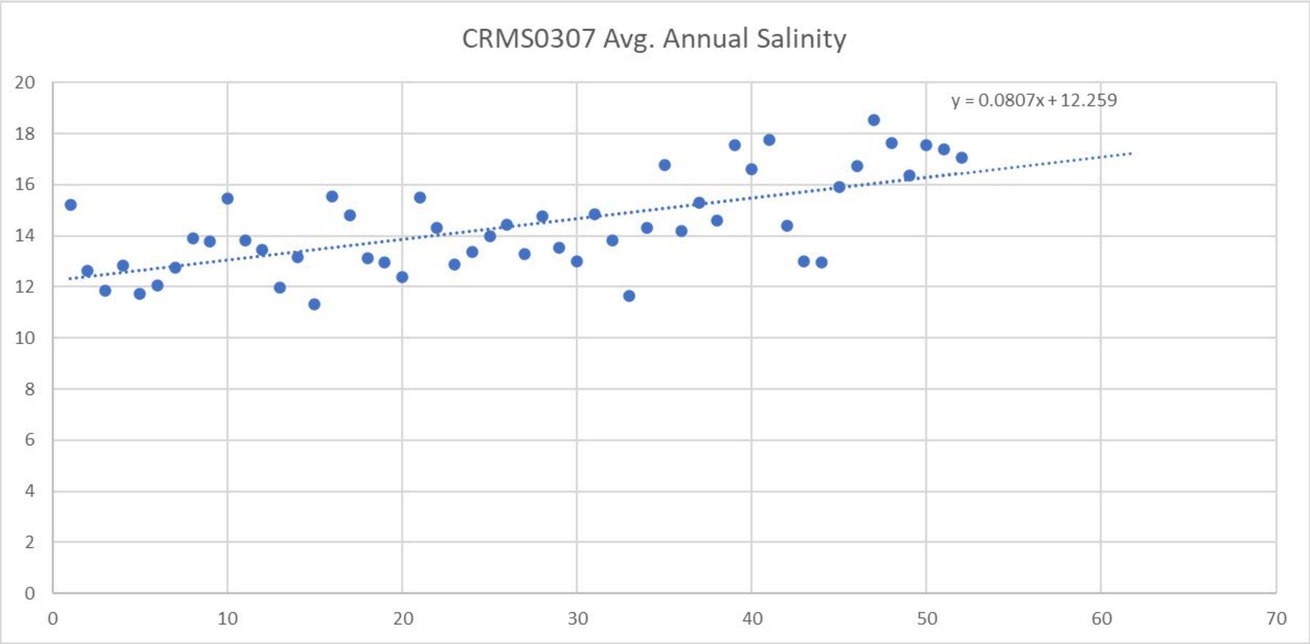

Figure C10:4-4. Projected average annual salinities for CRMS0307 station with regression line.

Table C10:4-13. Mean annual salinity values for West Terrebonne Lower East 696 based on CMP ICM CRMS0307 salinity regression equation

Target Year	FWOP	FWP
0	12.7	13
1	12.8	12.8
3	N/A	13.0
5	N/A	13.1
6	N/A	13.2
50	17.6	17.6

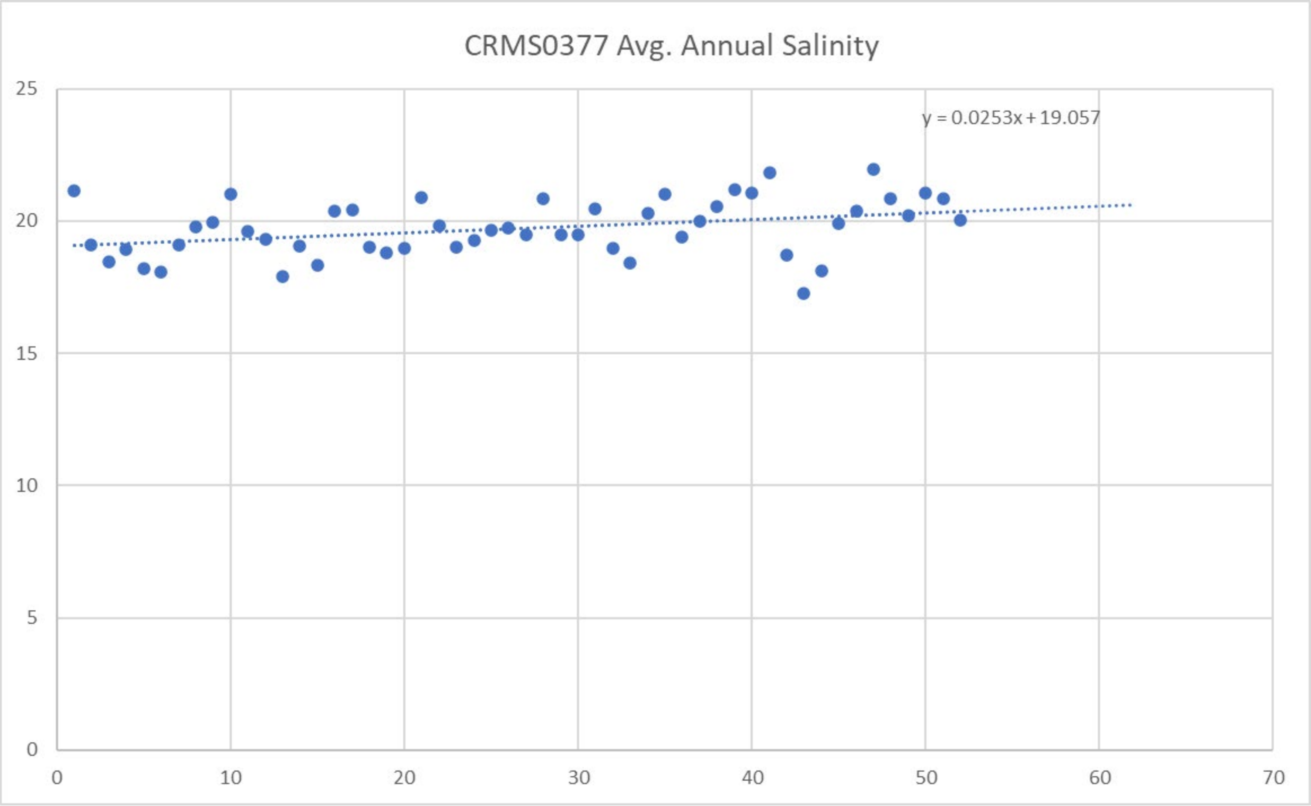

Figure C10:4-5. Projected average annual salinities for CRMS0377 station with regression line.

Table C10:4-14. Mean annual salinity values for West Terrebonne Lower West 956 based on CMP ICM CRMS0377 salinity regression equation.

Target Year	FWOP	FWP
0	19.2	19
1	19.2	19.2
3	N/A	19.3
5	N/A	19.3
6	N/A	19.4
50	20.7	20.7

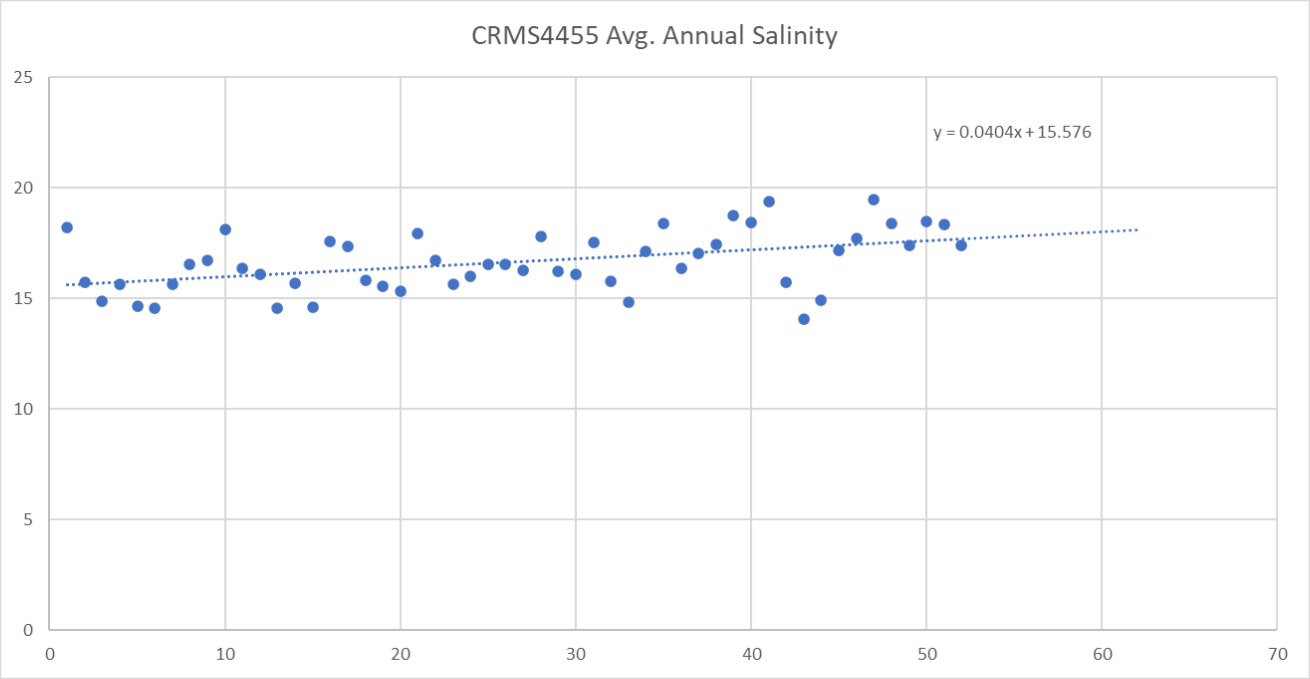

Figure C10:4-6. Projected average annual salinities for CRMS4455 station with regression line.

Table C10:4-15. Mean annual salinity values for West Terrebonne Upper 497 based on CMP ICM CRMS4455 salinity regression equation.

Target Year	FWOP	FWP
0	15.8	16
1	15.9	15.9
3	N/A	15.9
5	N/A	16.0
6	N/A	16.1
50	18.2	18.2

4.8 V6 ACCESS VALUE

The V6 Calculator tab in the model was used to assign structure ratings to all impediments to water flow in or out of the WVA area to get a total access value from 1 (open system) to 0.0001 (solid plug; no water flow). The West Terrebonne: Lower East 696, Lower West 956, and Upper 497 sites are all open systems with no impediments to water and materials exchange. Thus, V6 is 1.0 for all TYs under FWOP, HSDRSS 2012 assumptions for marsh creation were followed for FWP. Access value in FWP is assumed to be 0.0001 for TYs 1-3 due to retention dikes, etc. and 1 by TY 5 when dikes have been gapped or degraded and water is able to flow through the system (Tables C10:4-26, C10:4-27, C10:4-29, C10:4- 30).

Table C10:4-16. West Terrebonne Lower East 696 total access values based on field/desktop observations and HSDRSS guidelines

Target Year	FWOP	FWP
0	1	1
1	1	0.0001
3	N/A	0.0001
5	N/A	1
6	N/A	1
50	1	1

Table C10:4-17. West Terrebonne Lower West 956 total access values based on field/desktop observations and HSDRSS guidelines

Target Year	FWOP	FWP
0	1	1
1	1	0.0001
3	N/A	0.0001
5	N/A	1
6	N/A	1
50	1	1

Table C10:4-18. West Terrebonne Upper 497 total access values based on field/desktop observations and HSDRSS guidelines

Target Year	FWOP	FWP
0	1	1
1	1	0.0001
3	N/A	0.0001
5	N/A	1
6	N/A	1
50	1	1

4.9 WVA RESULTS:

Table C10:4-19. WVA Resultant AAHUs for West Terrebonne Lower East Project Site.

TOTAL BENEFITS IN AAHUs DUE TO PROJECT

A. Emergent Marsh Habitat Net AAHUs =	1978.09
B. Open Water Habitat Net AAHUs =	-1396.00
Net Benefits= (3.5xEMAAHUs+OWAAHUs)/4.5	1228.29

Table C10:4-20. WVA Resultant AAHUs for West Terrebonne Lower West Project Site.

TOTAL BENEFITS IN AAHUs DUE TO PROJECT

A. Emergent Marsh Habitat Net AAHUs =	2011.81
B. Open Water Habitat Net AAHUs =	-1434.53
Net Benefits= (3.5xEMAAHUs+OWAAHUs)/4.5	1245.96

Table C10:4-21. WVA Resultant AAHUs for West Terrebonne Upper Project Site.

TOTAL BENEFITS IN AAHUs DUE TO PROJECT

A. Emergent Marsh Habitat Net AAHUs =	4632.64
B. Open Water Habitat Net AAHUs =	-3316.66
Net Benefits= (3.5xEMAAHUs+OWAAHUs)/4.5	2866.13

SECTION 5
Potential Mitigation Sites Summary

Based on our preliminary WVAs it appears that all sites are relatively similar in terms of mitigation potential. Once engineering surveys are complete, more detailed WVAs should be done during advanced engineering design to determine the true expected mitigation potential of the chosen mitigation site(s) to ensure appropriate sizing of the projects to ensure complete satisfaction of the mitigation requirement.

SECTION 6

List of Acronyms and Abbreviations

ac	Acres
AAHU	Average Annual Habitat Unit
CMP	Coastal Master Plan
CRMS	Coastwide Reference Monitoring System
DS	Deep Subsidence
ER	Engineering Regulation
FWP	Future With Project
FWOP	Future Without Project
GIWW	Gulf Intracoastal Waterway
HSDRRS	Hurricane Storm Damage Risk Reduction System
ICM	Integrated Compartment Model
MCA	Marsh Creation Area
MTG	Morganza to the Gulf
PIS	Project Information Sheet
RSLC	Relative Sea Level Change
RSLR	Relative Sea Level Rise
SEC	Surface Elevation Change
SLC	Sea Level Change
SOW	Shallow Open Water
TS	Total Subsidence
SS	Shallow Subsidence
TY	Target Year
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USGS	United States Geological Survey
SAV	Submerged Aquatic Vegetation
WVA	Wetland Value Assessment

Mississippi Valley Division,
Regional Planning and Environment Division South

Morganza to the Gulf of Mexico, Louisiana, Hurricane and Storm Damage Risk Reduction Project

Appendix C – Attachment 10 – Fresh and Intermediate Marsh Project Information Sheets

November 2025

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CONTENTS

LIST OF TABLES

LIST OF FIGURES

SECTION 1
Introduction

The shapefile of the proposed Reach A mitigation sites was imported into ArcGIS. Using ArcGIS Imagery base map dated March 2022 marsh loss polygons (from the 2023 Coastal Master Plan), and interspersion were determined.

Figure C10:1-1. Map of Fresh and Intermediate Marsh Mitigation Project Sites.

Mitigation is required for the construction of the Morganza to the Gulf of Mexico (MTG) Reach A levee construction and surveys and borings. Preliminary, desktop only, Wetland Value Assessments (WVAs) of potential mitigations sites were run and from there the three sites described in this PIS were chosen for further consideration and field visits. Field work (October 2023) consisted of water depth measurements and observations of Submerged Aquatic Vegetation (SAV) coverage from airboats. These measurements were used for the WVAs for the sites contained in this PIS.

In this impact analysis, the following USACE certified WVA model was used: the Fresh/Intermediate Marsh WVA version 2.0.

Initially a standard 50-year project life span was assumed for the mitigation projects. The Delta Farms site was revisited to include the standard functional marsh creation protocols, which includes TYs 1, 3, and 5 after the construction event. These WVAs were preliminary for the purpose of ranking potential mitigation sites. These WVAs were simplified due to time limitations. More in depth WVAs should be done on chosen mitigation sites in the next phase of this project.

SECTION 2

Avoca Island Mitigation Site

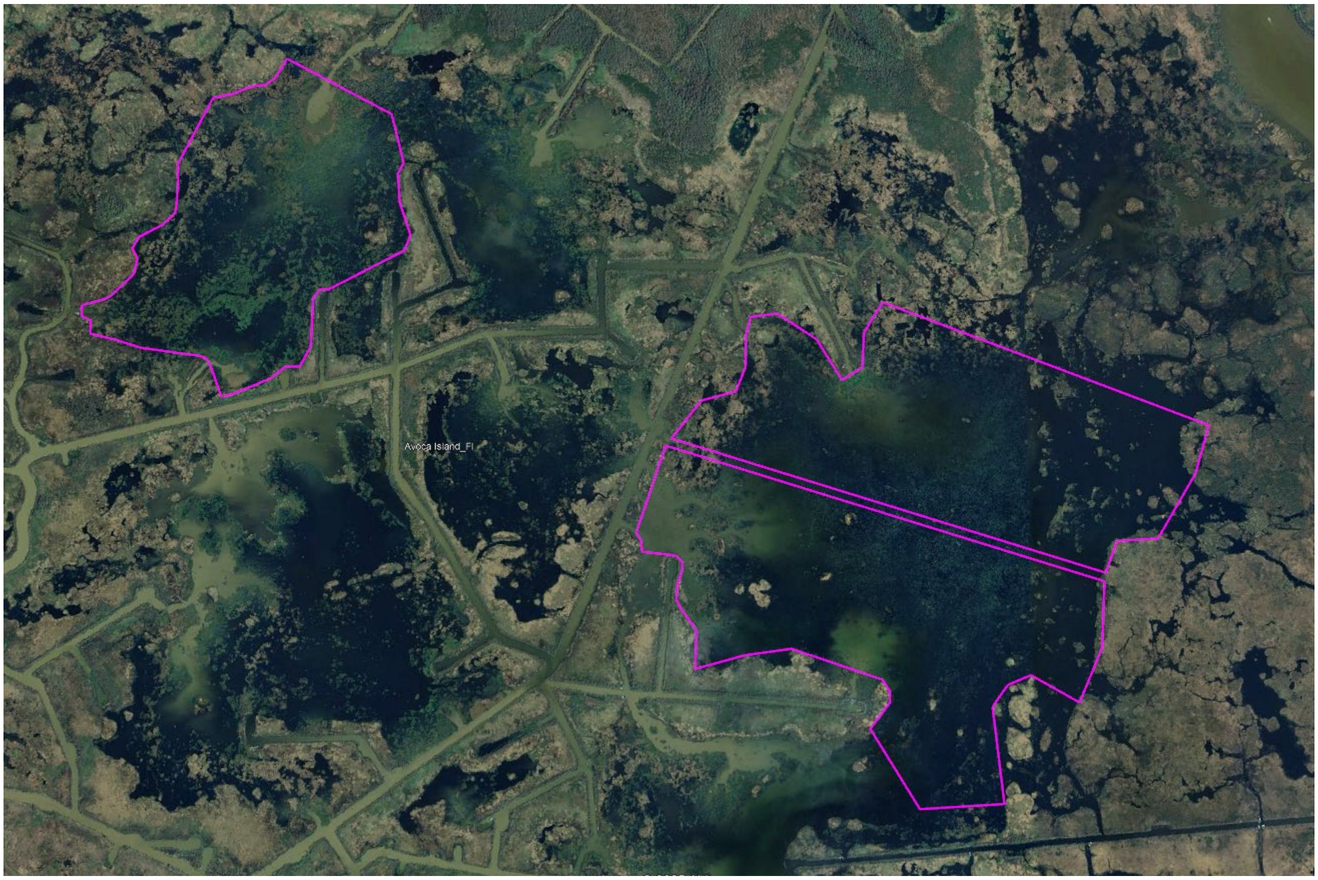

Figure C10:2-1. Map of Fresh and Intermediate Marsh Mitigation Project – Avoca Island

For consistency between sites until field data can be obtained, the Avoca Island site was assumed to be mostly deep (over 1.5 ft) open water with minimal emergent vegetation and little to no SAV. Habitat was representative of fresh/intermediate marsh. The land loss rates for the Avoca Island site were taken from the Coastal Master Plan, Land Loss Polygon #166.

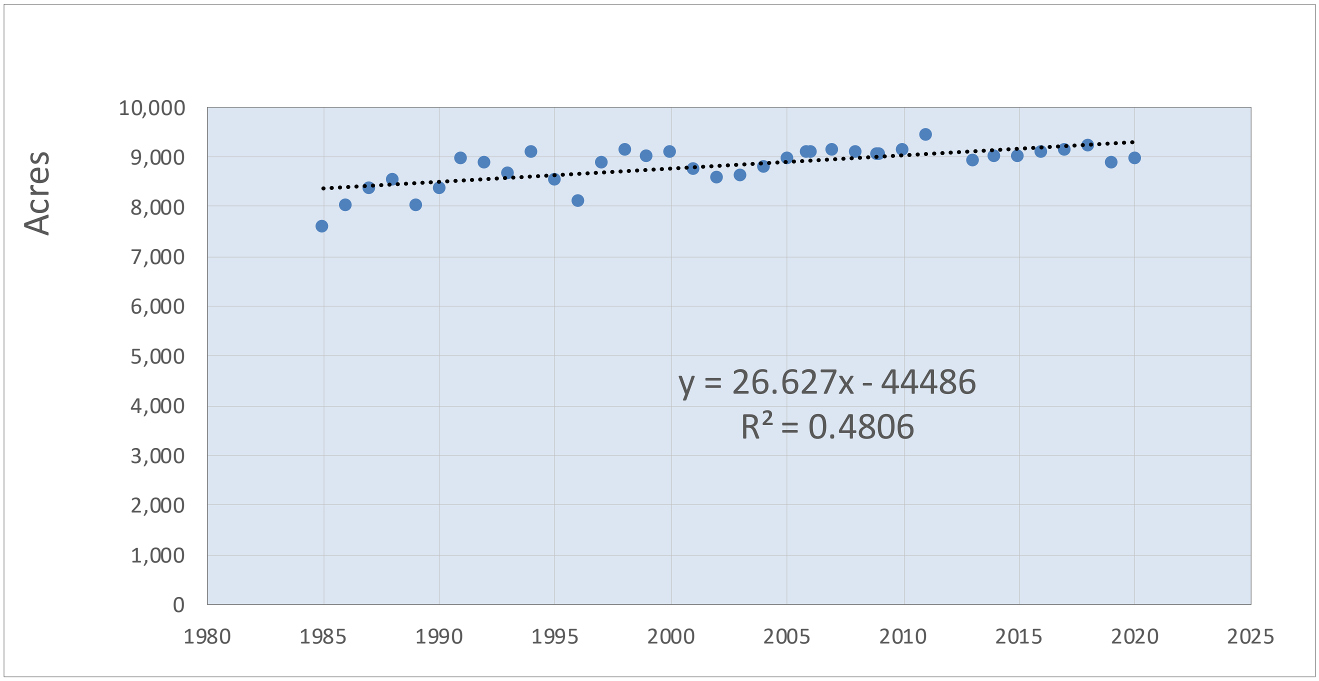

Figure C10:2-2. Marsh acreage data from polygon 166 reveals an increasing acreage trend.

2.1 V1 PERCENT EMERGENT MARSH

The average 1985-2020 loss rate for this area (relative to the predicted 1985 acreage of 16,958 ac) = -0.427%/year. Baseline marsh acreage and marsh loss rate information was plugged into the MIMs version 3.11 spreadsheet. For these quick assessments, a simplifying assumption of no existing marsh within the mitigation polygon was used.

Table C10:2-1. % Emergent Marsh for FWOP and FWP by Target Year 0, 1, 3, 5, 6, and 50.

Target Year	FWOP Percent Marsh	FWP Percent March
0	0%	0%
1	0%	0%
3		15%
5		50%
6		100%
50	0%	100%

2.2 V2 PERCENT SUBMERGED AQUATIC VEGETATION

SAV was observed during the field visit to this location. We are assuming maintenance of SAV in this area throughout the project life because salinities will likely maintain over time with RSLR due to freshwater influence from the Atchafalaya into the GIWW and eventually the project area. A % aquatic vegetation of 50% was assumed for FWOP and FWP.

Table C10:2-2. Percent Submerged Aquatic Vegetation for FWOP and FWP by Target Year 0, 1, 3, 5, 6, and 50.

Target Year	FWOP Percent Aquatic Vegetation	FWP Percent Aquatic Vegetation
0	50%	50%
1	50%	50%
3		50%
5		50%
6		50%
50	50%	50%

2.3 V3 INTERSPERSION

Under FWOP the site is almost entirely deep (greater than 1.5 ft) open water (Class 5). For FWP, TY1 is a Class 3 (carpet marsh), as is standard convention for newly created marsh. By TY 50 we assume the site will be mainly Class 3 with some Class 2 caused by natural hydrology reshaping the marsh as initially built.

Table C10:2-3. Interspersion for FWOP and FWP by Target Year 0, 1, 3, 5, 6, and 50.

Target Year	FWOP V3	FWP V3
0	Class 5 -100%	Class 5 - 100%
1	Class 5 -100%	Class 3 - 100%
3		Class 3 - 100%
5		Class 3 - 50% Class 2- 50%
6		Class 2- 100%
50	Class 5 -100%	Class 3 - 50% Class 4- 50%

2.4 V4 PERCENT SHALLOW OPEN WATER

Water depth measurements showed that no shallow open water (less than 1.5 feet) occurred within the site and none is expected to develop under FWOP. For FWP we assume there will be 100% shallow open water in TY1 but that number is assumed to drop to 0% by TY 50.

Table C10:2-4. Percent Shallow Open Water for FWOP and FWP by Target Year 0, 1, 3, 5, 6, and 50.

Target Year	FWOP Percent Open Water Less than 1.5 Deep	FWP Percent Open Water Less than 1.5 Deep
0	0%	0%
1	0%	100%
3		100%
5		100%
6		0%
50	0%	0%

2.5 V5 AVERAGE GROWING SEASON SALINITY

There are no CRMS gages within the project area so two nearby CRMS gages (CRMS5035 and CRMS0490) were used to estimate salinity.

Table C10:2-5. Growing Season Salinity (in ppt) for FWOP and FWP by Target Year 0, 1, 3, 5, 6, and 50.

Target Year	FWOP & FWP Salinity (ppt)
0	0.1
1	0.1
3	0.1
5	0.1
6	0.1
50	0.1

2.6 V6 ACCESS VALUE

Due to time limitations, for simplification all V6s set to 1.0 for all TYs. Thus, V6 is 1.0 for all TYs under both FWOP and FWP.

2.7 WVA RESULTS:

Table C10:2-6. WVA Resultant AAHUs for Avoca Island Project Site.

TOTAL BENEFITS IN AAHUs DUE TO PROJECT	
A. Emergent Marsh Habitat Net AAHUs =	65.20
B. Open Water Habitat Net AAHUs =	-73.01
Net Benefits=(2.1xEMAAHUs+OWAAHUs)/3.1	20.61

SECTION 3

GIWW MITIGATION SITE

Figure C10:3-1. Map of Fresh and Intermediate Marsh Mitigation Project – GIWW.

For consistency between sites until field data can be obtained, the GIWW site was assumed to be mostly deep (over 1.5 ft) open water with minimal emergent vegetation and little to no SAV. Habitat was representative of fresh/intermediate marsh. The land loss rates for the Avoca Island site were taken from the Coastal Master Plan, Land Loss Polygon #147.

Marsh acreage data from polygon 147 reveals a decreasing acreage trend.

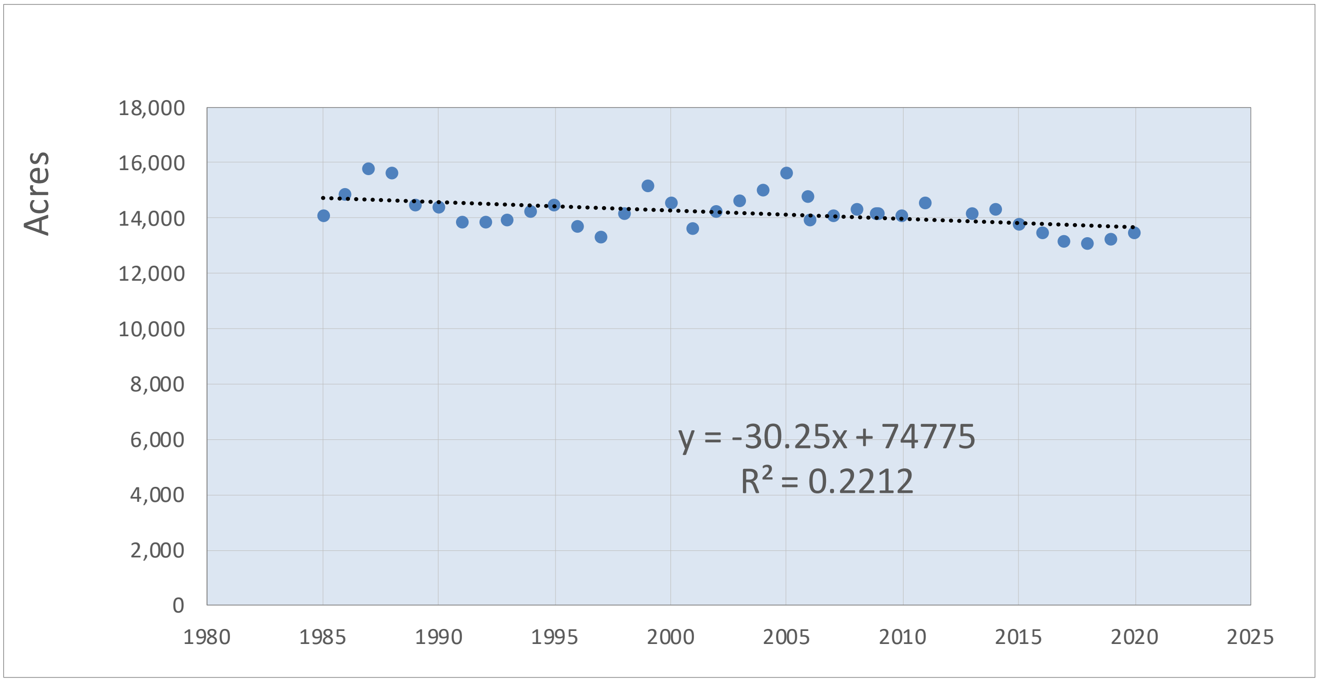

Figure C10:3-2. Marsh acreage data from polygon 147 reveals a decreasing acreage trend.

3.1 V1 PERCENT EMERGENT MARSH

The average 1985-2020 loss rate for this area (relative to the predicted 1985 acreage of 38,735 ac) = -0.075%/year. Baseline marsh acreage and marsh loss rate information was plugged into the MIMs version 3.11 spreadsheet. For these quick assessments, a simplifying assumption of no existing marsh within the mitigation polygon was used.

Table C10:3-1. Percent Emergent Marsh for FWOP and FWP by Target Year 0, 1, 3, 5, 6, and 50.

Target Year	FWOP Percent Marsh	FWP Percent March
0	0%	0%
1	0%	0%
3		15%
5		50%

6		100%
50	0%	74%

3.2 V2 PERCENT SUBMERGED AQUATIC VEGETATION

SAV was observed during the field visit to this location. We are assuming maintenance of SAV in this area throughout the project life because salinities will likely maintain over time despite RSLR due to freshwater influence from the Atchafalaya into the GIWW and eventually the project area. A % aquatic vegetation of 50% was assumed for FWOP and FWP.

Table C10:3-2. Percent Submerged Aquatic Vegetation for FWOP and FWP by Target Year 0, 1, 3, 5, 6, and 50.

Target Year	FWOP Percent Aquatic Vegetation	FWP Percent Aquatic Vegetation
0	50%	50%
1	50%	50%
3		50%
5		50%
6		50%
50	50%	50%

3.3 V3 INTERSPERSION

Under FWOP the site is almost entirely deep (greater than 1.5 ft) open water (Class 5). For FWP, TY1 and TY3 are Class 5(carpet marsh), as is standard convention for newly created marsh. By TY 5 we assume the site will be mainly Class 3. By TY 50 we assume the marsh have a Class 1 interspersion.

Table C10:3-3. V3 Interspersion for FWOP and FWP by Target Year 0, 1, 3, 5, 6, and 50.

Target Year	FWOP Interspersion Class	FWP Interspersion Class
0	Class 5 - 100%	Class 5 - 100%
1	Class 5 - 100%	Class 3 - 100%
3		Class 3 - 100%
5		Class 3 - 50% Class 2- 50%
6		Class 2- 100%
50	Class 5 - 100%	Class 3 - 50% Class 2- 50%

3.4 V4 PERCENT SHALLOW OPEN WATER

Water depth measurements showed that no shallow open water (less than 1.5 feet) occurred within the site. For FWP we assume there will be 90% shallow open water in TY1 but that number is assumed to drop to 73% by TY 50. The reasons percent open water less than 1.5 feet does not decrease lower than 70% is because the site is somewhat inland and is therefore more protected from factors like wave fetch and the water is more fresh.

Table C10:3-4. Percent Shallow Open Water for FWOP and FWP by Target Year 0, 1, 3, 5, 6, and 50.

Target Year	FWOP Percent Open Water Less than 1.5 Deep	FWP Percent Open Water Less than 1.5 Deep
0	0%	0%
1	0%	90%
3		90%
5		80%

6		80%
50	0%	73%

3.5 V5 AVERAGE GROWING SEASON SALINITY

There are no CRMS gages within the project area so two nearby CRMS gages (CRMS5035 and CRMS0490) were used to estimate salinity.

Table C10:3-5. Growing Season Salinity for FWOP and FWP by Target Year 0, 1, 3, 5, 6, and 50.

Target Year	**FWOP & FWP Salinity (ppt)**
0	0.1
1	0.1
3	0.1
5	0.1
6	0.1
50	0.1

3.6 V6 ACCESS VALUE

Due to time limitations, for simplification all V6s set to 1.0 for all TYs. Thus, V6 is 1.0 for all TYs under both FWOP and FWP.

3.7 WVA RESULTS:

Table C10:3-6. WVA Resultant AAHUs for GIWW Project Site.

TOTAL BENEFITS IN AAHUs DUE TO PROJECT

A. Emergent Marsh Habitat Net AAHUs =	67.81
B. Open Water Habitat Net AAHUs =	-62.28
Net Benefits=(2.1xEMAAHUs+OWAAHUs)/3.1	**25.84**

SECTION 4
Delta Farms Mitigation Site

Figure C10:4-1. Map of Fresh and Intermediate Marsh Mitigation Project – Delta Farms.

The Delta Farms site is mostly deep (over 1.5 ft) open water with minimal emergent vegetation little SAV at the time of sampling. The site is protected from wave action by existing surrounding marsh. Habitat was representative of fresh/intermediate marsh. The land loss rates for the Delta Farms site were taken from the Coastal Master Plan, Land Loss Polygon #187.

After a field visit, this site's WVA was chosen to be revisited and refined therefore more TYs were chosen, and a more in-depth analysis was performed.

Marsh acreage data from polygon 187 reveals an increasing acreage trend.

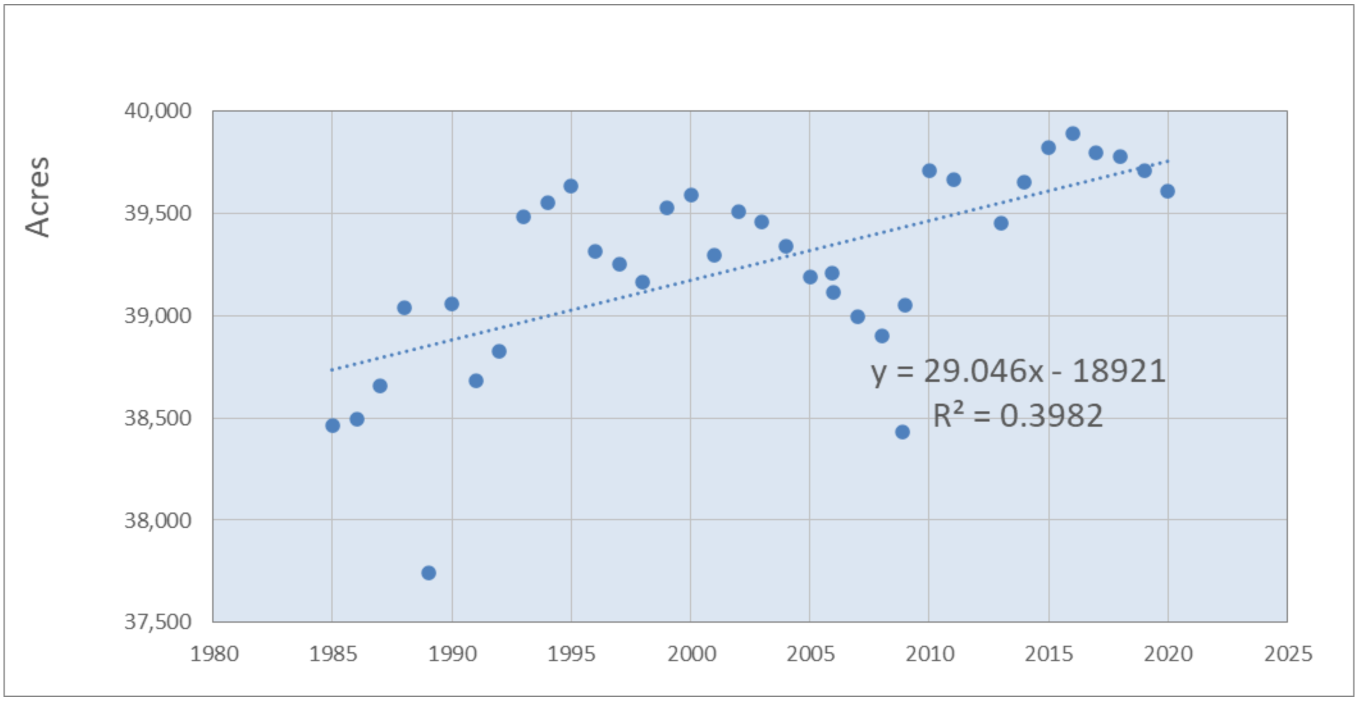

Figure C10:4-2. Marsh acreage data from polygon 187 reveals an increasing acreage trend.

4.1 V1 PERCENT EMERGENT MARSH

The average 1985-2020 loss rate for this area (relative to the predicted 1985 acreage of 38,735 ac) = -0.075%/year. Baseline marsh acreage and marsh loss rate information was plugged into the MIMs version 3.11 spreadsheet. For these quick assessments, a simplifying assumption of no existing marsh within the mitigation polygon was used.

Table C10:4-1. Percent Emergent Marsh for FWOP and FWP by Target Year 0, 1, 3, 5, 6, and 50.

Target Year	FWOP Percent Marsh	FWP Percent March
0	0%	0%

1	0%	0%
3		15%
5		50%
6		100%
50	0%	95%

4.2 V2 PERCENT SUBMERGED AQUATIC VEGETATION

Little SAV was observed during the field visit to this location. Based on field observations of less than 1% aquatic vegetation, a V2 of 0% was used for the FWOP WVA. For FWP aquatic vegetation is expected to begin at 0% and reach 60% by TY50. This is based on the fact that, though there was little SAV at the site, some SAV was present and could increase as a healthier marsh environment (increased shallow water, decreased wave fetch, maintaining fresh conditions from nearby diversion influence, etc.) is developed.

Table C10:4-2. Percent Submerged Aquatic Vegetation for FWOP and FWP by Target Year 0, 1, 3, 5, 6, and 50.

Target Year	FWOP Percent Aquatic Vegetation	FWP Percent Aquatic Vegetation
0	0%	0%
1	0%	10%
3		30%
5		50%
6		60%
50	0%	60%

4.3 V3 INTERSPERSION

Under FWOP the site is almost entirely deep (greater than 1.5 ft) open water (Class 5). For FWP, TY1 and TY3 are Class 5(carpet marsh), as is standard convention for newly created marsh. By TY 5 we assume the site will be mainly Class 3. By TY 50 we assume the marsh have a Class 1 interspersion.

Table C10:4-3. V3 Interspersion for FWOP and FWP by Target Year 0, 1, 3, 5, 6, and 50.

Target Year	FWOP Interspersion Class	FWP Interspersion Class
0	Class 5 - 100%	Class 5 - 100%
1	Class 5 - 100%	Class 5 - 100%
3		Class 3 - 100%
5		Class 3 - 50% Class 2- 50%
6		Class 2- 100%
50	Class 5 - 100%	Class 3 - 50% Class 4- 50%

4.4 V4 PERCENT SHALLOW OPEN WATER

Water depth measurements showed that no shallow open water (less than 1.5 feet) occurred within the site. For FWP we assume there will be 95% shallow open water in TY1 but that number is assumed to drop to 70% by TY 50. The reasons percent open water less than 1.5 feet does not decrease lower than 70% is because the site is somewhat inland and is therefore more protected from factors like wave fetch and the water is more fresh.

Table C10:4-4. Percent Shallow Open Water for FWOP and FWP by Target Year 0, 1, 3, 5, 6, and 50.

Target Year	FWOP Percent Open Water Less than 1.5 Deep	FWP Percent Open Water Less than 1.5 Deep
0	0%	0%
1	0%	95%
3		95%
5		93%
6		92%
50	0%	70%

4.5 V5 AVERAGE GROWING SEASON SALINITY

CRMS gage CRMS4218 was used to determine salinity in the project area. Salinity is expected to increase slightly due to the effects of relative sea level rise.

Table C10:4-5. Growing Season Salinity for FWOP and FWP by Target Year 0, 1, 3, 5, 6, and 50.

Target Year	FWOP & FWP Salinity (ppt)
0	1
1	1
3	1
5	1
6	1
50	2

4.6 V6 ACCESS VALUE

The evaluation site is an open system with no impediments to water and materials exchange. Thus, V6 is 1.0 for most TYs under both FWOP and FWP. The exception to this is TY1 of FWP where access is expected to be close to 0. We assume TY1 will have an access value of close to 0 due to the assumed use of containment dikes at the time of construction. Natural hydrologic processes are expected to remedy the low access value.

4.7 WVA RESULTS:

Table C10:4-6. WVA Resultant AAHUs for Delta Farms Project Site.

TOTAL BENEFITS IN AAHUs DUE TO PROJECT

A. Emergent Marsh Habitat Net AAHUs =	66.37
B. Open Water Habitat Net AAHUs =	-15.58
Net Benefits=(2.1xEMAAHUs+OWAAHUs)/3.1	39.93

SECTION 5
Lake Salvador Mitigation Site

Figure C10:5-1. Map of Fresh and Intermediate Marsh Mitigation Project – Lake Salvador.

The Lake Salvador site is mostly deep (over 1.5 ft) open water with minimal emergent vegetation and little to no SAV at the time of sampling. We could not sample as much of the site as we would have hope due to low fuel in the airboat, but we were able to get an acceptable sample for a preliminary WVA. This site is subject to high amounts of wave action. The land loss rates for the Delta Farms site were taken from the Coastal Master Plan, Land Loss Polygon #197.

Marsh acreage data from polygon 197 reveals an increasing acreage trend, but because of wave action at this site (due to the proximity to Lake Salvador) it is very likely there is a decreasing acreage trend within the site.

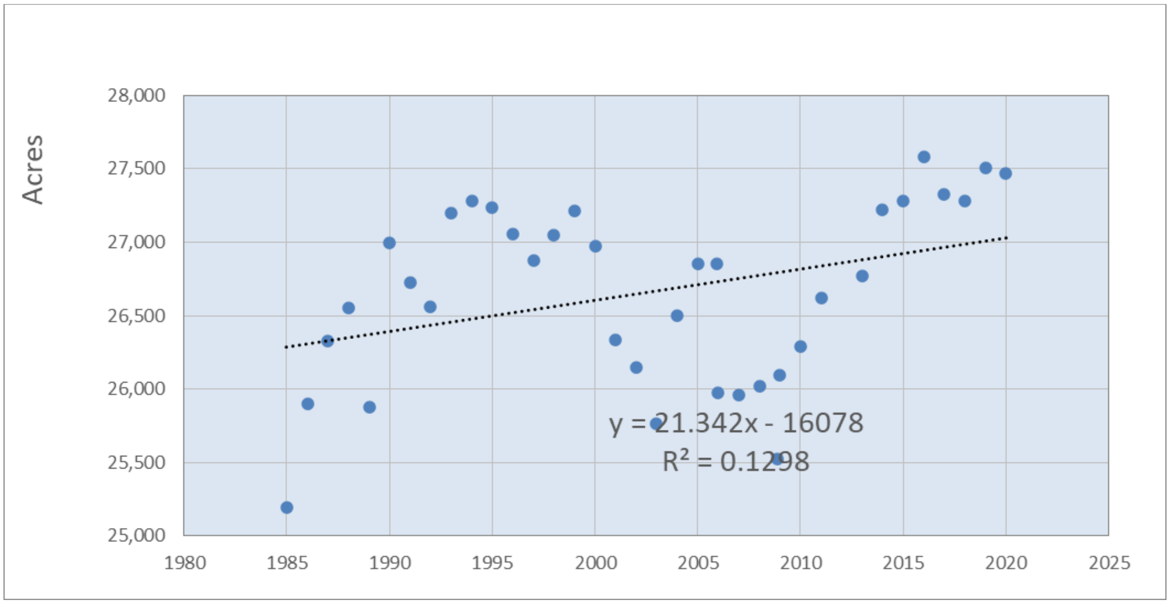

Figure C10:5-2. Marsh acreage data from polygon 197 reveals an increasing acreage trend.

5.1 V1 PERCENT EMERGENT MARSH

The average 1985-2020 loss rate for this area (relative to the predicted 1985 acreage of 26,286 ac) = -0.081%/year. Baseline marsh acreage and marsh loss rate information was plugged into the MIMs version 3.11 spreadsheet. For these quick assessments, a simplifying assumption of no existing marsh within the mitigation polygon was used.

Table C10:5-1. Percent Emergent Marsh for FWOP and FWP by Target Year 0, 1, 3, 5, 6, and 50.

Target Year	FWOP Percent Marsh	FWP Percent March
0	0%	0%
1	0%	0%
3		15%
5		30%
6		100%
50	0%	95%

5.2 V2 PERCENT SUBMERGED AQUATIC VEGETATION

Little to no SAV was observed during the field visit to this location. This may be due to wave action from Lake Salvador. We are assuming some recruitment of SAV in this area at the end of the project life. A % aquatic vegetation of 0% was assumed for FWOP. For FWP it is assumed % aquatic vegetation will reach 50% by TY1 and maintain those levels throughout the project life.

Table C10:5-2. Percent Submerged Aquatic Vegetation for FWOP and FWP by Target Year 0, 1, 3, 5, 6, and 50.

Target Year	FWOP Percent Aquatic Vegetation	FWP Percent Aquatic Vegetation
0	0%	0%
1	0%	50%
3		50%
5		50%
6		50%
50	0%	50%

5.3 V3 INTERSPERSION

Under FWOP the site is almost entirely deep (greater than 1.5 ft) open water (Class 5). For FWP, TY1 is assumed to be Class 3 (carpet marsh) and TY50 is expected to be Class 1 due to natural hydrologic processes.

Table C10:5-3. Interspersion for FWOP and FWP by Target Year 0, 1, 3, 5, 6, and 50.

Target Year	FWOP Interspersion Class	FWP Interspersion Class
0	Class 5 - 100%	Class 5 - 100%
1	Class 5 - 100%	Class 5 - 100%
3		Class 3 - 100%
5		Class 3 - 50% Class 2- 50%
6		Class 2- 100%
50	Class 5 - 100%	Class 3 - 50% Class 4- 50%

5.4 V4 PERCENT SHALLOW OPEN WATER

Water depth measurements showed that no shallow open water (less than 1.5 feet) occurred within the site. For FWP we assume there will be 95% shallow open water in TY1 for simplification and because of low land loss rates in the area, but the actual percentage of shallow open water may be lower due to erosion from waves from the lake so more in-depth WVAs should be conducted if this site is chosen to move forward for the next project phase.

Table C10:5-4. Percent Shallow Open Water for FWOP and FWP by Target Year 0, 1, 3, 5, 6, and 50.

Target Year	FWOP Percent Open Water Less than 1.5 Deep	FWP Percent Open Water Less than 1.5 Deep
0	0%	0%
1	0%	95%
3		95%
5		95%
6		95%
50	0%	95%

5.5 V5 AVERAGE GROWING SEASON SALINITY

There are no CRMS gages within the project area so the CRMS3054 gage was used to estimate salinity.

Table C10:5-5. Growing Season Salinity for FWOP and FWP by Target Year 0, 1, 3, 5, 6, and 50.

Target Year	FWOP & FWP Salinity (ppt)
0	0.1
1	0.1
3	0.1
5	0.1
6	0.1
50	0.1

5.6 V6 ACCESS VALUE

Due to time limitations, for simplification all V6s set to 1.0 for all TYs. Thus, V6 is 1.0 for all TYs under both FWOP and FWP.

5.7 WVA RESULTS:

Table C10:5-6. WVA Resultant AAHUs for Lake Salvador Project Site.

TOTAL BENEFITS IN AAHUs DUE TO PROJECT

A. Emergent Marsh Habitat Net AAHUs =	70.90
B. Open Water Habitat Net AAHUs =	-20.95
Net Benefits=(2.1xEMAAHUs+OWAAHUs)/3.1	**41.27**

SECTION 6
Potential Mitigation Sites Summary

Based on our preliminary WVAs it appears that all sites are relatively similar in terms of mitigation potential. Once engineering surveys are complete, more detailed WVAs should be done during advanced engineering design to determine the true expected mitigation potential of the chosen mitigation site(s) to ensure appropriate sizing of the projects to ensure complete satisfaction of the mitigation requirement.

SECTION 7
List of Acronyms and Abbreviations

ac	Acres
AAHU	Average Annual Habitat Unit
CMP	Coastal Master Plan
CRMS	Coastwide Reference Monitoring System
DS	Deep Subsidence
ER	Engineering Regulation
FWP	Future With Project
FWOP	Future Without Project
GIWW	Gulf Intracoastal Waterway
HSDRRS	Hurricane Storm Damage Risk Reduction System
ICM	Integrated Compartment Model
MCA	Marsh Creation Area
MTG	Morganza to the Gulf
PIS	Project Information Sheet
RSLC	Relative Sea Level Change
RSLR	Relative Sea Level Rise
SEC	Surface Elevation Change
SLC	Sea Level Change
SOW	Shallow Open Water
TS	Total Subsidence
SS	Shallow Subsidence
TY	Target Year
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USGS	United States Geological Survey
SAV	Submerged Aquatic Vegetation
WVA	Wetland Value Assessment