GULFPORT HARBOR, GULFPORT, MISSISSIPPI

DRAFT

Integrated Feasibility Report With Environmental Assessment

NEPA ID: EAXX-202-00-SAM-K5P-17340153333

US Army Corps of Engineers
Mobile District

December 13, 2024

PORT OF GULFPORT MISSISSIPPI

TABLE OF CONTENTS

Figures

Tables

Appendices

Appendix A – Engineering

Appendix B – Economics

Appendix C – Environmental

Appendix D – Real Estate

Appendix E – Public Comments

Appendix F – Additional Documentation

Abbreviations and Acronyms

AEO	Annual Energy Outlook		
AFCA	Anadromous Fish Conservation Act	**DO**	Dissolved Oxygen
ALDOT	Alabama Department of Transportation	**DWT**	Deadweight Tonnage
AMRD	Alabama Marine Resources Division	**EFH**	Essential Fish Habitat
AOI	Area of Influence	**EIS**	Environmental Impact Statement
APE	Area of Potential Effect	**EJ**	Environmental Justice
APM	A.P. Moller-Maersk Group	**EM**	Engineer Manual
ASA	American Sportfishing Association	**EO**	Executive Order
ASA(CW)	Assistant Secretary of the Army for Civil Works	**EOP**	Environmental Operating Principles
BA	Biological Assessment	**EPA**	Environmental Protection Agency
BCR	Benefit-to-Cost Ratio	**EPCRA**	Emergency Planning and Community Right to Know Act
BGS	Below Ground Surface	**EQ**	Environmental Quality
BO	Biological Opinion	**ER**	Engineer Regulation
BTU	British Thermal Unit	**ERDC**	Engineering Research and Development Center
BU	Beneficial Use	**ESA**	Endangered Species Act
C	Celsius	**ESO**	Endangered Species Observer
CAA	Clean Air Act	**F**	Fahrenheit
CBD	Central Business District	**FAMP**	Fisheries Assessment and Monitoring Program
CBRA	Coastal Barrier Resources Act	**FEMA**	Federal Emergency Management Agency
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	**FHWA**	Federal Highway Administration
CEQ	Council on Environmental Quality	**FMC**	Fishery Management Councils
CFR	Code of Federal Regulation	**FMP**	Fishery Management Plan
CFS	Cubic Feet Per Second	**FNC**	Federal Navigation Channel
CN	Canadian National	**FR**	Federal Register
CSRA	Cost and Schedule Risk Analysis	**FWCAR**	Fish and Wildlife Coordination Act Report
CSX	Chessie Seaboard	**FWP**	Future With Project
CWA	Clean Water Act	**FWOP**	Future Without-Project
CWT	Continuous Wavelet Transformation	**FY**	Fiscal Year
CY/YR	Cubic Yards Per Year	**GDP**	Gross Domestic Product
CZMA	Coastal Zone Management Act	**GHG**	Green House Gas

GI	Global Insight	**MDEQ**	Mississippi Department of Environmental Quality
GIS	Geographic Information System	**MDMR**	Mississippi Department of Marine Resources
GIWW	Gulf Intracoastal Waterway	**MFR**	Memorandum for Record
GMFMC	Gulf of Mexico Fishery Management Council	**MHTB**	Mobile Harbor Turning Basin
GNF	General Navigation Features	**MLLW**	Mean Lower Low Water
GRBO	Gulf Regional Biological Opinion	**MMPA**	Marine Mammal Protection Act
GRR	General Reevaluation Report	**MMS**	Minerals Management Service
GRR/SEIS	General Reevaluation Report with Supplemental Environmental Impact Statement	**MOA**	Memorandum of Agreement
GSA	Geological Survey of Alabama	**MPRSA**	Marine Protection, Research, and Sanctuaries Act
GUIS	Gulf Islands National Seashore	**MRC**	Mobile River Channel
GWP	Global Warming Potential	**MRD**	Marine Resources Division
IBA	Important Bird Areas	**MSFCMA**	Magnuson-Stevens Fishery Conservation and Management Act
IDC	Import Distribution Center	**MSPA**	Mississippi State Port Authority
ILEC	Incumbent Local Exchange Carrier	**MT/YR**	Million Tons/Year
IPAC	Information for Planning and Consultation	**MWL**	Mean Water Level
IPCC	Intergovernmental Panel on Climate Change	**NAAQS**	National Ambient Air Quality Standards
LERR	Lands, Easements, Rights-of-way and Relocations	**NED**	National Economic Development
LFA	Load factor Analysis	**NEP**	National Estuary Program
LOA	Length Overall	**NEPA**	National Environmental Policy Act
LPC	Limiting Permissible Concentration	**NFS**	Non-federal Sponsor
LRR	Limited Reevaluation Report	**NFWF**	National Fish and Wildlife Foundation
MANLA	May affect, not likely to adversely affect	**NGO**	Non-Governmental Organization
MBNEP	Mobile Bay National Estuary Program	**NHPA**	National Historic Preservation Act
MBSC	Mobile Bay Ship Channel	**NM**	Nautical Mile
MBTA	Migratory Bird Treaty Act	**NMFS**	National Marine Fisheries Service
MCY	Million Cubic Yards	**NNOMPEAS**	National Navigation Operation & Management Performance Evaluation & Assessment System

NTU	Nephelometric Turbidity Units	**NOAA**	National Oceanic Atmospheric Administration
NWR	National Wildlife Refuge	**NPS**	National Park Service
O&M	Operation and Maintenance	**SMCA**	Sunken Military Craft Act
ODMDS	Ocean Dredged Material Disposal Site	**SPT**	Standard Penetration Test
OSE	Other Social Effects	**SSC**	Suspended Sediment Concentration
OSHA	Occupational Safety and Health Administration	**SST**	Sea Surface Temperature
P&G	Principles and Guidelines	**STS**	Ship-to-Shore
PAR	Photosynthetically Active Radiation	**SWAN**	Simulating Waves Nearshore
PARA	Prepare, Absorb, Recover, and Adapt	**TCS**	Transportation Cost Savings
PDT	Project Delivery Team	**TEU**	Twenty-foot Equivalent Units
PED	Preconstruction Engineering and Design	**TNC**	The Nature Conservancy
PICS	Particle Imaging Camera System	**TPCS**	Total Project Cost Summary
PIMS	Public Involvement Management Strategy	**TSC**	Theodore Ship Channel
PL	Public Law	**UKC**	Underkeel Clearance
PPA	Project Partnership Agreement	**U.S.**	United States
PPM	Parts Per Million	**USACE**	U.S. Army Corps of Engineers
PPT	Parts Per Thousand	**USEPA**	U.S. Environmental Protection Agency
PSD	Prevention of Significant Deterioration	**USCG**	U.S. Coast Guard
PSU	Practical Salinity Unit	**USDA**	U.S. Department of Agriculture
RCRA	Resource Conservation and Recovery Act	**USFWS**	U.S. Fish and wildlife Service
RED	Regional Economic Development	**USGS**	U.S. Geological Survey
REP	Real Estate Plan	**VGWE**	Vessel Generated Wave Energy
Ro-Ro	Roll on/Roll off	**WCSC**	Waterborne Commerce Statistics Center
ROI	Region of Interest	**WIS**	World Industry Service
SAD	South Atlantic Division	**WRDA**	Water Resources Development Act
SAV	Submerged Aquatic Vegetation	**WRRDA**	Water Resources Reform and Development Act
SEIS	Supplemental Environmental Impact Statement	**WTS**	World Trade Service
SHPO	State Historic Preservation Office		
SL	Standard Length		
SLR	Sea Level Rise		

1.0 Introduction

The Gulfport Harbor, Gulfport, Mississippi, Navigation Improvement Project Integrated Feasibility Report/Environmental Assessment (IFR/EA), documents the investigations and analyses conducted by the United States Army Corps of Engineers (USACE), for recommended navigation improvements, including widening and deepening, of Gulfport Harbor, Gulfport, Mississippi, and documents compliance with the National Environmental Policy Act (NEPA) in the planning process.

The Gulfport Harbor Federal Navigation Channel (FNC) provides access for deep draft vessel traffic to utilize terminal facilities located at the Port of Gulfport along the shoreline of the Mississippi Sound as shown in **Figure 1-1**. The investigations described in this report evaluate the feasibility of alternative plans to address navigation while addressing environmental concerns to provide long term navigation improvements.

Figure 1-1: Gulfport Harbor, Mississippi Feasibility Study Area Map

1.1 Study Authority

This study is authorized by Section 216 of the Flood Control Act of 1970 (Public Law 91-611) as amended, as follows:

33 U.S. Code § 549a. SEC 216. REVIEW OF NAVIGATION, FLOOD CONTROL, AND WATER SUPPLY PROJECTS "The Secretary of the Army, acting through the Chief of Engineers, is authorized to review the operation of projects the construction of which has been completed and which were constructed by the Corps of Engineers in the interest of navigation, flood control, water supply, and related purposes, when found advisable due to significantly changed physical or economic conditions, and to report thereon to Congress with recommendations on the advisability of modifying the structures or their operation, and for improving the quality of the environment in the overall public interest."

1.1.1 Congressional Districts

The study area is in the 4th congressional district of the State of Mississippi. The congressional delegation consists of Senator Roger Wicker, Senator Cindy Hyde-Smith, and Congressman Mike Ezell.

1.1.2 Study Sponsor

The Mississippi Port Authority (MSPA) is the non-Federal sponsor (NFS) for the study and the current navigation project.

1.2 Study Area

Gulfport Harbor, Mississippi is located south of the City of Gulfport in Harrison County, Mississippi and is approximately seven miles (mi) south of Interstate 10. It is approximately 80 mi equidistant between New Orleans, Louisiana and Mobile, Alabama. Gulfport Harbor encompasses approximately 300 acres (ac) and is located on the north shore of the Mississippi Sound within five mi of the Gulf Intracoastal Waterway (GIWW) and 10 mi from the Gulf of Mexico and Gulf Island National Seashore (GINS).

The Gulfport Harbor Federal Navigation Channel (FNC) is approximately 21 mi in length (**Figure 1-1**), 300 feet (ft) wide in the Sound Channel and maintained to a depth of 36 feet, the Bar Channel from Ship Island south to the Safety Fairway is 400 feet wide with a depth of 38 feet. The Port's Inner Harbor is maintained to a depth of 32 feet, while the Outer Harbor and Gulfport Anchorage Basin, which are approximately 1,320 feet wide, are maintained to a depth of 36 feet (USACE, 2009a). USACE, Mobile District constructed a bend easing of the Gulf Bar channel to a 1,400 feet width that was approved by USACE, South Atlantic Division (SAD). The actual dredge depths of these channels include an additional -2 feet of advanced maintenance and -2 feet of overdepth dredging. An additional -3 feet of sediment below the -2-foot paid allowable dredging cut may be disturbed in the dredging process with minor amounts of the material being removed. The plane of reference is mean lower low water (MLLW). The

harbor is constructed on fill over former open-water bottom areas in Mississippi Sound and includes the East Pier, North Harbor, West Pier, and a Commercial Small Craft Harbor that is 8 feet deep and 100 feet wide. Access to the Port is via the Channel and a Commercial Small Craft Channel (8 feet deep). Located to the east of the Port are the Gulfport Small Craft Harbor, Gulfport Yacht Club, Harbor Square Park, and U.S. Coast Guard (USCG) Station Gulfport. Public beaches are located to the east and west of, and adjacent to, the Port. Its northern boundary is U.S. Highway 90.

Strategically located and serving as an economic driver for the Mississippi Gulf Coast, Gulfport Harbor supports major imports and exports of poultry products, fruit, wood products, metals, and minerals for manufacturing processes. It also supports approximately 2 million tons of commerce annually.

Figure 1-2 illustrates the current channel alignment and associated open-water placement options for the currently authorized project.

Figure 1-2: Existing Dredged Material Placement Areas

1.2.1 Advanced Maintenance

In areas that experience frequent shoaling, advanced maintenance is often conducted to reduce the frequency of dredging and in turn reduce overall operations and maintenance (O&M) costs of authorized channel dimensions. The channel segments described above are approved for 2 feet of allowable over depth and 2 feet of advanced maintenance in addition to the described depths.

1.2.2 Historically Authorized Projects

Table 1.1 below summarizes the historical authorizations of construction and modifications to the Federal channel.

Table 1.1. Summary of Historical Authorized Project Depths

Acts	Work Authorized	Documents
Mar. 3, 1899	A channel 19 feet deep and 300 feet wide from the anchorage basin at Ship Island to Gulfport, Mississippi, and an anchorage basin next to the shore end 19 feet deep and not less than 2,640 feet by 1,320 feet in area.	H. Doc. 120, 55th Cong., 3d Sess.
Mar. 2, 1907	Combined Ship Island Pass with Gulfport Harbor project	
Feb. 27, 1911	Increased depth to 26 feet and width to 300 feet across Ship Island Bar and depth to 19 feet in channel from anchorage basin at Ship Island to anchorage basin at Gulfport.	H. Doc. 2, 60th Cong.,1st Sess.
Jan. 21, 1927	Authorized relocation of channel across Ship Island Bar.	
July 23, 1930	Increased depth to 27 feet and width to 300 feet across Ship Island Bar, 26 feet deep and 220 feet wide through Mississippi Sound and depth of 26 feet in the anchorage basin at Gulfport.	H. Doc. 692, 69th Cong., 2d Sess.
June 30, 1948	Increased depth of 32 feet and width to 300 feet across Ship Island Bar, 30 feet deep and 220 feet wide through Mississippi Sound, and a depth of 30 feet in the anchorage basin at Gulfport.	River and Harbor Act of 1948 § 101, P.L. 80-771, 62 Stat. 1171 (June 30, 1948)

July 3, 1958	Maintenance of the existing commercial small-boat harbor and an approach channel 100 feet wide and 4,300 feet long, from deep water in Mississippi Sound to the small-boat basin, all at a depth of 8 feet.	S. Doc. 123, 84th Cong., 2d Sess.
Aug. 15, 1985	Modify the existing Ship Channel to 36 x 300 feet in Mississippi Sound, and 38 x 400 feet across the bar, with changes in the channel alignment and the entrance to the anchorage basin for safe and unrestricted navigation	The Energy and Water Development Approp. Act, 1985 (P.L. 99-88)

1.3 Purpose and Need

The Commerce Clause of the U.S. Constitution establishes the Federal interest in navigation. The project purpose is to provide safe, reliable, and efficient waterborne transportation systems that are environmentally sustainable and contribute to National Economic Development (NED). The proposed Federal action, the project seeks to improve navigation into and out of the port at Gulfport Harbor for deep draft vessels currently calling at Gulfport and those vessels anticipated to use the harbor in the future. By providing unrestricted navigation into and out of Gulfport Harbor Transportation Cost Savings (TCS) would be achieved and future economic growth at the Port of Gulfport and immediate region is encouraged and facilitated.

Since the construction of the harbor in 1948, the Port of Gulfport has become the third largest container port on the Gulf of Mexico and is currently experiencing growth in commerce. As of 2023, the Port is developing Terminal 4 into an operational container terminal, which will increase its container capacity. The world fleet vessels have also trended toward additional capacity, becoming longer, wider, and requiring deeper drafts. The existing channel dimensions at Gulfport Harbor restrict navigation access to smaller, less efficient vessels. The current channel dimensions are such that larger vessels are not loaded efficiently to meet the draft restrictions. The need for the project is to reduce these transportation inefficiencies and improve overall navigability of Gulfport Harbor.

1.3.1 Study Scope

The scope for this study is to determine ways to increase transportation efficiencies for the Gulfport Harbor in ways that are engineeringly feasible, environmentally acceptable, and economically justifiable. Engineeringly feasible means that the project can be implemented from an engineering standpoint, and the methods used would promote the resiliency of the project when able. Resilient design follows the Prepare, Absorb, Recover, and Adapt (PARA) principles. As part of this study, the effects of sea level

change over the project life will be assessed. Environmentally acceptable means that the impacts to environmental resources, both the natural and built environmental, are accessed according to policies, regulations, and laws. Further that significant negative effects have been avoided, minimized, or mitigated appropriately. Economically justified means that the benefits from the project exceed the implementation costs with any required mitigation.

The study will use the best available information, and supplement only where necessary to the decision-making process.

1.4 Prior Reports and Studies

The USACE has been involved with the navigation channel at Gulfport Harbor since 1930. There have been numerous studies and Congressional Authorizations leading up to this current investigation. An abbreviated list of reports on Gulfport Harbor in the last 45 years is provided below.

1. U.S. Army Corps of Engineers. (1975). *Final Environmental Impact Statement, Gulfport Harbor, Mississippi (Maintenance Dredging) Harrison County, Mississippi.* Mobile: U.S. Army Corps of Engineers, Mobile District.
2. U.S. Environmental Protection Agency. (1982). *Environmental Impact Statement (EIS) for the Pensacola, FL., Mobile, AL., and Gulfport, MS. Dredged Material Disposal Site Designation (Including Appendix A).* Washington: U.S. Environmental Protection Agency.
3. U.S. Army Corps of Engineers. (1989). *Final Environmental Impact Statement, Gulfport Harbor, Mississippi, Harrison County, Mississippi.* Mobile: U.S. Army Corps of Engineers, Mobile District.
4. U.S. Army Corps of Engineers. (2009). *Final Supplemental Environmental Impact Statement, Gulfport Harbor Navigation Channel, Harrison County, Mississippi.* Mobile: U.S. Army Corps of Engineers, Mobile District.
5. U.S. Army Corps of Engineers. (2009). *Draft Plans for Gulfport Harbor Navigation Improvement, Gulfport, Mississippi, Harrison County, Mississippi.* Mobile: U.S. Army Corps of Engineers, Mobile District.
6. U.S. Army Corps of Engineers. (2011). *Sediment Budget: Mississippi Sound Barrier Islands, Hancock, Harrison, and Jackson Counties, Mississippi.* Mobile: U.S. Army Corps of Engineers, Mobile District.
7. U.S. Army Corps of Engineers. (2012). *Littoral Sediment Budget for the Mississippi Sound Barrier Islands, Hancock, Harrison, and Jackson Counties, Mississippi.* Mobile: U.S. Army Corps of Engineers.
8. U.S. Army Corps of Engineers. (2013). *Final Evaluation of Proposed Dredged Material, Gulfport Bar Channel, Gulfport, Mississippi.* Mobile: U.S. Army Corps of Engineers.
9. U.S. Army Corps of Engineers. (2015). *Port of Gulfport Expansion Project, Gulfport, Harrison County, Mississippi. Draft Environmental Impact Statement, Volume I.* Mobile: U.S. Army Corps of Engineers.

10. U.S. Army Corps of Engineers. (2015). *Port of Gulfport Expansion Project, Gulfport, Harrison County, Mississippi. Draft Environmental Impact Statement, Volume II (Appendices A-G).* Mobile: U.S. Army Corps of Engineers.
11. U.S. Army Corps of Engineers. (2015). *Port of Gulfport Expansion Project, Gulfport, Harrison County, Mississippi. Draft Environmental Impact Statement, Volume III (Appendices H-P).* Mobile: U.S. Army Corps of Engineers.
12. U.S. Army Corps of Engineers. (2017). *Final Environmental Impact Statement for the Proposed Port of Gulfport Expansion Project.* Mobile: U.S. Army Corps of Engineers, Mobile District.
13. U.S. Army Corps of Engineers. (2019). *Marine Protection, Research, and Sanctuaries Act, Section 103 Evaluation. Gulfport Harbor Bend Easing, Gulfport, Mississippi.* Mobile: U.S. Army Corps of Engineers.

1.5 NEPA Tiered and Integrated Document Inclusion

The Environmental Assessment (EA) portion of this Integrated Feasibility Report /Environmental Assessment (IFR/EA) is tiered from the 2009 Gulfport Harbor Supplemental Environmental Impact Statement. Sections of the IFR/EA that required NEPA components are designated with an asterisk (*) in the major heading of each applicable topic.

2.0 Existing and Future Without Project Conditions*

2.1 General Setting

Gulfport Harbor, Mississippi is located south of the City of Gulfport in Harrison County, Mississippi, and is approximately seven miles south of Interstate 10, approximately 80 miles west of Mobile, Alabama, and 80 miles east of New Orleans, Louisiana.

The Port of Gulfport encompasses almost 300 acres, is located on the north shore of the Mississippi Sound within 5 miles of the GIWW and 10 miles from the Gulf of Mexico and GINS.

The Port is constructed on fill over former open-water bottom areas in Mississippi Sound and includes the East Pier, North Harbor, West Pier, and Commercial Small Craft Harbor. Access to the Port is via the Channel and a Commercial Small Craft Channel (8 feet deep). Located to the east of the Port are the Gulfport Small Craft Harbor, Gulfport Yacht Club, Harbor Square Park, and USCG Station Gulfport. Public beaches are located to the east and west of, and adjacent to, the Port. Its northern boundary is U.S. Highway 90.

The Port is strategically located and serves as a national leader in waterborne commerce and as an economic driver for the Mississippi Gulf Coast. The Port supports major imports and exports of poultry products, fruit, wood products, metals, and minerals for manufacturing processes. It also supports approximately 2 million tons of commerce annually.

The Gulfport Harbor FNC shown in **Figure 1-1**, is 300 ft wide in the inner channel (Sound Channel) and maintained to a depth of 36 feet within Mississippi Sound. The outer channel (Bar Channel) from Ship Island south to the safety fairway is 400 feet wide with a depth of 38 feet. The Port's North Harbor (Inner Harbor) is maintained to a depth of 32 feet, while the South Harbor (Outer Harbor) and Gulfport Harbor Anchorage Basin, which are approximately 1,320 feet wide, are maintained to a depth of 36 feet (USACE, 2009a). USACE, Mobile District constructed a bend easing of the Bar Channel to a 1,400 feet width that was approved by USACE, SAD. The actual dredge depths of these channels include an additional -2 feet of advanced maintenance and -2 feet of overdepth dredging. An additional -3 feet of sediment below the -2-foot paid allowable dredging cut may be disturbed in the dredging process with minor amounts of the material being removed. The plane of reference is MLLW.

2.2 Facilities and Infrastructure

The existing Port facilities include two deep water terminals, the West and the East Piers. Additionally, there is a Small Craft Harbor that is located outside of the secured Port area and has a draft of 11 feet.

The West Pier Terminal is the primary cargo handling pier. Area on the West Pier is leased by Dole, Chiquita, Crowley (containers) and Chemours (bulk). Additionally, the

West Pier has two warehouses which are leased by Dole, Chiquita, and Crowley. The West Pier has three gantry cranes, capable of unloading container ships measuring 17 boxes across. A fourth gantry crane, capable of containerships up to 19 boxes across, is on order as of 2023. There are 7 berths in addition to a Roll on/Roll off (Ro-Ro) berth on the West Pier.

The East Pier Terminal is primarily used for breakbulk cargo. It has three berths and two warehouses. Below is the list of berths on the East Pier, each maintained to a depth of 36 feet. The two piers comprise of nearly 6,000 feet of berthing space across the 10 vessel berths, all maintained at 36 feet. **Figure 2-1** is an aerial view of the port facilities, identifying the gantry cranes, berthing spaces, Terminal 4 and the Small craft harbor.

Additionally, Ocean Aero, a manufacturer of autonomous, surface/subsurface drones leases space on the East Pier, though most units are transported by truck when complete.

Figure 2-1. Port of Gulfport Facilities

2.2.1 Highway and Rail Connections

Infrastructure at the Port allows for vessel-to-truck or vessel-to-rail connection. The Port is located off U.S. Highway 90 and 30th Avenue in Gulfport, which is approximately five miles south of Interstate 10.

The following rail services are available at the Port of Gulfport:

- Kansas City Southern Railway Company – Class 1 rail service that provides access to the Midwest, Northern Alabama, Tennessee, and Kentucky.
- Chessie, Seaboard (CSX) – A class 1 rail that provides East/West access to New Orleans, Mobile, inland Alabama, and Georgia.
- Canadian National (CN) – This new north-south intermodal railroad service began running in the Fall of 2023. It has capability to run to the U.S. Midwest (Chicago) and eventually to Canada. The train has the capacity to move 300 units per day out of Gulfport.

The Port has the following inland facilities:

- North Port Property
- Highway 90 Property
- North Port Property
- Cotton Compress
- North Port Property
- Inland Port

The West Pier has 4 rail spurs (1,070 linear feet, 1,400 linear feet, 1,300 linear feet, and 1,600 linear feet) while the North Harbor has 3 (all 800 linear feet). Monthly railcar counts in 2021 (before CN Railroad started operations at the Port) were between 600 and 1,000 per month. The truck roads to access the Port are 30th Avenue and Highway 90. Trucks connect to I-10 using 30th Avenue, Highway 49, or Canal Road. Initial estimates show that without additional land expansion of the Port, TEU capacity is at least 800,000 TEUs annually.

2.3 Commodity Trends

Gulfport Harbor serves the national economy by moving close to two million metric tons of cargo annually. Import cargo were more than twice that of exports of metric tons as represented in **Figure 2-2** below. Domestic cargo accounted for approximately 10-15% of cargo between 2013 and 2016, but in recent years, it has accounted for less than 2% of total tonnage. Refer to Appendix B for detailed description of the historical commerce data inputs in the analysis.

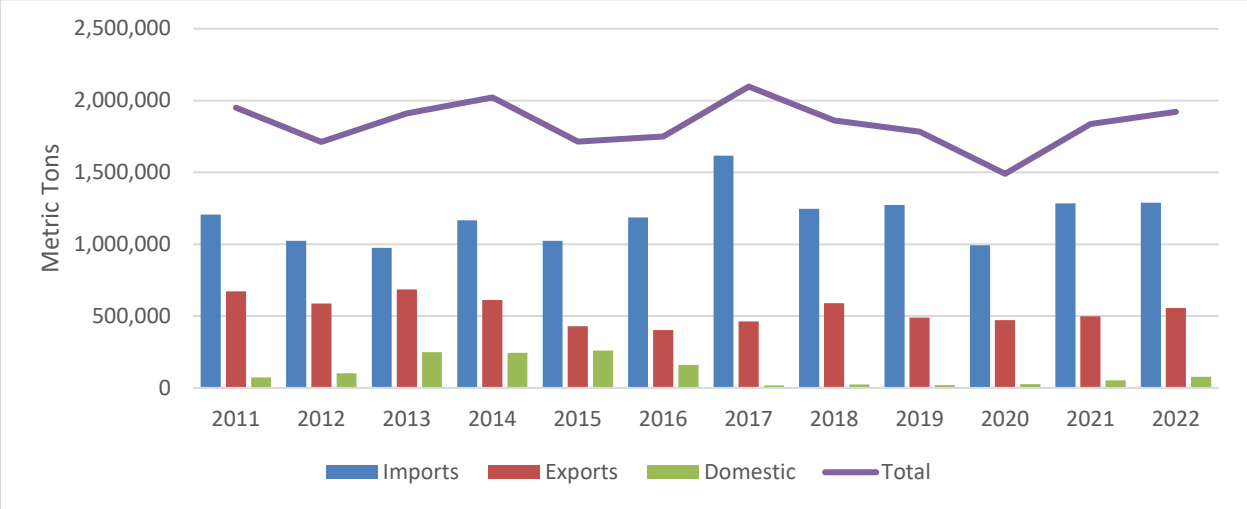

Figure 2-2. Total Tonnage Moved Through Gulfport 2011-2022

Containerships and bulk carriers are the primary cargo carriers received at Gulfport with occasional barges. Approximately 60-70% of tonnage was carried on containerships with 20-30% carried on bulk vessels between 2016 and 2020. Approximately 3% of tonnage represents cargo carried on a different type of vessel in a given year.

2.3.1 Commodity Types

Containerized cargo consists mainly of food products, cotton, textiles, and paper. Dole and Chiquita import bananas and other fruit accounting for 30-40% of overall tonnage moved through Gulfport in recent years (2016-2020).

Ilmenite ore imported for use at the Chemours' plant in Mississippi is another main commodity activity. The finished product is currently trucked to New Orleans from Mississippi to be exported. There is potential to export the finished product from Gulfport with a deeper channel via containership. Data for 2011 to 2022 record food and farm products accounted for an average of 40% of total tonnage; crude materials account for 31%, Manufactured machinery and equipment accounted for 14%, and Primary manufactured goods accounted for 12%. **Figure 2-3** shows the commodity distribution from 2011 to 2022 for both foreign and domestic (import and export) cargo.

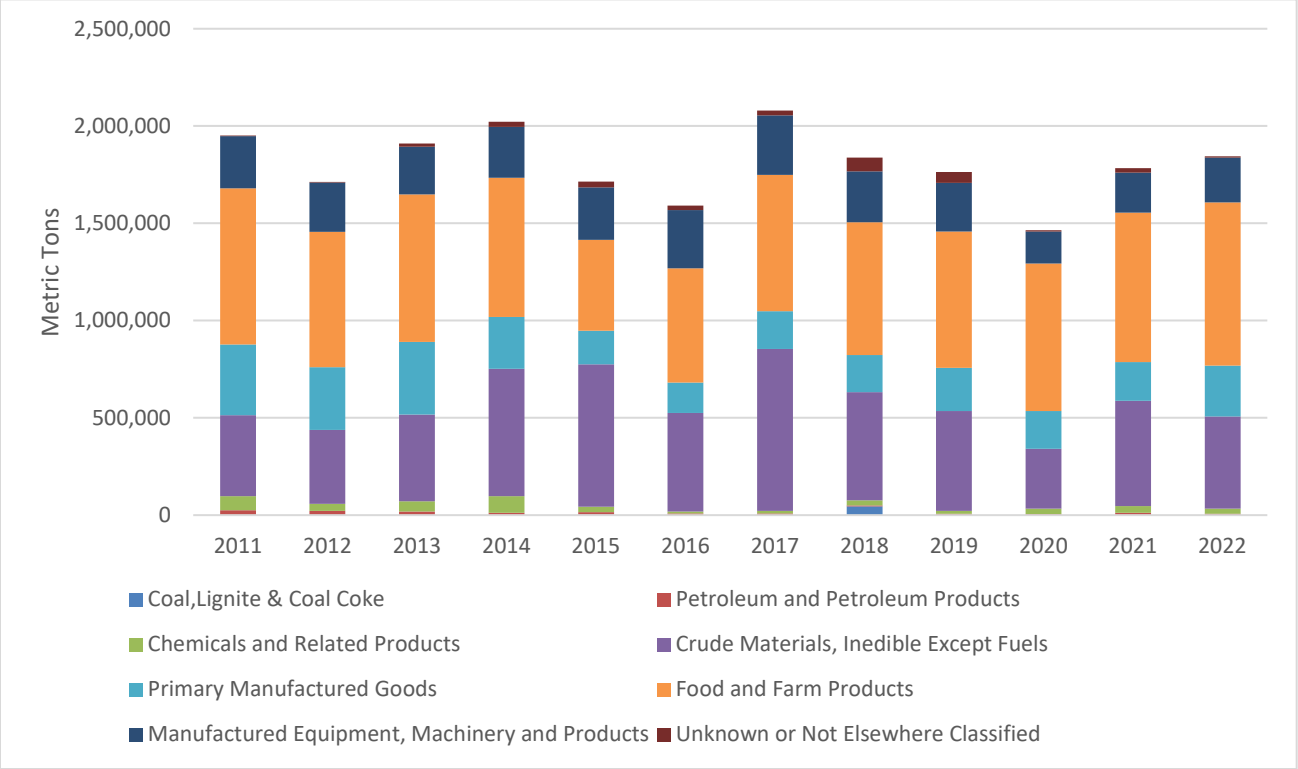

Figure 2-3. Distribution by Commodity Type (2013-2022)

2.3.2 Containerized Cargo

As of 2023, three container services were calling at Gulfport. **Table 2.1** shows the operator, service, vessel TEU capacity and trade area. Current routes include services to the Central America and the Gulf.

Table 2.1. Existing Container Services at Gulfport

Operator	Vessel TEUs	Routes	Trade Areas
Dole	3,000	Central America/Caribbean	Central America • Freeport • Gulfport • Tampa
Chiquita	2,000-3,000	Central America/Caribbean	
Crowley	1,000	Central America/Caribbean	Central America • Gulfport

2.3.2.1 Container Facility and Capabilities

Between 2013 and 2021, an average of 143,437 loaded TEUs were handled through Gulfport. When including empty TEUs, an average of 188,555 TEUs were handled during the same timeframe. In terms of container tonnage, imports currently account for approximately 60% of tonnage while exports account for 40%. **Figure 2-4**. shows import and export loaded TEUs from 2013 to 2021 according to Waterborne Commerce Statics Center (WCSC) data.

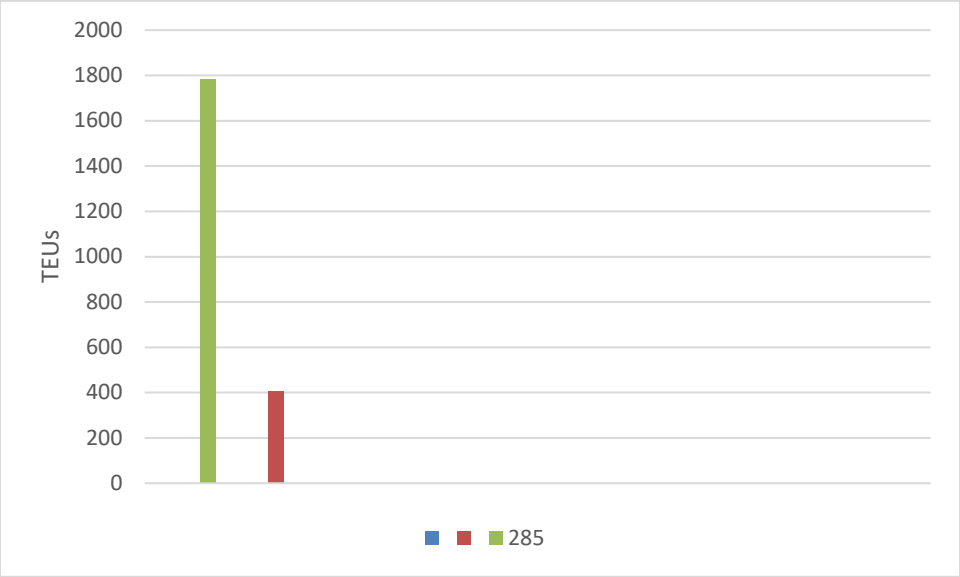

Figure 2-4 Total Loaded TEUs at Gulfport 2013-2021

2.3.3 TEU Weight by Route Group

TEU weight by route group is an important input to the load factor analysis (LFA) which is conducted as a part of assessing TCS. Cargo trade routes are one of the attributes considered in the LFA. Currently, cargo is only moved to and from Gulfport on one of the four future with- and without-project route groups. As such, an average TEU weight for that route group (Caribbean and Central America) can be estimated with empirical data, but the rest are unknown. To develop a reasonable average TEU weight by route, TEU weights from cargo moving to and from other Gulf Coast ports was gathered. The TEU weights by port for the available routes were averaged to estimate a TEU weight by route for Gulfport and presented in **Table 2.2**.

Table 2.2. Tons per TEU by Route

Route Group Description	TEU Weight Import
Caribbean /Gulf/Central America	10.2
East Coast South America	13.0
Northern Europe/Mediterranean	11.0
Far East	10.4

2.3.4 Fleet Characteristics

Vessel data for between 2016 and 2020 was obtained from the National Navigation Operation & Management Performance Evaluation & Assessment System (NNOMPEAS) and the Gulfport Harbor logs to determine vessel characteristics of the fleet calling at Gulfport. **Table 2.3** displays all vessel types with dimensions that called at Gulfport between 2016 and 2020. The maximum design draft is recorded at 45 feet for a Bulk carrier vessel with a maximum deadweight tonnage (DWT) of 73,600 tons.

Table 2.3. Summary of Vessel Fleet Dimensions

Vessel Types	Deadweight Tons (DWT)		Length Overall (ft)		Vessel Width (ft)		Design Draft (ft)	
	Min	Max	Min	Max	Min	Max	Min	Max
Bulk Carrier	30,478	66,721	576	656	91	119	32	44
Bulk Carrier, Self-discharging	46,606	73,609	615	810	106	106	37	45
Chemical/Products Tanker	22,430	22,430	492	492	81	81	33	33
Container Ship	10,831	35,465	441	695	73	100	24	38
Crane Vessel	21,550	21,550	497	497	153	153	31	31
Crew/Supply Vessel	311	1,753	194	202	32	34	7	18
General Cargo Ship	7,428	32,752	393	594	66	94	25	34
Heavy Load Carrier	7,572	45,028	329	791	69	138	24	28
Offshore Support Vessel	4,243	21,011	298	591	65	106	20	35
Open Hatch Cargo Ship	33,143	33,398	581	591	93	94	33	33
Passenger/Cruise	6,953	13,294	880	952	117	118	26	27

Platform Supply Ship	2,738	6,163	265	320	54	64	14	21
Research Survey Vessel	50	4,047	177	281	34	65	18	20
Ro-Ro Cargo Ship	25,957	25,957	738	738	106	106	31	31
Tug	327	669	86	126	30	35	13	16
Vehicles Carrier	19,670	21,233	653	656	106	106	32	33
Well Stimulation Vessel	3,117	3,117	260	260	60	60	17	17

2.3.4.1 Containership Fleet

The current containership fleet consists of vessels between 10,000 and 35,000 deadweight tons with a maximum TEU capacity of 2,600. It is likely that current port users will shift to using vessels at the top of this range more often in the future. Additionally, this study assumes that terminal expansions, discussed further in Appendix B, will lead to larger vessels calling at the port in the future. The dimensions of the largest container ship currently calling at the port are listed in **Figure 2-5**. **Table 2.4** illustrates the largest Gulfport Harbor containership characteristics.

Table 2.4. Largest Gulfport Harbor Containership Characteristics

Vessel Name	Beam	Draft	LOA	DWT	TEU Capacity
Chiquita Trader	98.4	37.4	695.1	35,465	2,490

2.3.4.2 Bulk Fleet

The bulk fleet consists almost exclusively of dry bulk carriers provides an overview of calls by vessel size between 2016 and 2020, according to NNOMPEAS data. Bulk vessel class names vary by source. The descriptors below are based on Marine Insight's classification, which classifies Handysize vessels as those between 25,000 and 40,000 DWT; Handymax are those between 40,000 and 60,000 DWT; and Panamax are those between 60,000 and 100,000 DWT. At Gulfport, the DWT capacity of Panamax-sized vessels is generally less than 70,000 DWT.

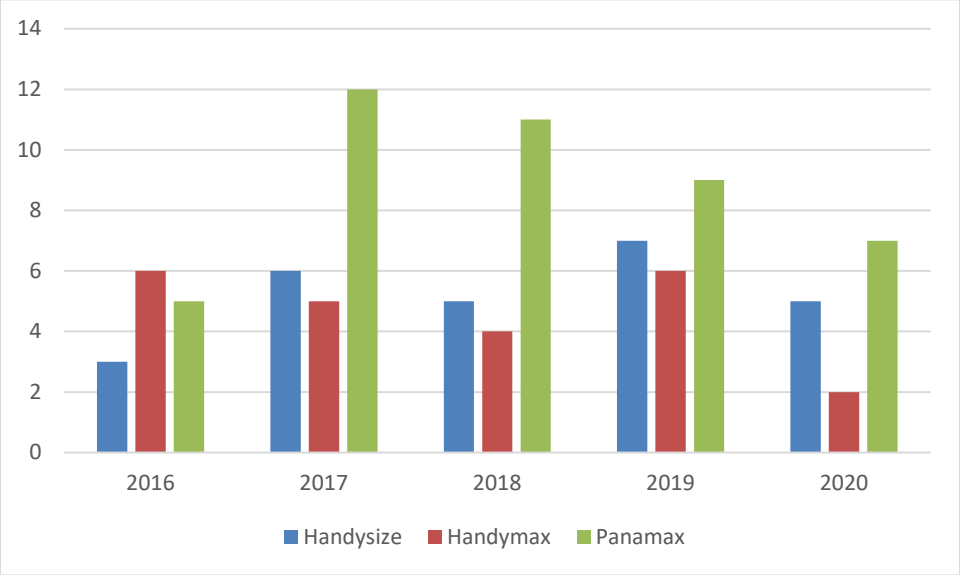

Figure 2-5. Bulk Fleet by Vessel Size

2.3.5 Existing Sailing Operations, Design Drafts Future Vessel Fleet Characteristics

2.3.5.1 Shipping Operations

The Gulfport Harbor Pilots do not have specific rules or restrictions in place for the channel that pertain to vessels that are currently calling. Based on discussions with the pilots, a large vessel required daylight restriction and an additional pilot in the past, so it is a fair assumption that larger vessels calling in the Future with Project (FWP) and Future without Project (FWOP) will be subject to additional restrictions.

2.3.5.2 Underkeel Clearance

The measure of underkeel clearance (UKC) for economic studies is applied according to ER 1105-2-100. According to this guidance, UKC is evaluated based on actual vessel operator and pilot practices within a harbor and subject to present conditions, with adjustment as appropriate or practical for with-project conditions. Discussions with the Gulfport harbor pilots indicated that there are no existing rules related to UKC established by the pilots; however, companies will frequently require a meter of UKC.

2.3.5.3 Tidal Range

The tidal variation in the Mississippi Sound and adjacent waters is diurnal with an average tide cycle of 24.8 hours. The mean diurnal tidal range near Harrison County Beaches as show in Figure 2-5 is 1.6 feet with spring tides reaching a range of 1.8 feet. According to discussions with the harbor pilots, tide does not cause discernible

differences in channel depth and is not relied upon for vessels to transit the channel. It is assumed that this will remain the case in the future with-project conditions.

2.3.5.4 Sailing Practices

Figure 2-6 and **Figure 2-7** show the vessel frequency and sailing drafts for bulk carriers and containerships between 2016 and 2020. It can be observed in these two figures that while the majority of vessels draft below 30 feet, the frequency of vessels drafting deeper increased during the last four years of available data (2016 through 2020).

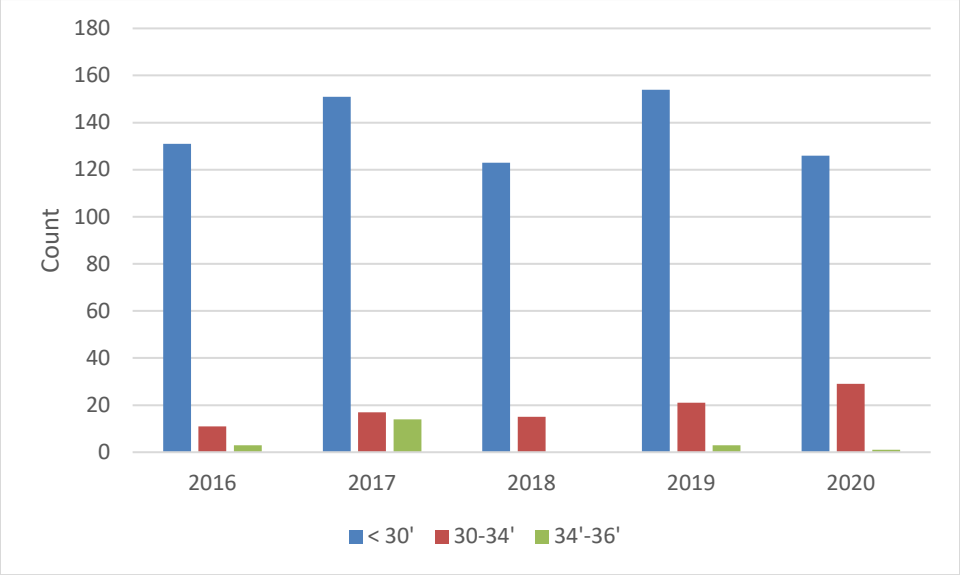

Figure 2-6. Arrival Drafts of Bulk Carriers and Containerships

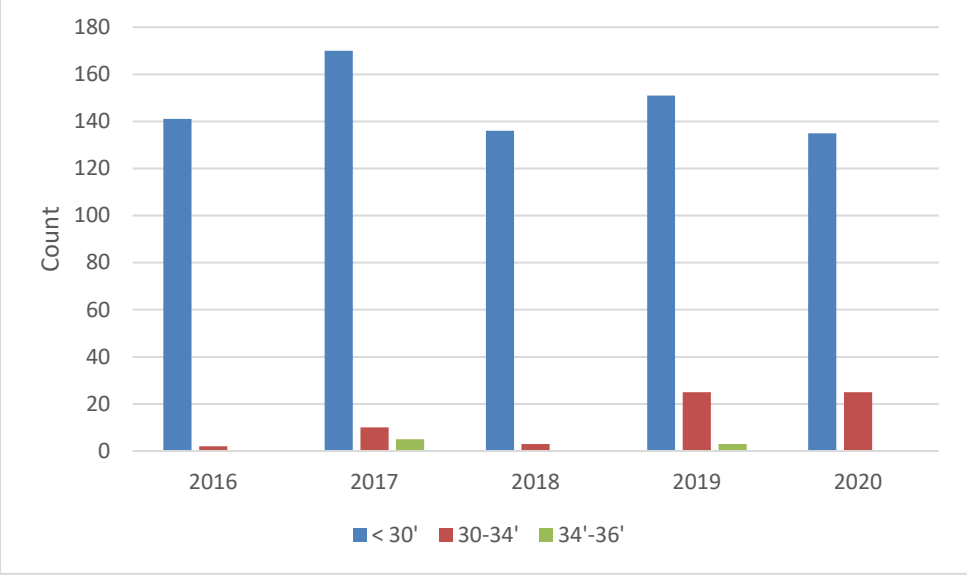

Figure 2-7. Departure Drafts of Bulk Carriers and Containerships

2.3.5.5 Design Vessel

Generally, waterway improvements should be designed for optimization across the entire forecasted fleet. In the existing condition, the dimensions of the bulk carriers calling at the Port exceed the dimensions of the container vessels in terms of length overall (LOA), beam, and draft. In the future, however, larger container vessels are anticipated to call at the Port as a result of the Terminal 4 expansion.

The design vessels are defined per USACE guidance from EM 1110-2-1613 stating:

"…the design ship or ships are selected on the basis of economic studies of the types and sizes of the ship fleet expected to use the proposed navigation channel over the project life…" The design ship is defined by EM 1110-2-1613 as "…the largest ship of the major commodity movers expected to use the project improvements on a frequent and continuing basis…"

In discussions with Ports America, it was conveyed that Terminal 4 is being designed to accommodate a vessel with dimensions corresponding to that of the Post-Panamax Generation III vessel class, as defined in Appendix B. Post-Panamax Generation IV vessels are being used at east and west coast ports with increased frequency, leaving PPX3 vessels to become the emergent container class on the gulf. Several recent USACE deep draft navigation studies along the Gulf Coast have selected a PPX3 vessel as their design vessel, including Houston, Mobile, and New Orleans. It is likely that vessels of these dimensions will call at Gulfport (assuming channel dimensions allow) while making other stops along the Gulf Coast. For these reasons, USACE adopted the vessel that is being used for the Terminal 4 design as the design vessel for the feasibility study and channel design. **Table 2.5** displays the design vessel characteristics.

Table 2.5. Design Vessel Characteristics

Vessel Type	DWT	Beam	LOA	Design Draft	TEU
Containership	110,000	158.5	984	47.6	10,926

2.4 Navigation Features

2.4.1 Navigation History

The construction of Gulfport Harbor was first authorized by Section 101 of the River and Harbor Act (RHA) of 1948 (Public Law 858) in accordance with the report of Chief of Engineers dated April 20, 1948. Additional construction for the Port of Gulfport, was authorized by Section 202(a) of the Water Resources Development Act (WRDA) of 1986 (Public Law 99-662), as modified by Section 4(n) of WRDA of 1988 (Public Law

100-676) in accordance with the Report of the Chief of Engineers, House Document Numbered 96-18 dated January 15, 1979. Authorized modification of the existing ship channel included deepening and widening from 30 x 220 feet to 36 x 300 feet through the Mississippi Sound, and from 32 x 300 feet to 38 x 400 feet across the bar channel, with changes in the channel alignment and the entrance to the anchorage basin for safe and unrestricted navigation. These changes were completed prior to the General Reevaluation Report (GRR) initiated in FY 2004

2.5 Existing Navigation Configuration and Dimensions

A visualization of the overall Gulfport Harbor FNC, including the existing and authorized dimensions, is shown in Figure 1-1. Further descriptions of the various Gulfport Harbor Channel segments evaluated as part of this study are provided in the following paragraphs.

2.5.1 Bar Channel

The Bar Channel is currently 38 feet deep by 400 feet wide for a length of approximately 10 miles from the Ship Island Bar to the Gulf of Mexico. The Bar Channel is located between stations 612+00 and 1142+14 with two channel bends at stations 716+98 and 1037+28. The current Bar Channel dimensions were authorized by the Supplemental Appropriations Act of 1985 (Public Law 99-88) and the Water Resources Development Act of 1986 (Public Law 99-662). Construction to the current authorized depth was completed in 1993 and construction to the current authorized width was completed in 2010. A channel bend easing review was performed in 2019 to evaluate the safety and efficiency of the Bar Channel. The review revealed that the bend configuration at station 1037+28 used in the 2004 General Reevaluation Report (GRR) ship simulation study was not incorporated into the 2009 design. As a result of the bend easing review, a bend easing project was implemented and current bend configuration was constructed in 2020. **Figure 2-8** shows the locations of the open water dredged material placement areas adjacent to the channel. These areas (Littoral Placement Area, Disposal Area No. 10, EPA East Ocean Dredged Material Disposal Site (ODMDS), and EPA West ODMDS) are available for placement of material dredged as part of routine maintenance of the Bar Channel. Disposal Area No. 10 and EPA West ODMDS has historically been used for placement of fine-grained material dredged of the Bar Channel. The Littoral Placement Area has historically been used for sands dredged from the Bar Channel. The EPA East ODMDS has historically not been used for material placement due to the east to west sediment transport in that location. Littoral Placement Area and the Northwest Extension are currently used for placement of material dredged as part of routine maintenance of the Bar Channel (predominantly sandy material).

Figure 2-8. Existing Placement Areas

2.5.2 Sound Channel South

The Sound Channel South is currently 36 feet deep by 300 feet wide for a length of approximately 5.5 miles from the intersection of the Gulf Intracoastal Waterway to the Ship Island Bar. The Sound Channel South is located between stations 362+00 and 612+00 with a single channel bend at station 457+37. The current Sound Channel South dimensions were authorized by the Supplemental Appropriations Act of 1985 (Public Law 99-88) and the Water Resources Development Act of 1986 (Public Law 99-662). Construction to the current authorized depth was completed in 1993 and construction to the current authorized width was completed in 2010. The Sound Channel South alignment and stationing are shown in. **Figure 2-8** shows the locations of the open water dredged material placement areas within the Mississippi Sound. These areas (Disposal Area No. 6-9) are used for placement of material dredged as part of routine maintenance of the Sound Channel South.

2.5.3 Sound Channel North

The Sound Channel North is currently 36 feet deep by 300 feet wide for a length of approximately 5.9 miles from the anchorage basin to the intersection of the Gulf Intracoastal Waterway. The Sound Channel North is located between stations 50+75 and 362+00. The current Sound Channel North dimensions were authorized by the Supplemental Appropriations Act of 1985 (Public Law 99-88) and the Water Resources Development Act of 1986 (Public Law 99-662). Construction to the current authorized depth was completed in 1993 and construction to the current authorized width was completed in 2010. The Sound Channel North alignment and stationing are shown in . **Figure 2-8** shows the locations of the open water dredged material placement areas within the Mississippi Sound. These areas (Disposal Area No. 1-5) are used for placement of material dredged as part of routine maintenance of the Sound Channel North.

2.5.4 Anchorage Basin

The Anchorage Basin is separated into an inner harbor and outer harbor. The inner harbor is located between stations 0+00 and 9+20. The inner harbor is currently 32 feet deep by approximately 920 feet long by approximately 1,110 feet wide. The outer harbor is located between stations 9+20 and 50+75. The outer harbor is currently 36 feet deep by approximately 4,155 feet long. The outer harbor width varies from 1,120 feet wide at station 9+20 widening to 1,470 feet wide at station 34+23 and narrowing down to 300 feet wide at station 50+75. The current turning and anchorage basin dimensions were authorized by the Supplemental Appropriations Act of 1985 (Public Law 99-88) and the Water Resources Development Act of 1986 (Public Law 99-662). Construction to the current authorized depth was completed in 1993 and construction to the current authorized width was completed in 2010. The Turning and Anchorage Basin alignment and stationing are shown in .

2.5.5 Maintenance Dredging

A summary of the dredge history for the Gulfport Harbor Channel is provided in **Table 2.6**. Summary of Maintenance Dredging History for the Gulfport Channel (1909-2023), with cumulative maintenance dredge volumes displayed. Dredging history was taken from Byrnes, *et. al.* (2012) "Littoral Sediment Budget for the Mississippi Sound Barrier Islands," Rosati, et. al (2009) "Mississippi Coastal Improvement Project Study, Regional Sediment Budget for Mississippi Mainland and Barrier Island Coasts," and updated with USACE, Mobile District dredging records to 2023.

The figure of cumulative maintenance dredge volumes shows varying dredge rates through time, with rates averaging approximately 235 thousand cubic yards per year in the Anchorage Basin, 2.8 million cubic yards per year in the Sound Channel, and 1 million cubic yards per year in the Bar Channel since the most recent expansion in 1993.

Table 2.6. Summary of Maintenance Dredging History for the Gulfport Channel (1909-2023)

Dates	Dredging (CY)	Dredging Rate (CY/yr)
1910-1919	893,851	99,317
1920-1929	598,738	66,526
1930-1939	299,280	33,253
1940-1949	279,715	31,079
1950-1959	1,418,373	157,597
1960-1969	32,706,127	3,634,014
1970-1979	17,929,944	1,992,216
1980-1989	39,153,261	4,350,362
1990-1999	25,659,156	2,851,017
2000-2009	34,770,192	3,863,355
2010-2019	23,826,977	2,647,442
2020-2023	16,145,295	5,381,765
1909-2023	193,680,909	1,698,955
1994-2023	94,009,853	3,241,719

Source: Modified from Rosati *et al.*, 2009, Byrnes *et al*, 2012, and USACE Dredging Records. Bold dates are decades where expansion was completed.

2.6 Sea Level Change

Tide gages throughout the Southeast indicated sea level rose by approximately 6 inches during the period of 1970 to 2020. By 2050, sea level is projected to rise 16 to 23 inches relative to 2000 sea level for the low to high scenarios. Projections for 2100 show sea level rise 2.2 to 7.3 feet (low to high scenarios) relative to 2000 sea level. Rising sea levels increases the likelihood of flooding conditions along coastal areas. In addition, sea level rise is expected to worsen storm surge inundation. (USGCRP, 2023)

Projections for the relative rise in sea level for Bay Waveland Yacht Club, MS is shown below in **Figure 2-9**. The relative SLR projection for year 2100 was used in this analysis. Projected rise between 2024 and 2100 varies from roughly 3.17 ft (0.97 m) for the low-rate curve to 8.45 ft (2.58 m) for the high-rate curve.

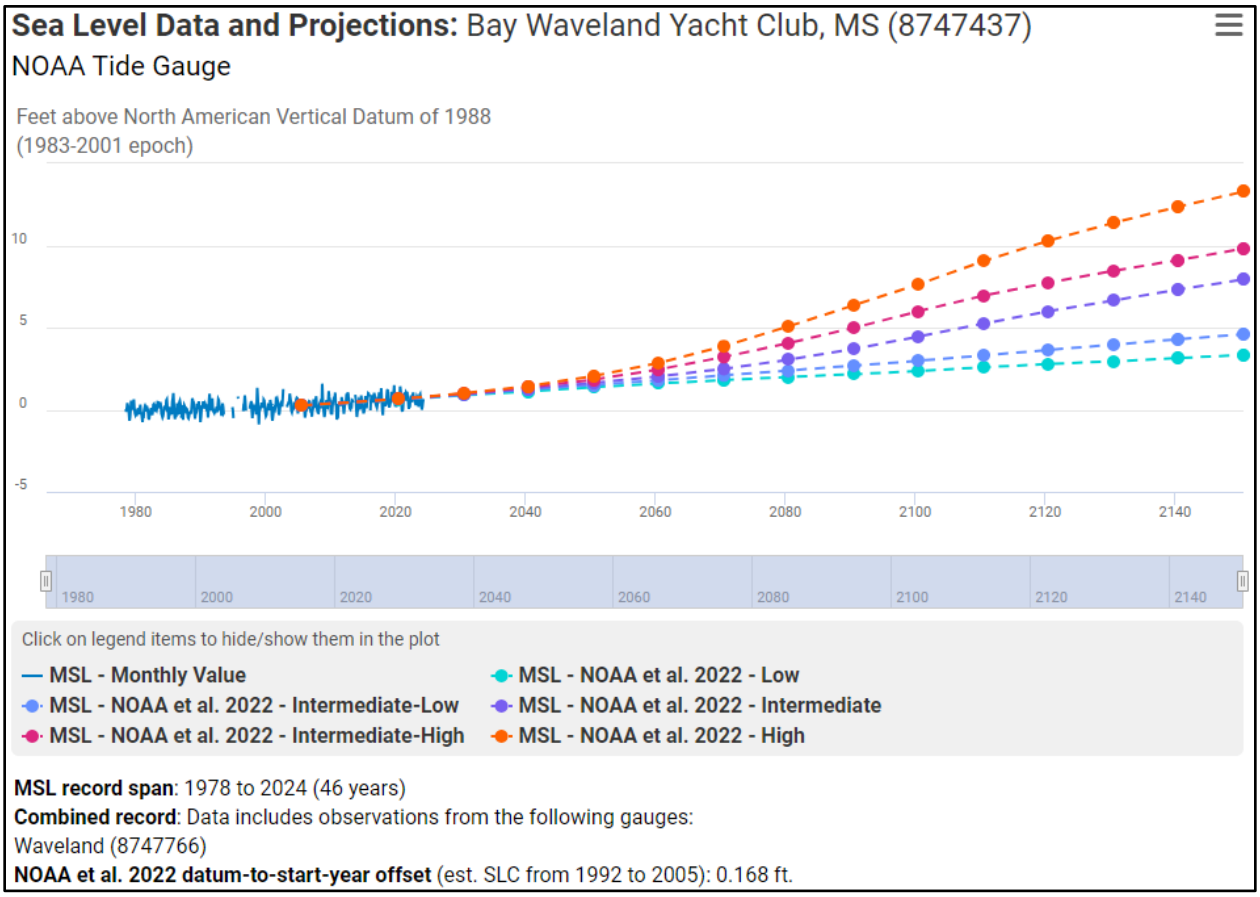

Figure 2-9: Sea Level Data and Projections for NOAA Gauge 8747437 at Bay Waveland Yacht Club, MS

Based on an extrapolation of the high curve values, elevations for sea level in the project area would be approximately 8.1 ft higher in the year 2100 relative to MLLW.

The most obvious effect of increased sea level with respect to performance is increased depth. Since the authorized project is referenced to Mean Lower Low Water (MLLW), which is a tidal datum, and because this tidal datum is adjusted periodically (on the order of 17 to 19 years based on celestial cycles, which are primarily responsible for the daily and seasonal variation in the tide signal), it is possible that dredging efforts could be decreased due to sea level rise. However, with rising sea level there could also be some shifts in the magnitude, location, and characteristics of river-borne sediment deposition, and the ability to accurately assess these types of potential impacts to determine if they outweigh the benefits of tidal datum shifts are currently limited. More detail on the Sea Level Change is found in Appendix A.

3.0 Environmental Setting*

3.1 Introduction

This section characterizes the affected environment in its existing condition. It provides descriptions of environmental, cultural, and socioeconomic resources in the study area, which includes the landward and coastal areas associated with the Port of Gulfport. More detailed information regarding resource assessments is presented in Environmental Appendix – C.

3.2 Geographic Setting

Gulfport Harbor is located within Mississippi Sound, the primary body of water off the Mississippi Coast that extends 70 miles west from Lake Borgne, Louisiana, to Mobile Bay, and between the mainland to the south barrier islands, Cat, Ship, Horn, Petit Bois, and Dauphin Islands (**Figure 3-1**). The Mississippi Sound varies in width from 4.5 miles (mi) to 14 mi and encompasses an estuary of 113 square miles (sq mi) that includes 17 sq mi of tidal marsh within a watershed of 100 sq mi. Average tidal range is 1.96 ft average mean sea level (AMSL), with local water depth and surface level fluctuations largely affected by wind. The climate is semitropical/subtropical with south-southeast winds at approximately 6.5 mph (Handley *et al.*, 2012).

Average natural depths throughout the Mississippi Sound range from 12 to 18 ft. Adjacent to the Port of Gulfport along the mainland, the undisturbed depths are 8 ft, and 12 ft along the northside off Ship Island and Cat Island (NOAA, 2015). The Gulfport Harbor FNC presently ranges from 36 to 38 ft deep. The GIWW transects the Mississippi Sound and crosses over the Gulfport Harbor shipping channel, with an average authorized depth of 12 ft. Entrances into Mississippi Sound include natural inlets between the barrier islands bordering the Sound on the south. The Gulfport Harbor FNC has been improved by dredging activities since 1903 to connect the Mississippi mainland coast with the Ship Island Pass channel. (USACE, 2009).

The Coastal Streams Basin, located adjacent to south Mississippi's coastline, drains an area of about 1,545 sq mi and empties into the Gulf of Mexico. Major water bodies in the basin include the Wolf, Jourdan, Little and Big Biloxi, and Pascagoula and Escatawpa Rivers, as well as the Bays of Biloxi and St. Louis. The Basin also includes the Mississippi Sound and the barrier islands of Cat, Ship, Deer, Horn, Round, and Petis Bois (MDEQ, 2023). Due to a large portion of Mississippi's watersheds draining into Mississippi Sound, it is a critical economic resource for Mississippi by providing recreation through fishing and boating, aquaculture value from the large seafood and oyster industry, and cultural value, and is a vital and growing tourism industry (MDWFP, 2023).

Figure 3-1: Mississippi Sound, including Gulfport Harbor and the Federal Navigation Channel

3.2.1 Gulf of Mexico

The circulation patterns within the Gulf of Mexico are dominated by the Loop Current which enters through the Yucatan Straits and moves along the shelf into the eastern Gulf. The Loop Current, travels at speeds of approximately 0.8 meters per second (m/s) into the Gulf and is one of the fastest currents in the Atlantic Ocean, exiting the Gulf through the Florida Straits to become the Gulf Stream (NOAA Coast Watch, 2021). The general circulation pattern is strongly influenced by the celestial tides, local winds, and freshwater inflows, as well as the open Gulf circulation. The coupling of local winds and tides is the major contributor to near-shore shelf circulation (Morton, 2008).

Circulation in central Mississippi Sound is attributed to the tidal flux through Dog Keys and Ship Island passes. Two natural channels between Horn Island and Ship Island are the main conduits for water passing into the Sound. Water flows through the Little Dog Key passage into the Mississippi Sound, laterally spreading toward the northwest (Eleuterius, 1976). Ship Island Pass, which includes the Gulfport FNC, has periodic dredging. The maintained depth allows the intrusion of higher salinity water into the Sound (Byrnes *et al.*, 2012). Lower salinity waters toward the west are from the Jourdan and Wolf Rivers, the Pearl River, and the diversionary channel of the Bonnet Carré Spillway, all flowing into St. Louis Bay (Eleuterius, 1976).

3.2.2 Coastal Mississippi

Inland from coastal Mississippi are diverse natural areas that consist of upland forests and herbaceous prairies, as well as freshwater forested swamps and wetlands and emergent herbaceous marshes associated with stream riparian watershed that grade into estuaries toward the coast. Estuarine natural areas along the immediate coastline consist mostly of brackish and salt-tolerant scrub/shrub and herbaceous salt marsh that grades into open marine waters. The rich diversity of the estuary in Mississippi Sound includes sporadic dense seagrass beds and oyster reefs that provide habitat for game fish, wading birds, manatee, and shorebirds. Multiple barrier islands off the Mississippi mainland coastline provide a first line of defense from extreme storm events and contain quality habitat for flora and fauna. These islands consist of intertidal flats, beaches and dunes that provide crucial habitat for protected species of sea turtles, shorebirds, and piping plover (*Charadrius melodus*) (SACS MS Appendix, 2022).

Saltmarshes are keystone habitats within the coastal environment that provide the base for ecosystem services and benefits (MDEQ & NFWF, 2017). Between 1998 and 2004, saltmarsh loss rates in the Gulf of Mexico were 25 times higher than anywhere in the U.S. (Stedman and Dahl, 2008). Specifically, Mississippi has lost approximately 10,000 acres of coastal wetlands in the last 60 years (MDEQ, 2017). Minor tidal changes can influence diversity of shoreline features. Low energy environments found in estuarine systems typically support saltmarsh and tidal flats, whereas higher energy creates beach and dune shoreline. An unintended impact can introduce salinity in a vulnerable freshwater system resulting in replacement by a more saline tolerant wetland system. Consequently, the understory flora and fauna supported by the displaced habitat will be

replaced by saline tolerant species. This scenario could significantly affect some protected species dependent on that habitat (SACS Mississippi Appendix, 2022).

3.2.3 Barrier Islands

Along the northern Gulf of Mexico at the barrier islands, wave action and onshore breezes transfer sand from the south side to the north side of the island. Meanwhile, prevailing south easterly winds set up longshore currents that gradually move sand from east to west (NPS GINS, 2023). Coastal barrier islands are fronted by an exposed beach of medium to fine grained sand that support nesting sea turtles and shorebirds. A small dune forms through tide, wave, and wind action at higher elevations inward from the beach which establishes a diverse herbaceous and shrub scrub plant community (Morton, 2008). In contrast, protected small lagoons at low tide become a sheltered tidal flat characterized by sand, shell fragments, silt, clay, and muck, the primary physical components of coastal deposits. Salt meadow cordgrass *(Spartina patens*), smooth cordgrass (*Spartina alterniflora),* and salt grass are commonly found in the intertidal zone and low saltmarsh (Mendelssohn *et al.*, 2017). These distinct shoreline types encourage habitat of specific flora and fauna that attract endangered species such as piping plover and rufa red knot (*Calidris canutus)*. These systems adjoin one another but are distinguished by elevation influence from tidal fluctuation (Morton 2008).

Estuaries associated with the barrier islands act as marine nurseries, as many species of fishes and invertebrates rely on their resources. They play an important role in the life cycles of many marine fish species by providing habitat for developing juveniles (SACS MS Appendix, 2022). Historical analysis of a barrier-island chain in the north-central Gulf of Mexico shows that the barriers are undergoing rapid systematic land loss and translocation associated with: (1) unequal lateral transfer of sand related to greater updrift erosion compared to downdrift deposition; (2) barrier narrowing resulting from simultaneous shoreline erosion along the Gulf and Mississippi Sound; and (3) barrier segmentation related to storm breaching (Morton, 2008). Ship Island and Cat Island are the two barrier islands within the Study area.

The nearshore and offshore islands also provide protection to communities and ecosystems from extreme weather by preventing erosion and flooding along the coastal mainland. As storm buffers, they can reduce the effects of waves hitting the shoreline. Beach and dune vegetation on barrier islands absorb wave energy before they hit the mainland causing less destructive storm surge and flooding on the coast (NOAA, 2023).

3.2.3.1 Ship Island

Ship Island is home to rich diversity of plants and wildlife, including migratory birds. Warm tidal pools and wind-shaped sand dunes crowned with sea oats help the island retain stability and natural beauty. The island is 8 mi in length with low, sandy terrain except at its east end. The Ship Island Ferry provides access to recreational opportunities including a significant historical cultural resource, the Civil War fort, Fort

Massachusetts, a National Historic Landmark (NPS, 2023). The island is part of the GINS, managed by the National Park Service (NPS) (NPS, 2023).

3.2.3.2 Cat Island

Cat Island's unique T-shape is the result of colliding Gulf of Mexico currents. Cat Island is unusual among the barrier islands in that it is covered by dense forests of oak and pine trees. The island's name is a reference to the raccoons that inhabit it; early French explorers mistook the local raccoons as feral cats (Mississippi Department of Marine Resources (MDMR) Gulfcoast Blueways, National Heritage Area)). Cat Island is 3.5 mi long and is approximately 7 mi offshore from Mississippi mainland coastline (Cuevas, 2018). Some portions of the island are privately owned. USACE performed a beach and dune fill project on the eastern shore of Cat Island in 2017. The State-owned water bottoms were filled to an elevation above the mean high waterline which remained State-owned. The NPS manages the land adjacent to state lands. Existing healthy saltmarsh occurs on Cat Island, with vegetation dominated by two common marsh species, smooth cordgrass, and salt meadow cordgrass.

3.2.4 Gulf Beaches

Harrison County's beaches line the shorefront of Mississippi Sound, extending along the east and west coast of Gulfport Harbor. The dynamic shoreline of Mississippi Sound makes the waterfront vulnerable to erosion and subject to wind and wave action that transports material away from the beach. The landscape consists of low-rise sand dune and beach vegetated with grasses, forbs, and non-native ornamentals. The beaches and dunes were severely damaged by Hurricane Katrina (2005) and Hurricane Zeta (2020) along with several storms (BMI Environmental Services LLC, 2022). As a result, the coastline beaches have been rehabilitated. Currently, additional maintenance renourishment is planned for the Harrison County beaches. Although the Harrison County Beaches extend for over 23 miles of coastline, this Study is limited to beach frontage immediately adjacent to Gulfport Harbor, which is 5 mi east and west of the Port. Beaches on both Cat and Ship Islands are included in the Study area.

3.3 Climate, Temperature, and Precipitation

The climate in the Study area is subtropical, characterized by warm summers and short, mild winters. The average daily temperature in the summer and winter ranges 81° to 91° and 52° to 67° Fahrenheit (F), respectively. The average annual rainfall is about 65 inches (in.) and is well distributed throughout the year. Precipitation records indicate July as the wettest month, while October is the driest. Annually, approximately 59.1 in. of precipitation descends in the Mississippi coastal region (Climate Data, 2024). Summer in Gulfport starts in mid-June and ends in late September. The month with the lowest amount of rainfall is October, recording a mere 3.7 in. which denotes an exceptionally dry period within that time frame. Most precipitation falls in August, with an average of 6.4 in. (Climate Data, 2024). The National Climatic Data Center summary for Gulfport from 2000 to 2023 is shown on **Table 3.1**.

Table 3.1. Climactic Summary, Gulfport Biloxi Regional Airport, Mississippi

(Station No. 015478)

Period of Record: 01/01/2000 to 12/31/2023													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temp. (°F)	61.5	64.9	71.4	77.1	84.0	89.6	90.8	90.7	87.3	80.6	70.9	64.0	77.1
Average Min. Temp. (°F)	41.7	45.8	52.2	58.7	66.8	73.1	74.7	74.5	70.3	60.3	49.3	45.0	59.4
Average Total Precip. (in.)	3.10	4.23	4.71	5.79	4.57	7.72	8.46	7.31	4.89	3.45	3.74	4.87	5.24
Average Total Snow Fall (in.)	0	0	0	0	0	0	0	0	0	0	0	0	0
Average Snow Depth (in.)	0	0	0	0	0	0	0	0	0	0	0	0	0

Source: NOAA National Centers for Environmental Information, Station: GULFPORT BILOXI AIRPORT, MS US.

3.3.1 Currents

Tides across the northeastern parts of the Gulf of Mexico approach the coast from the south and enter the Mississippi Sound through the natural passes between the barrier islands. Because of the relative depths of the coastal areas offshore of the barrier islands, tidal influence tends to penetrate the Mississippi Sound near Petit Bois Island sooner than through the passes to the west. Hydrologic characteristics of the Mississippi Sound are strongly influenced by wind-driven currents in combination with tidal influences of the Gulf of Mexico. Tides within the Mississippi Sound are diurnal, with an average range of up to 2 ft. Typical tidal currents range between 0.5 to 1.0 foot per second (fps) in the navigation channel except in the vicinity of Ship Island Pass. Tides are strongly influenced by local bathymetry, local river discharges, and winds (Jarrell, 1981).

The currents caused by tides diverge and split the Mississippi Sound into two distinct areas. Horn Island Pass and the area north of the pass is the natural dividing point for tidal currents. Kjerfve and Sneed (1984) described tidally based circulation in the eastern portion of the Mississippi Sound as having a strong clockwise rotation. The western parts of the Mississippi Sound are characterized by a weaker, counterclockwise

rotation. These circulation patterns would contribute to how the potential effects of barrier island restoration might be distributed within the Mississippi Sound, depending on proximity of the restoration activities to the passes where tidal inflow and outflow would transport any suspended materials.

The influence of winds on coastal currents both within the Mississippi Sound and on the Gulf of Mexico side of the barrier islands is well documented (Morton *et al.*, 2004). Wind-driven waves and associated currents were identified as the primary mechanisms driving sediment transport. Prevailing winds from the south and east drive currents toward the west (Cipriani and Stone, 2001). While much of the literature focuses on the east-to-west currents being major factors in influencing barrier island migration westward and to some degree landward, these same factors influence localized current speed and direction on the Mississippi Sound side of the islands.

3.3.2 Severe Storm History

Published in the National Oceanic and Atmospheric Administration (NOAA) Historical Hurricane Tracks tool (**Figure 3-2**), 145 hurricane, tropical, depression, or extratropical events have passed within 100 nautical miles (NM) of the central mainland coast of Mississippi since 1852. This includes one Category 5 hurricane on record for the state, Hurricane Camille, which occurred in 1969, and six Category 4 hurricanes—Hurricane Ida in 2021; Hurricane Katrina in 2005; Hurricane Ivan in 2004; Hurricane Frederic in 1979; Hurricane Betsy in 1965; and an unnamed storm in 1893. Figure 3-2 includes Category 1 to Category 5 hurricanes that tracked within 100 NM of the central mainland coast of Mississippi during the period of record (1852 to present).

Figure 3-2: Mississippi Period of Record Hurricane Categories 1 to 5 Storm Tracks Occurring Within a 100-Nautical Mile Radius of the Central Mainland Coast of Mississippi (NOAA, 2024).

3.3.3 Winds

Wind data are readily available from the Iowa Environmental Mesonet. The nearest published location is the Keesler Air Force Base in Biloxi, MS. Wind data here are presented as a graphical representation of the wind regime in the area. Wind data for Keesler Air Force Base is shown in **Figure 3-3**. Wind rose data at the site shows wind speeds rarely exceed 15 miles per hour (mph). The station at Keesler is located between and within a mi of both the Mississippi Sound and Biloxi Back Bay. Winds from the north at Keesler prevail from the northeast quadrant and those from the south range broadly between south-southwest to south-southeast.

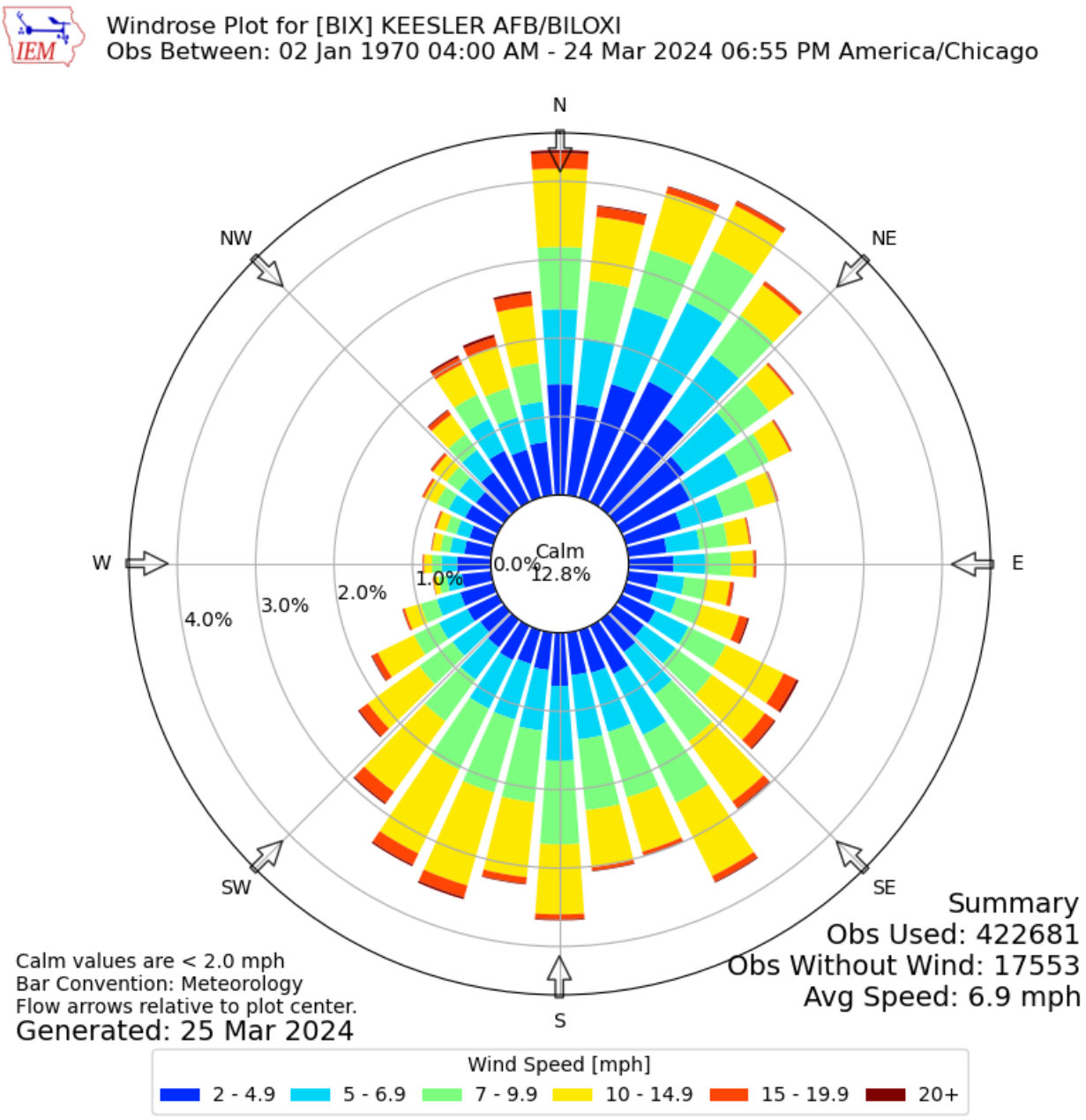

Figure 3-3: Keelser Airforce Base (BIX) Wind Rose from Iowa Environmental Mesonet (Jan 1970 to Mar 2024)

3.3.4 Tides

The tidal variation in the Mississippi Sound and adjacent waters is diurnal with an average tide cycle of 24.8 hours (hr). The mean diurnal (represented as “MN”) tidal range near Gulfport is show in **Figure 3-4** as 1.6 ft with spring tides reaching a range of

1.8 ft. Although the tidal range caused by astronomical forces is relatively small, winds can induce larger variations, with ranges of 3.5 ft. Strong winds blowing from the north can force water out of the Mississippi Sound and result in current velocities of several knots in the passes. The reverse occurs with winds blowing from the southeast, which forces water shoreward toward the Mississippi coastline.

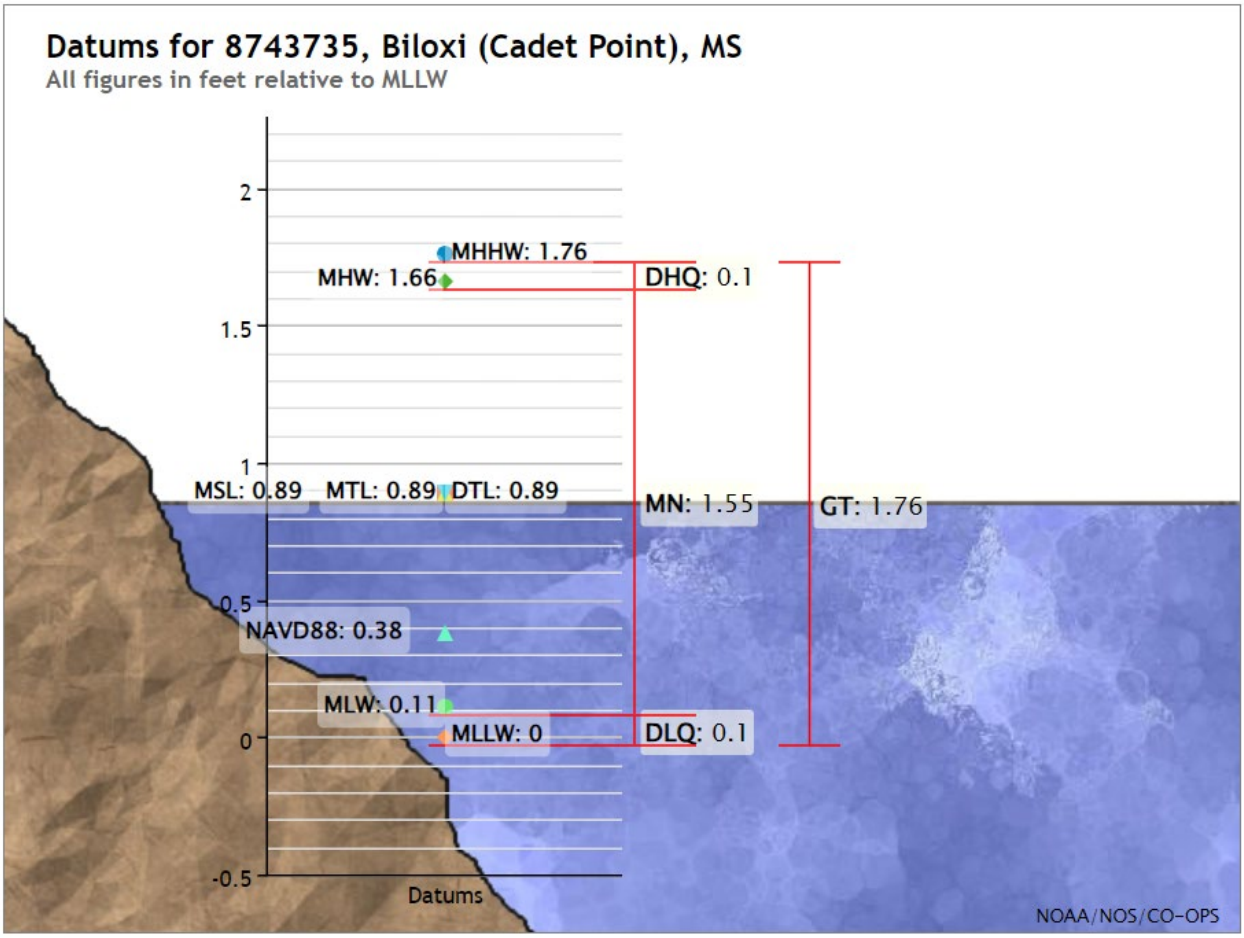

Figure 3-4: Tide Gage Cadet Point Biloxi, Mississippi.
Source: NOAA Tides and Currents Station. 8743735

3.3.5 Waves

As discussed in Section 2.7 of Appendix A - Engineering, wave intensity of the Mississippi Sound is generally low to moderate. Fetch and depth limited waves within the Mississippi Sound average less than one foot in height. Breaking wave heights along the shoreline of the offshore barrier islands fronting the Mississippi Sound average approximately three feet. However, hurricane and storm conditions, and strong winter cold fronts can produce significant surges and much larger wave conditions along the mainland coast and barrier islands. Even under the most severe conditions, significant wave heights in the Mississippi Sound would rarely exceed six feet, as large

waves generated by storms in the Gulf of Mexico break on entering the Sound due to depth-limited conditions and must regenerate within those limited confines.

3.4 Sediment Transport

For Ship Island the computed large scale longshore transport pattern is largely affected by the presence of Camille Cut. At Camille Cut the transport has been blanked, since at this location cross-shore processes with a considerable longshore component dominate the littoral drift. These cross-shore processes are not subject of discussion in this chapter and therefore this area has been blanked. Along East Ship Island an increasing transport from east to west from about 5,000 to 50,000 cy/yr is computed which can be explained by the slight convex shape of the shoreline. Along West Ship Island a maximum transport of about 50,000 cy/yr is found at the location where the shoreline orientation deviates about 40º from the estimated year-average direction of the nearshore wave energy. The accreting transport gradient at the western end of West Ship Island implies that this part of the shoreline is moving seaward. Reference Section 2.11 in Appendix A – Engineering.

3.5 Geology

3.5.1 Geologic Setting

Surface geology exhibits a strong influence of the Mississippi Embayment and the Gulf of Mexico basin on the orientation of outcropping formations within the state. Along the mainland coastal plain, the formation is overlain by the Gulfport Formation. Holocene sediment deposits formed along the western mainland coastline and barrier islands that formed lithified sediment of sand, clay, and marl (Cushing *et al.*, 1968). Along the western Mississippi Coast, the Citronelle Formation is overlain by the Catahoula Formation, a thick layer of clay and sand sediment. The Gulfport Formation overlies the Catahoula formation along the central Mississippi coastline between Waveland and Bienville, and from Gulfport to Biloxi (Otvos and Howat, 1992) (**Figure 3-5)**. The barrier island chain emerged as lateral progradation, separating the Mississippi Sound from the Gulf of Mexico (Otvos, 2001). The Biloxi sands are Pleistocene deposits adjoining the saltwater of Mississippi Sound from the mouth of Pearl River to Mobile Bay with hard clay bottom deposits now accumulating in the Sound substrate (Dockery and Thompson, 2016*)*.

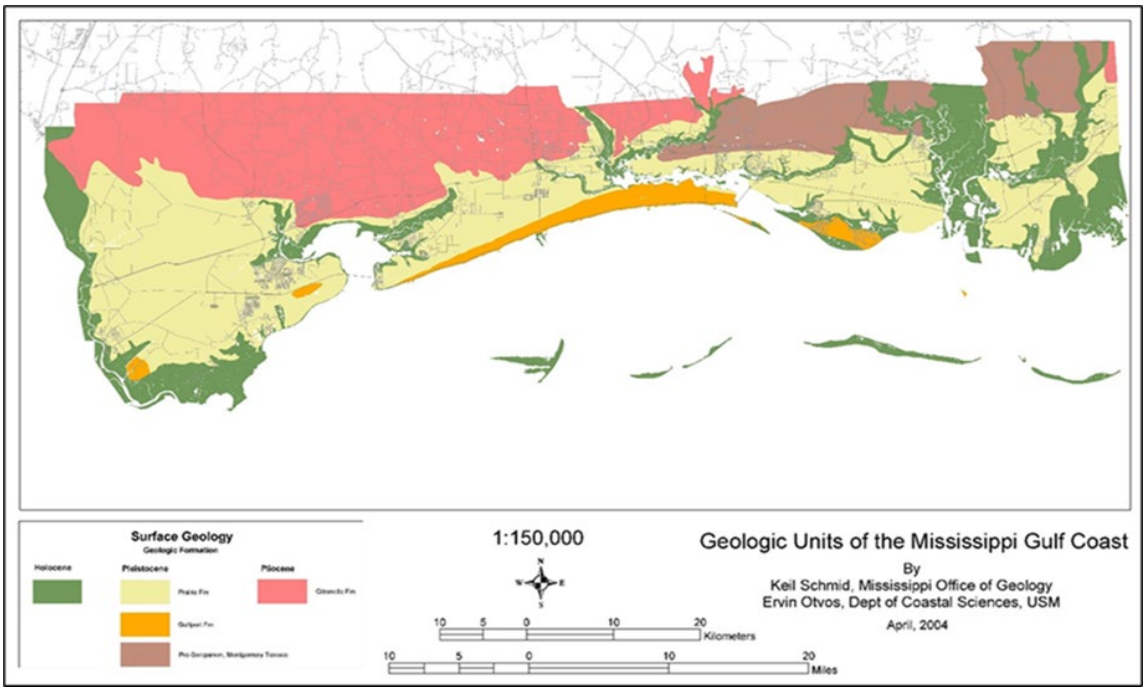

Figure 3-5. Coastal Mississippi Surface Geologic Units, Gulfport Formation underlying the Holocene along the shoreline at the Port of Gulfport.

3.5.2 Soils

The majority of the study area lies within the watered environment that includes the anchorage basin, the navigational channel in the Mississippi Sound and Gulfport Bar channel extending into the Gulf of Mexico. The substrate for the watered components of the study area known as sediment is not addressed in the soil description of this section (**Table 3.2**). A comprehensive description of sediment occurring within the study area is found in Section 3.5.3.

Table 3.2. Mapped Soil Units Occurring within the Gulfport Harbor Study Area

Mapped Unit/Brief description	Symbol	Hydric Yes/No	Estimated cover within Study area[1]	Location in Study area Mainland/Barrier Islands
Beaches, 0 to 8% slope, medium sand underlain by coarse sand, excessively drained	Cb	No	1.0%	Mainland and Barrier Islands along coast, beaches renourished from storm damage
Handsboro Association, low elevation, mucky silt loam underlain by stratified muck to loam, very poorly drained	Ha	Yes	8.8	Barrier Islands
Harleston fine sandy load, 0 – 2% slope, fine sandy loam underlain by sandy clay loam, moderately well drained	HlA	No	0.1%	Mainland. Disturbed by urban development
Lakeland fine sand, 0 – 2% slope, deep horizon of fine sand underlain by medium sand, excessively drained	Lr	No	0.1%	Mainland. Disturbed by urban development
Latonia loamy sand, 0 – 2% slope, loamy sand surface, underlain by sandy loam and sand; well drained	Lt	No	0.1%	Mainland. Disturbed by urban development
Newhan-Duckston complex, 0 – 8% slope, deep layer of fine sand underlain by sand, excessively drained	Su	No	12.2%	Barrier Islands, in small isolated mapped units
Ocilla Loamy sand, 0 – 2% slope, Loamy sand underlain by sandy loam, somewhat poorly drained	Oc	No	0.3%	Barrier Island West Ship Island only, small, isolated unit on eroded beach
Pactolus-Urban land complex, 0 – 8% slope, loamy sand, moderately to well drained	PbC	No	1.2%	Mainland
Plummer loamy sand, 0 – 2% slope, loamy sand thick lens underlain by sandy clay loam at	Pm	Yes	0.2%	Mainland and both Barrier Islands

depth, poorly drained, high water table				
St. Lucie sand, hummocky, 0 – 8% slope, deep layer sand, excessively drained	Sv	No	2.3%	Mainland and both Barrier Islands
Sulfaquepts, deep layer sand, poorly drained	Sw	No	1.3%	Mainland in small isolated disturbed unit at Port

Source: Natural Resource Conservation Service, US Dept of Agriculture. Web Soil Survey

3.5.3 Sediment

Sediments located in the study area are typical of a depositional tidal basin. The material within the depths and horizontal extents are composed of maintenance and new work material. Physical grain analysis of collected material from past survey events for the Gulfport FNC have described sediments in or near the FNC and adjacent areas as mostly fine-grained silts and clay underlain by fine sand (USACE, 2006 and 2013). Adjacent to Ship and Cat Islands, sediments are more medium – coarse grained sand with less clay. A sediment analysis is proposed for the study area during the Preconstruction Design Phase (PED). Additional information of previous sediment analysis is presented in Appendix C - Environmental.

3.6 Ground Water

Miocene aquifers in the highlands of southwestern Mississippi connect with aquifers supplying groundwater for Baton Rouge and municipalities in southeastern Louisiana (Stewart and Everett, 2002). This formation supplies shallow groundwater as naturally occurring springs while also suppling gravel resources. Most rivers and streams in southern Mississippi are spring fed from the Citronelle Formation. Pliocene aquifers also provide freshwater for Mississippi's barrier islands and are potential freshwater sources while surrounded by seawater (Stewart and Everett, 2002). The Delta region of northwestern Mississippi floodplain accounts for intense agricultural pressure resulting in heavy use of water resources for irrigation, accounting for 98% of water use from the Mississippi alluvial aquifer in that region as shown in **Figure 3-6** (Mississippi State University Extension, 2015).

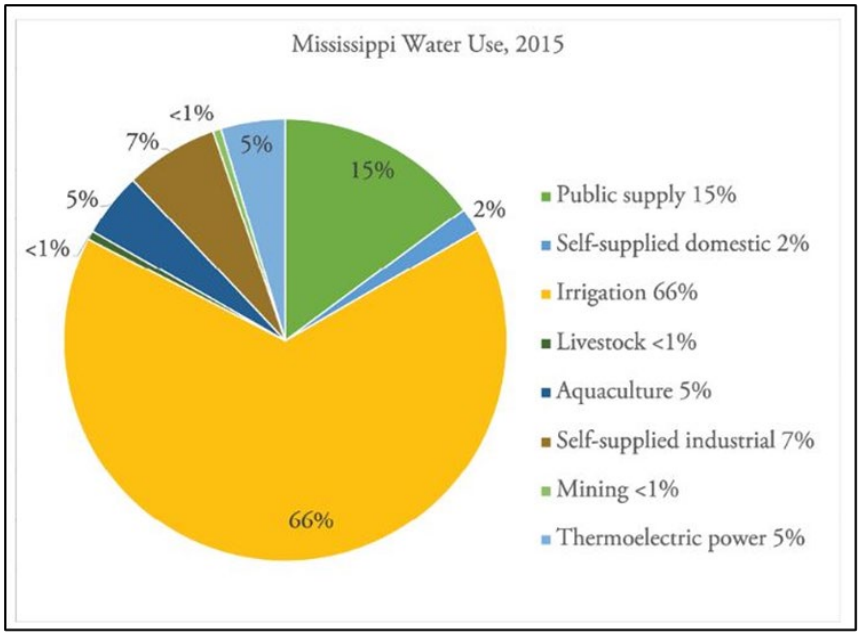

Figure 3-6. Mississippi water use in 2015.
Source: Mississippi State University Extension, Publication no. P3011.

3.7 Water Quality

Water quality within Mississippi Sound is influenced by several factors such as discharge of freshwater from rivers, seasonal climate changes, and variations in tide and currents. The primary contributors in the study area are the Pascagoula River, the Pearl River, and the predominantly westward flow from the Mobile Bay system. Freshwater inputs from these major contributors provide nutrients and sediments that maintain productivity in the Mississippi Sound and its extensive estuarine saltmarsh habitats. The dynamic features throughout the study area include multiple water quality parameters of temperature, salinity, nutrients, and dissolved oxygen that influence biological and ecological processes naturally occurring in the estuary. Mississippi Sound is classified by the Mississippi Department of Environmental Quality (MDEQ) for recreational uses and approved shellfish harvesting. All waters are classified to support aquatic life. See Appendix C - Environmental for an in-depth discussion of water quality.

3.7.1 Dissolved Oxygen (DO)

Nearshore and open Gulf waters are normally at or near oxygen saturation; however, high organic loading, high bacterial activity from organic material decomposition, and restricted water circulation cause oxygen depletion, creating hypoxia (DO < 2 mg/L). The U.S. Environmental Protection Agency (USEPA) estimates that 4% of Gulf estuaries experience hypoxic conditions that affects aquatic resources, biological diversity, and biological populations (USEPA, 2013). As oxygen levels fall below critical values, mobile organisms (fish, crabs, and shrimp) evacuate the area, though many

sessile bottom-dwelling organisms may perish. Additional information regarding hypoxia effects to benthic organisms are discussed in Section 3.8.5 .

3.7.2 Nutrients

Nutrients in both freshwater and marine ecosystems provide the building blocks of biological production. Mississippi Sound has a productive estuarine system with a naturally nutrient-rich habitat. However, this natural balance can be dramatically upset by nonpoint source pollutants deposited into local waterways (MDEQ, 2024). Sources include fertilizers, herbicides, and insecticides, as well as pathogens and nutrients released from pet waste, livestock, faulty septic systems, and yard waste.

Although dissolved nitrogen and phosphorus are critical nutrients, increased inputs stimulate excessive growth of algae and aquatic plants. The resulting eutrophic condition interferes with the health and diversity of vegetation, insects, fish, and aquatic organisms. The National Coastal Condition Assessment data found that 81.9% of the Gulf coastal area was in good condition for dissolved nitrogen (USEPA 2021, data updated April 2023).

Dissolved inorganic phosphorus is a component of the Eutrophication Index affecting estuarine habitat. Primary nutrients are taken up by algae and other phytoplankton species, the key drivers for eutrophication. Agricultural and urbanized watersheds are identified as the primary sources of these nutrients (NOAA, 2024). Ultimately, runoff from inland rivers and coastal bayou watersheds is delivered to the Mississippi Sound water column.

3.7.3 Salinity and Temperature

The estuary receives an influx of two major rivers, four minor rivers, and a number of bayous, along with two ship channel crossings, all of which facilitate fluctuation of salinity in the Gulf of Mexico waters. Evaluation of salinity data from the continuous monitoring sites at the Gulfport Lighthouse (30191208858330) established a trend from six years (2017 to 2023), with a low of 2.6 parts per thousand (ppt) in May 2019, a high of 32 ppt in July 2023, and a mean of 13 ppt (USGS Waterdata, 2024). All gauges show similar temporal trends of highest salinities between July and November when low river discharges normally occur, and lowest salinities in January and May when rivers typically discharge higher freshwater quantities. Water temperature data determined a low of 6.9° Celsius (C) in January 2023, and a mean of 23.7°C (Waterdata USGS, 2024).

Figure 3-7: Hydrodynamic Modeling monitoring locations for habitat suitability in Study Area
Source: USACE ERDC HD Modeling, 2024.

For this Study, Hydrodynamic modeling was conducted by Engineering Research and Development Center (ERDC) (April 2024) and included salinity and water temperature at 13 locations in Mississippi Sound to determine habitat suitability for oyster and submerged aquatic vegetation (SAV) viability (**Figure 3-7**). The FWOP, Case 2, is aligned with the existing condition at the locations in the Mississippi Sound that represent salinity and water temperatures. The remaining FWP, Cases 3 and 4, are

discussed in Section 5.7.3. Full discussion of the HD modeling results and data are presented in the Hydrodynamics Modeling Report – Appendix A.

3.8 Biological Resource

3.8.1 Terrestrial Plant Communities

Terrestrial uplands are areas of higher ground not subjected to riverine flooding or tidal inundation. Upland natural areas within these broader communities include coastal hardwood forest, upland pine savanna, coastal scrub, upland prairie, coastal beach and dune, and dry coniferous/mixed hardwood forest (SACS Environmental Technical Report, 2022).

Isolated and scattered remnants of upland forested systems remain in the City of Gulfport as most available terrain is developed by urban high to medium population density along the mainland coastline. Away from the immediate business district of Gulfport which includes the Port, the intensity relaxes with medium to low density development, represented by residential-dominated communities that include landscaped parks and open greenspace, **Figure 3-8**.

Further description of the undeveloped terrestrial upland plant communities that occur in the study area can be found in Appendix C - Environmental.

3.8.2 Wetlands

The Clean Water Act (CWA), Section 404 defines wetlands as “areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, under normal conditions, a prevalence of vegetation typically adapted for life in saturated soil conditions” (USACE, 2010). In 1973, the Mississippi Legislature passed the Coastal Wetlands Protection Act which applies to all “publicly owned lands subject to the ebb and flow of tide, accretions, and submerged substrate below the watermark of ordinary high tide” (MDMR, 2015).

Vegetated coastal wetlands include salt and brackish marshes, tidal freshwater marshes, and swamps, and SAV beds. Non-vegetated coastal wetlands include tidal, open water habitats such as bayous, river channels and oyster beds (MDMR, 1999). Wetlands occurring in the study area are depicted in **Figure 3-9.** Further detail of wetland plant communities occurring in the Study area can be found in Appendix C - Environmental.

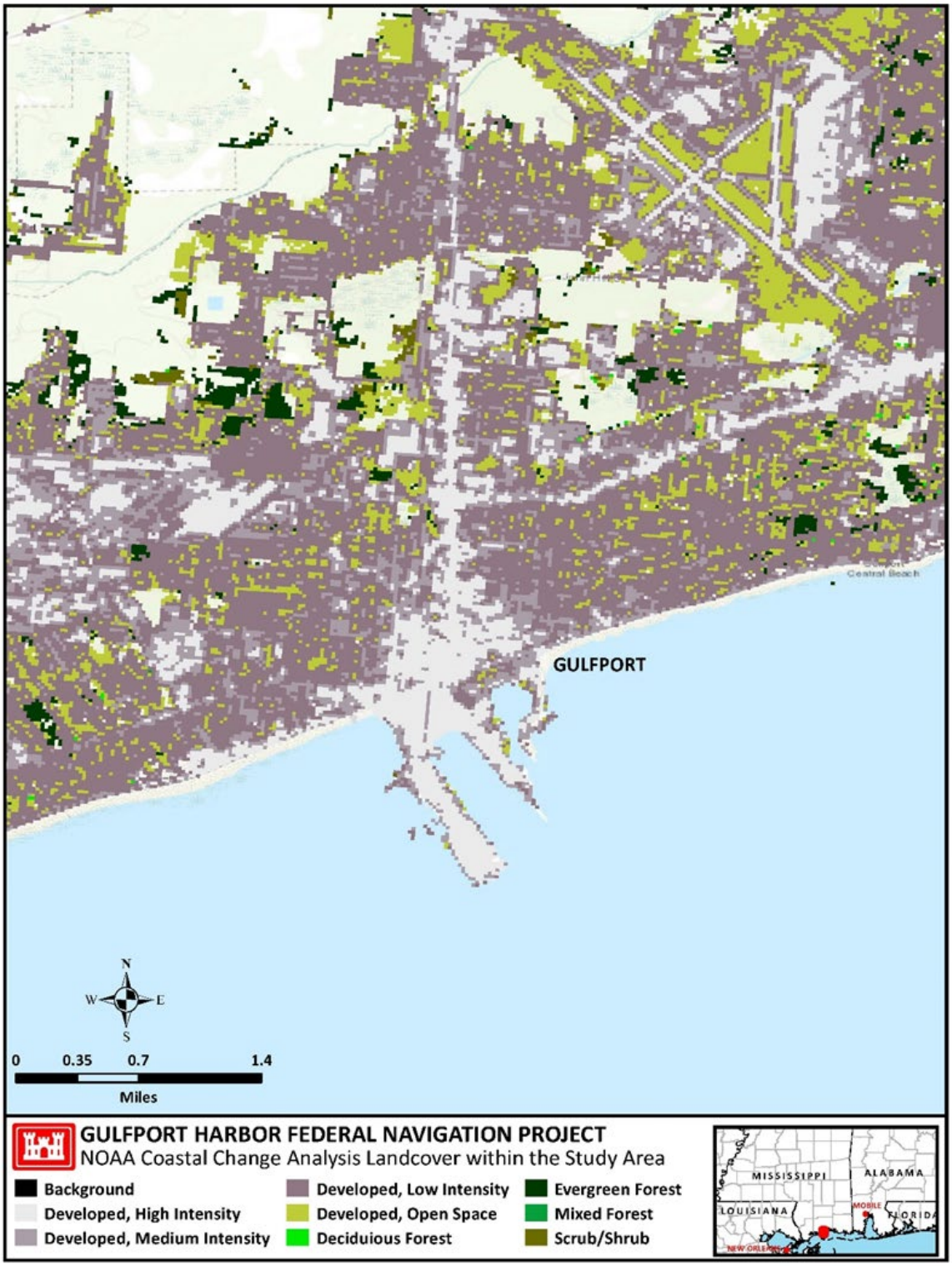

Figure 3-7. Land use of coastal Mississippi including Gulfport Harbor Study area.
Source: NOAA C-CAP Regional Land Cover 2016 https://coast.noaa.gov/digitalcoast/data/ccapregional.html

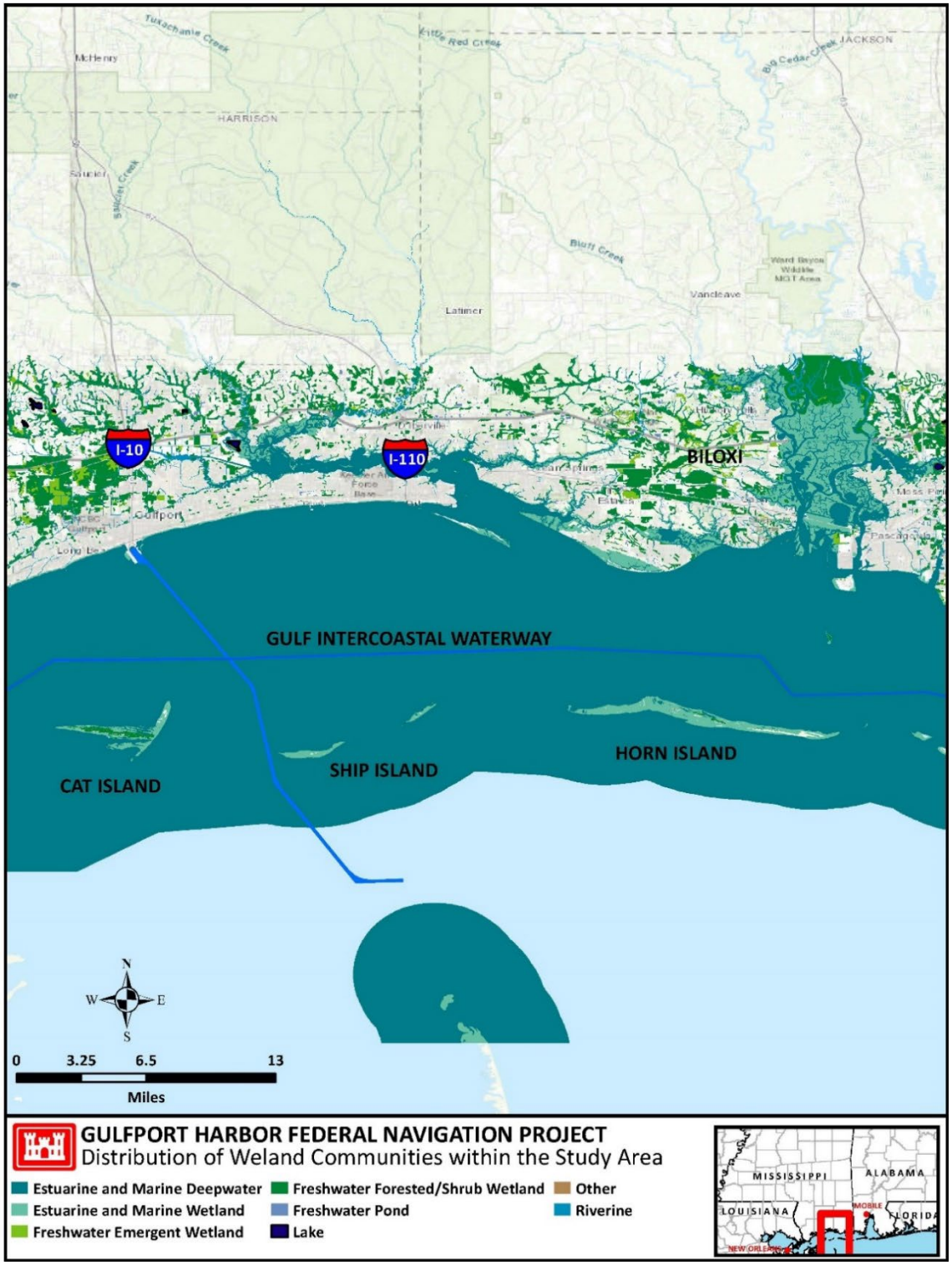

Figure 3-8: Wetlands in the Gulfport Harbor Study Area in Estuarine and Palustrine Water Regimes

Source: USFWS National Wetlands Inventory https://www.fws.gov/program/national-wetlands-inventory

3.8.3 Submerged Aquatic Vegetation

SAV in Mississippi Sound include shoal grass (*Halodule wrightii*), and possibly widgeon grass (*Ruppia maritima*), manatee grass (S*yngonium filiforme*), and turtle grass (*Thalassia testudinum*) (Pham *et al*., 2017). Data collection from previous surveys in the Mississippi Sound within the study area confirmed that dense seagrass colonies are present along the northside nearshore of Cat Island and West Ship Island (Ley *et al.*, 2023). Cat Island has dense populations occurring at the north and west tips of this T-shaped island, and in protected areas along its southwest shoreline (Moncreiff, 2006). Vittor and Associates (2015) conducted an SAV mapping survey in 2010 and again in 2014 for the Cat Island and Ship Island restoration projects. The findings of these survey events determined only shoal grass exists in any type of measurable area throughout the southern portion of Mississippi Sound.

Shoal grass bed mapping at Cat Island found a continuous density of 459 ac in 2014, a significant increase from the 2010 mapping event that recorded 178 ac (Vittor and Associates, 2015). Similarly, density of patchy seagrass beds at Cat Island increased in 2014 to 1,591 ac from 1,534 ac mapped in 2010. At Ship Island, only patchy seagrass beds were recorded; the 2014 data showed a density decrease of 76 ac from the 2010 data reported density of 125 ac. East Ship Island reported a similar trend of patchy seagrass bed density decrease to 242 ac in 2014 from 261 ac recorded in the 2010 data. Macroalgal beds were also found during the two surveys which may account for the visual extent depicted on aerial mapped data, **Figure 3-10**. The densest macroalgal beds were recorded in the 2014 data at the western tip of Ship Island (Vittor and Associates, 2015). For more information of SAV within the Study area and its significance, see Appendix C - Environmental.

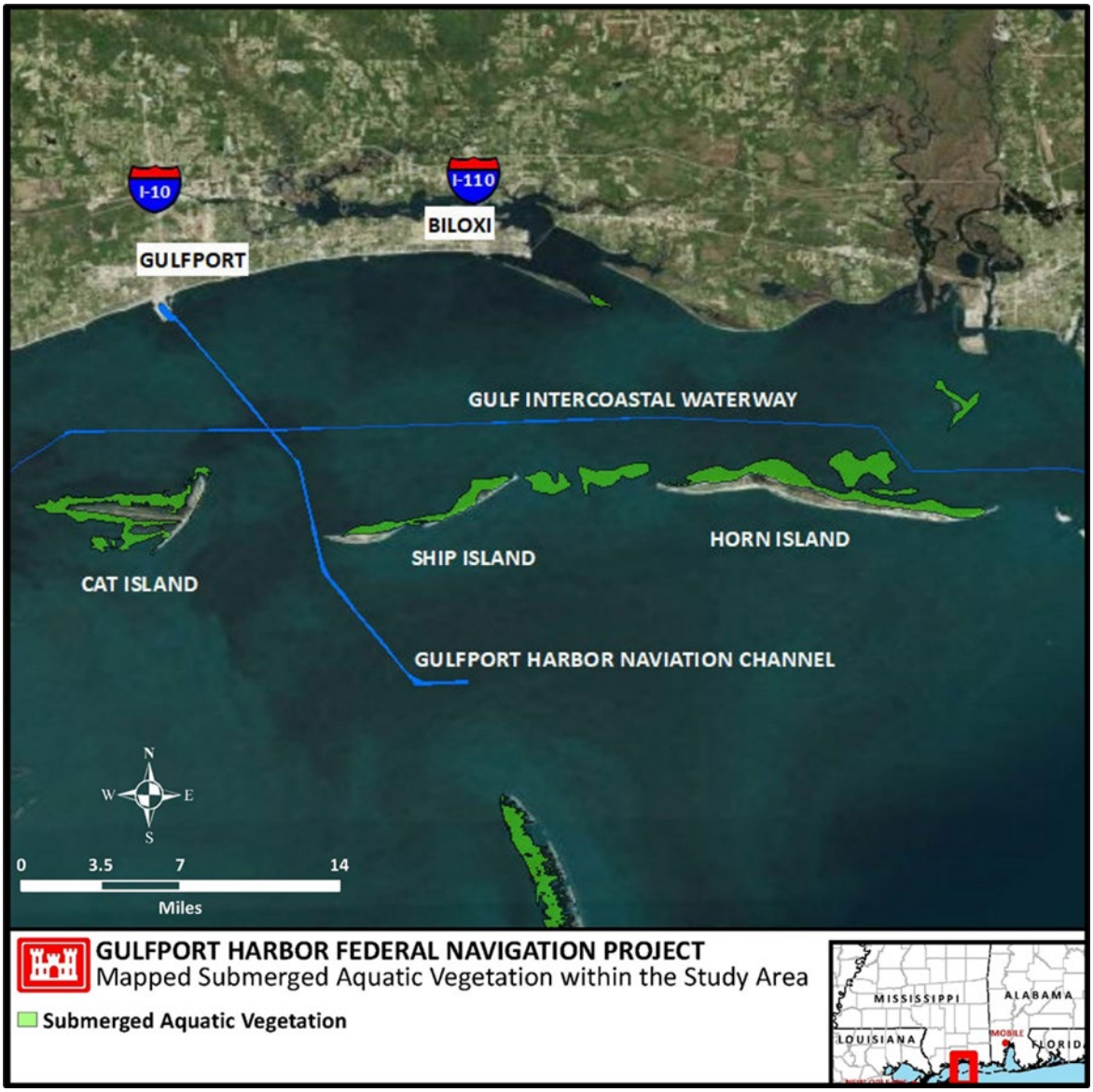

Figure 3-10: Seagrass beds that occur in the Study Area adjacent to Cat Island and Ship Island.
Source: Seagrass Map, Cat Island and Ship Island 2014

3.8.3 Artificial Reefs and Structures

An artificial reef is defined as “one or more objects of natural or human origin deployed purposefully on the sea floor to influence physical, biological, or socioeconomic processes related to living marine resources” (MDMR Artificial Reef Program, 2024). Mississippi, natural bottoms are predominately flat sand/mud that do not attract commercially or recreationally valuable fish. In 1999, DMR developed the Mississippi Artificial Reef Program in Mississippi’s marine waters and adjacent federal waters, Figure 3-8. Since the establishment of the program, 67 inshore reefs, 15 offshore reefs

and 8 rigs to reef sites have been created to enhance and support important marine species (MDMR Artificial Reef Program, 2024). Numerous other reef restoration efforts in the estuarine environment have been completed over the past decade by The Nature Conservancy (TNC) and NOAA with the purpose of creating reef habitat.

3.8.2.1 Offshore

MDMR in conjunction with Mississippi Gulf Fishing Banks, has developed 15 permitted offshore reef sites that combined cover approximately 16,000 ac, with sites ranging from 8 to 10,000 ac. The sites located north of the barrier islands consist of concrete rubble. The sites located south of the barrier islands include debris from concrete culverts, and steel hull vessels, as well as “Florida Limestone” artificial reef pyramids. The artificial reefs created under MDMR Artificial Reef Program have been shown to recruit juvenile fish species and other associated reef dwelling communities that allow the artificial reef to function as natural reefs (MDMR, 2024). Numerous artificial reefs are placed within or near the study area as shown on **Figure 3-11**. Additionally, there are numerous gas and oil platforms in the Gulf of Mexico outside of the study area that provide artificial structural habitats.

3.8.3 Hard Bottom Habitat

Hard bottom habitats serve as important spawning areas for fish species and support unique communities of marine organisms. No natural hard bottom habitats are located within the Gulfport Harbor FNC and surrounding waters. See Appendix C - Environmental for detailed discussion.

3.8.3.1 Inshore

In addition to Mississippi offshore artificial reef program, the State has created numerous inshore artificial fishing reefs south of the Mississippi coastline in local waters. Inshore artificial reefs are comprised of multiple materials, including crushed concrete, limestone and oyster shell that provide both vertical relief and hard substrate, and assist with establishing high quality oyster production (MDMR Artificial Reef Bureau). The reefs are developed to ring marginally productive oyster reefs with some form of hard, durable material, and filled with oyster cultch such as shell or crushed limestone for vertical relief. Creating such structures are anticipated to improve sportfishing at the sites from the increased vertical relief and biological diversity (MDMR, 2024).

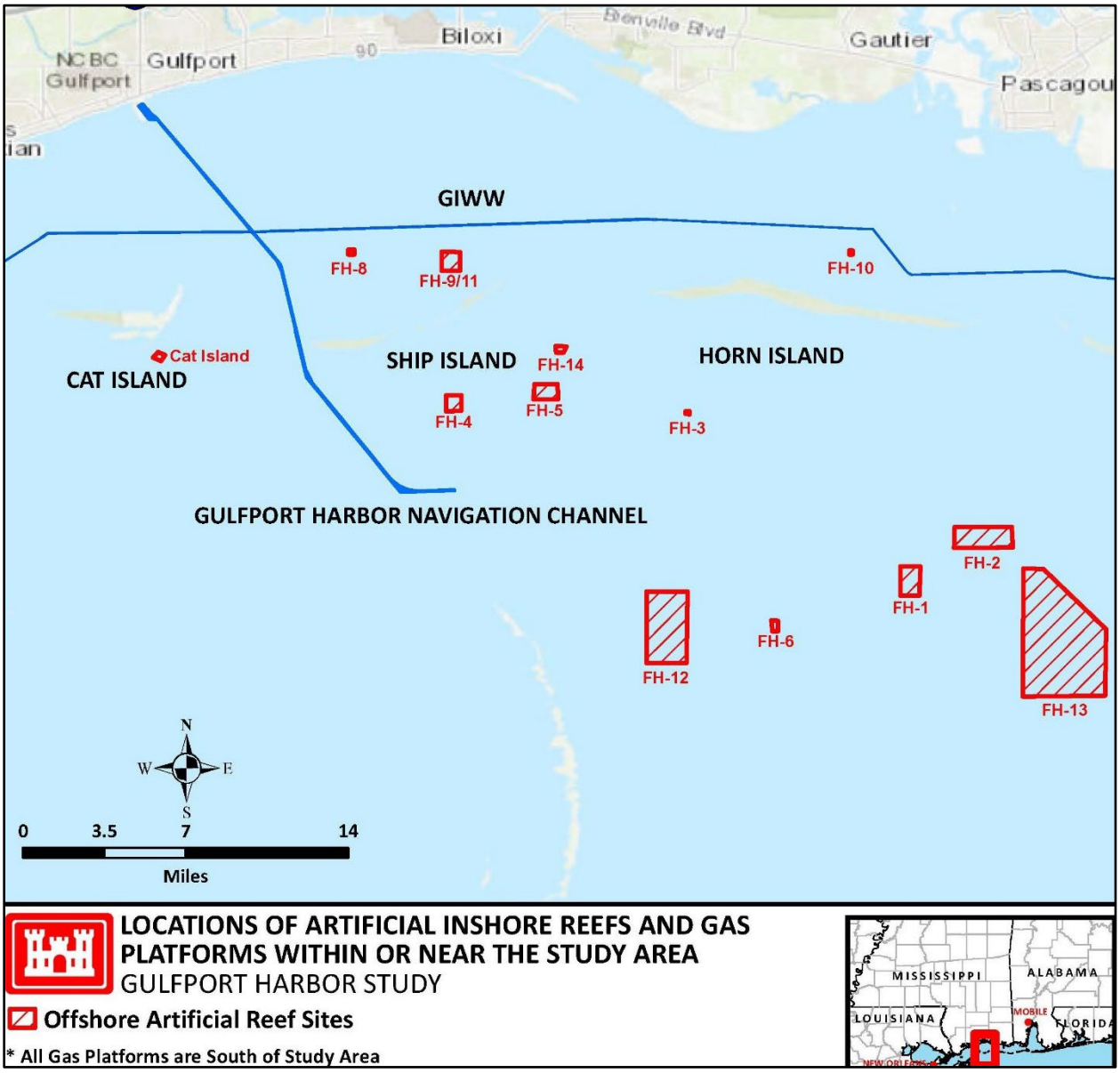

Figure 3-9. Artificial Reefs Occurring Near the Gulfport Harbor Channel Source: MDMR Artificial Reef Program

3.8.4 Essential Fish Habitat

The MSFCMA is administered by NOAA, NMFS-HCD (16 U.S.C. § 1855(2). Pursuant to the MSFCMA, each fishery management plan must identify and describe EFH for the managed fishery. EFH is defined as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity” 16 U.S.C. § 1802(10).

The Gulf of Mexico region includes the states of Texas, Louisiana, Mississippi, Alabama, and the west coast of Florida, which comprise NOAA Fisheries' Southeast

Region which includes the Gulf of Mexico Fishery Management Council (GMFMC), one of eight (8) U.S. regional councils to address fishery resources in Federal waters. Specifically, the GMFMC manages reel fish, shrimp, spiny lobster, coastal migratory pelagic, corals, essential fish habitat, red drum, and aquaculture. Within the study area waters, the GMFMC has designated and described EFH for 53 managed species which encompasses all estuarine and marine waters and substrates from the shoreline to the seaward limit of the Exclusive Economic Zone. In estuarine waters of Mississippi Sound, these habitats include inundated emergent wetlands, seagrass beds, algae flats, mud, sand, and shell substrates, and estuarine open waters.

Table 3.3 provides a list of the species that NMFS-HCD manages under the federally implemented FMP based on the NOAA Southeast Region - HCD EFH Data Inventory and EFH Mapper application (NOAA - HCD, 2024). None of the stocks managed by the GMFMC are endangered or threatened. The listing is a general description of species contained in the fishery management plan FMP developed by the GMFMC. No Habitat Areas of Particular Concern (HAPC) were identified at the report location.

Table 3.3. FMPs and Managed Species for Gulf of Mexico and Those Likely to Occur in Mississippi Sound.

Species/Management Unit	Lifestage(s) Found at Location	Management Council/FMP
Shellfish		
Brown Shrimp (*Penaeus aztecus)*	All	GMFMC/Shrimp Fishery
Pink Shrimp (*Penaeus duorarum)*	All	GMFMC/Shrimp Fishery
White Shrimp *(Penaeus setiferus)*	All	GMFMC/Shrimp Fishery
Royal Red Shrimp (*Pleoticus robustus)*	All	GMFMC/Shrimp Fishery
Coastal Migratory Pelagics	All	GMFMC/Coastal Migratory Pelagic Resources (Mackerels)
Red Drum (Sciaenops ocellatus)	All	GMFMC/Red Drum Fishery
Shark and Cartilaginous Species		
Atlantic Sharpnose Shark *(Rhizoprionodon terraenovae)*	Juvenile/Adult, Neonate	Secretarial/Amendment 10, 2006 Consolidated HMS FMP: EFH
Blacktip Shark (*Carcharhinus limbatus*)	Juvenile/Adult, Neonate	Secretarial/Amendment 10, 2006 Consolidated HMS FMP: EFH
Bull Shark (*Carcharhinus leucas*)	Juvenile/Adult, Neonate	Secretarial/Amendment 10, 2006 Consolidated HMS FMP :EFH

Finetooth Shark (*Carcharhinus isodon*)	All	Secretarial/Amendment 10, 2006 Consolidated HMS FMP: EFH
Spinner Shark (*Carcharhinus brevipinna*)	Neonate	Secretarial/Amendment 10, 2006 Consolidated HMS FMP: EFH
Reef Fish (43 species)		
Red Drum (Sciaenops ocellatus)	All	GMFMC/Red Drum Fishery
Gray Triggerfish (*Balistes capriscus)*	All	GMFMC/Reef Fish Fishery
Greater Amberjack (*Seriola dumerili)*	All	GMFMC/Reef Fish Fishery
Lesser Amberjack (*Seriola fasciata*)	All	GMFMC/Reef Fish Fishery
Almaco jack (*Seriola rivoliana)*	All	GMFMC/Reef Fish Fishery
Banded rudderfish (*Seriola zonata)*	All	GMFMC/Reef Fish Fishery
Hogfish (*Lachnolaimus maximus)*	All	GMFMC/Reef Fish Fishery
Queen Snapper (*Etelis oculatus)*	All	GMFMC/Reef Fish Fishery
Mutton Snapper (*Lutjanus analis)*	All	GMFMC/Reef Fish Fishery
Schoolmaster (*Lutjanus apodus)*	All	GMFMC/Reef Fish Fishery
Blackfin Snapper (*Lutjanus buccanella)*	All	GMFMC/Reef Fish Fishery
Red Snapper (*Lutjanus campechanus)*	All	GMFMC/Reef Fish Fishery
Cubera Snapper (*Lutjanus cyanopterus)*	All	GMFMC/Reef Fish Fishery
Gray Snapper (*Lutjanus griseus)*	All	GMFMC/Reef Fish Fishery
Dog Snapper (*Lutjanus jocu)*	All	GMFMC/Reef Fish Fishery
Mahogany Snapper (*Lutjanus mahogoni)*	All	GMFMC/Reef Fish Fishery
Lane Snapper (*Lutjanus synargis)*	All	GMFMC/Reef Fish Fishery
Yellowtail Snapper (*Ocyurus chrysurus*	All	GMFMC/Reef Fish Fishery
Silk Snapper (*Lutjanus vivanus)*	All	GMFMC/Reef Fish Fishery

Wenchman Snapper (*Pristipomoides aquilonaris)*	All	GMFMC/Reef Fish Fishery
Vermilion Snapper (*Rhomboplites aurorubens)*	All	GMFMC/Reef Fish Fishery
Goldface Tilefish (*Caulolatilus Chrysops)*	All	GMFMC/Reef Fish Fishery
Blackline tilefish (*Caulolatilus cyanops)*	All	GMFMC/Reef Fish Fishery
Anchor Tilefish (*Caulolatilus intermedius)*	All	GMFMC/Reef Fish Fishery
Blueline Tilefish (*Caulolatilus microps)*	All	GMFMC/Reef Fish Fishery
Golden Tilefish (*Lopholatilus chamaeleonticeps)*	All	GMFMC/Reef Fish Fishery
Dwarf Sand Perch (*Diplectrum bivittatum)*	All	GMFMC/Reef Fish Fishery
Sand Perch (*Diplectrum formosum)*	All	GMFMC/Reef Fish Fishery
Rock Hind (*Epinephelus adscensionis)*	All	GMFMC/Reef Fish Fishery
Speckled Hind (*Epinephelus drummondhayi)*	All	GMFMC/Reef Fish Fishery
Yellowedge Grouper (*Epinephelus flavolimbatus)*	All	GMFMC/Reef Fish Fishery
Red Hind (*Epinephelus Guttatus)*	All	GMFMC/Reef Fish Fishery
Red Grouper (*Epinephelus morio)*	All	GMFMC/Reef Fish Fishery
Misty Grouper (*Epinephelus mystacinus)*	All	GMFMC/Reef Fish Fishery
Warsaw Grouper (*Epinephelus nigritus)*	All	GMFMC/Reef Fish Fishery
**Snowy Grouper (*Epinephelus niveatus*	All	GMFMC/Reef Fish Fishery
Nassau Grouper (*Epinephelus striatus)*	All	GMFMC/Reef Fish Fishery
Marbled Grouper (*Epinephelus inermis)*	All	GMFMC/Reef Fish Fishery

Black Grouper (*Mycteroperca interstitialis*)	All	GMFMC/Reef Fish Fishery
Yellowmouth Grouper (*Mycteroperca interstitialis)*	All	GMFMC/Reef Fish Fishery
Gag (*Mycteroperca microlepis)*	All	GMFMC/Reef Fish Fishery
Scamp (*Mycteroperca plenax)*	All	GMFMC/Reef Fish Fishery
Yellowfin Groupler (*Mycteroperca venenosa*)	All	GMFMC/Reef Fish Fishery

Source: NOAA NMFA HCD EFH Mapping Tracker

3.8.4 Plankton and Zooplankton

3.8.4.1 Phytoplankton

Phytoplankton, also known as microalgae, contain chlorophyll requiring sunlight to grow. Most buoyant species float in the upper water column where sunlight penetration is plentiful. Nutrients needed for lifecycle processes are discharged into the Gulf of Mexico by runoff from inland surface and groundwater enabling phytoplankton to congregate in the nearshore at stream confluences (O'Connor, 2018). In a balanced ecosystem, phytoplankton provide food for diverse marine organisms including shrimp, snails, and jellyfish. In addition to providing to the marine food system, phytoplankton also serve as "carbon sinks" by removing dissolved CO_2 in seawater. In the Gulf of Mexico, a productive area for phytoplankton growth is at the confluence of the Mississippi River.

Several hundred species of planktonic algae comprise the algal communities in the Mississippi Sound. Most concerns are caused by planktonic algae classified as cyanobacteria, green algae, or Euglenoid algae (Neal *et al.*, 2023). A population explosion (bloom) may be lime-green, blue-green, or brownish red that form a surface scum. Planktonic algae, particularly diatoms and green algae, compose the aquatic food web base to promote a healthy and thriving ecosystem (Neal *et al.*, 2023).

Excessive nutrients cause phytoplankton to grow uncontrollably forming harmful algal blooms, producing toxic compounds that adversely affect fish, shellfish, mammals, birds, and even people (NOAA 2024 Factsheet). Coastal circulation of the Mississippi River outflows north and east into the Chandeleur-Breton Sound and into the Mississippi Sound (Walker *et al.*, 2005). Plankton blooms attract large populations of plankton-consuming fish, predatory fish, sea birds, and marine mammals (O'Connor, 2018). Phytoplankton biomass is lowest in the winter and spring, gradually rising through the summer to peak in the fall (Atwell, 1973).

Excessive phytoplankton results in low DO creating a hypoxic zone off the Mississippi coast during summer when water column stratification limits re-aeriation to bottom strata (Rabalais *et al.*, 2001). While fish might flee this lethal effect, slow moving or bottom-dwelling organisms are less able to escape impact (Nunnally *et al.*, 2013). As the shelf

in the west central Gulf of Mexico is frequently hypoxic by mid-summer, the variability of the western region shallow shelf largely controls the size of the hypoxic area in a given year (Nunnally *et al.*, 2013).

3.8.4.2 Zooplankton

Zooplankton in the Gulf of Mexico include organisms such as hydromedusae, siphonophores, ctenophores, and tunicates. High zooplankton volumes are near the mouth of the Mississippi River, suggesting this area markedly affects populations in the northern Gulf of Mexico. Copepods were the most abundant group of zooplankton collected in a Louisiana State University 1976 study (Howey, 1976). Of the 101 species of copepods collected in samples from the northern Gulf of Mexico, diversity was greatest in oceanic waters, lower in slope waters, and lowest in continental shelf waters (Howey, 1976). Although this 1976 study is a bit dated, a literature search for the study did not find more recent data, indicating that limited research has been conducted of zooplankton in the Mississippi Sound.

Zooplankton production is influenced by high volume of river discharge that enhances stratification along frontal boundaries and current jets, increasing nutrients and phytoplankton availability as a food source (Daly *et al.*, 2021). Other factors include salinity, turbidity, nutrient concentration, predator abundance, and various pollutant levels (Daly *et al.*, 2021). Zooplankton are significant in governing ocean production and mediating biochemical cycles (Banse, 1995). Zooplankton are essential to sustaining fishery production. They are the dominant prey for larval, juvenile, and some adult fish species that spend their earliest life stages as zooplankton (Daly *et al.*, 2021).

3.8.5 Benthic Communities

Nearshore soft sediment in the Gulf of Mexico is largely composed of macroinvertebrates such as sponges, polychaetes, echinoderms, and crustaceans (Brooks *et al*. 2006). Soft-sediment habitats, with grain size between 40% to 60% clay, contain a majority of the Mississippi Sound benthos (~ 427,379 acres). Various surveys conducted between 1970 and 2005 specifically identified polychaetes as the dominant macrofaunal taxon in 85% in the Mississippi Sound.

Benthic communities perform critical functions in the nearshore food web that contribute substantially to their biomass. Abundant distribution of benthic taxa indicates a stable aquatic habitat. Taxa include filter-feeders which digest phytoplankton and particulate organic matter, and deposit processed materials in the substrate (Felder and Camp, 2009). Factors affecting habitat quality include severe storms and changes in sediment. Alteration of freshwater (droughts, floods, flood control levees) or saltwater (dredging, channel deepening) affect biotic communities by changing taxonomic composition and distribution. Salinity is a stress factor for benthic invertebrates, controlling function of the brackish estuarine between marine and terrestrial ecotone (Mrozinska *et al.*, 2021).

The distributions of benthic invertebrates respond to sediment composition, competition, and predator-prey relationships (Little *et al.,* 2017). Anthropogenic threats to benthic

habitats include commercial fishing, followed by pollution and litter, aggregate mining, oil and gas production, coastal development, invasive species, and climate change (Harris, 2020). Habitat in the northern Gulf of Mexico suffered considerable losses to secondary productivity from the significant event of the Deepwater Horizon oil spill (MDEQ/NFWF, 2016).

3.8.5.1 Ship Island Restoration post-construction monitoring ERDC study 2021

Post- construction monitoring associated with the Ship Island restoration was conducted in 2021 from passes around Ship Island and the former Camille Cut. Benthic macrofaunal and sediment sampling was conducted at 88 stations in October and November of 2021 (USACE ERDC, 2021) (**Figure 3-12**). The assessment characterized benthic macrofauna resources relative to habitat depth and sediment composition presumably encountered by Gulf sturgeon during winter foraging. The ERDC study results indicate that benthic habitat north of Camille Cut was undergoing recolonization in 2021 as evidenced by the change in sediment composition and the prevalence of early successional stages of benthic invertebrates. Benthic recovery in other studies determined a return to total infaunal abundances within 10 months of thin-layer dredged material placement in Mississippi Sound, but dissimilarities in assemblage composition persisted for at least 16 months (Wilber *et al*., 2007). Although total densities of macrofauna were restored in areas of the western Atlantic within a year of dredging, full species assemblage recovery may require more than 2.5 years (Pickens and Taylor, 2020). The study concluded that given this variability in recovery rates, benthic monitoring of individual projects is needed to understand the recovery rate in a specific area. Detailed information of the ERDC study is presented in Appendix C - Environmental.

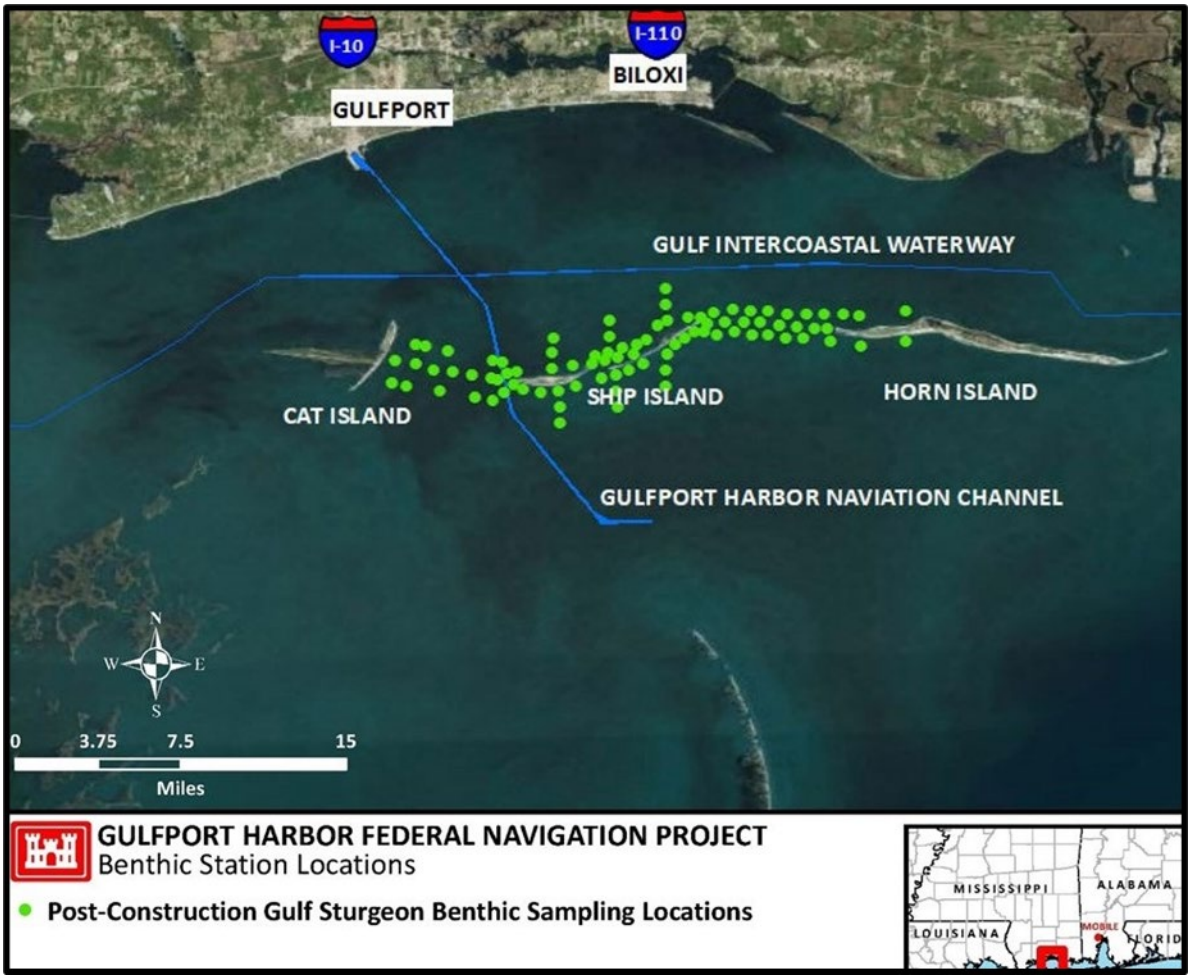

Figure 3-10. Location of benthic sampling stations in Ship Island Pass (SIP), Camille Cut (CC), and Dog Keys Pass (DKP). Samples were collected in Fall of 2021.

Source: ERDC, 2023. Benthic Macrofauna Distributions and Golf Sturgeon Occupancy Patterns at Year 1 Post-restoration of Ship Island, MS. February 2023

3.9 Fish and Fisheries Resources

3.9.1 Fisheries Resources

The Mississippi seafood industry has an annual economic impact of over $377 million and provides employment for over 8,500 people. Major species produced are shrimp, crabs, oysters, and finfish. Pascagoula/Moss Point and Gulfport/Biloxi are among the leading seafood ports in the nation (MDWFP, 2024). MDMR data show a steady decline of commercial shrimp vessels on opening day over the past 7 years (2014 – 2020), from a count high of 368 vessels to 71 vessels in Mississippi Sound (MDMR, 2021). Fisheries for many species in the Gulf of Mexico exhibit wide annual population fluctuations. A variety of factors contribute to variations in population abundance, such

as quality of habitat, fishing pressure, environmental parameters, and pollution (MDWFP, 2024). The Gulf of Mexico has fewer food resources and less cover from predators; thus, estuaries like the Mississippi Sound serve as marine nurseries with numerous grass beds and oyster reefs that also serve as protective habitat (MDWFP, 2024). Recreational fishing is extremely popular in the Mississippi Sound estuarine. Common recreational fishes targeted in the study area, include red drum (redfish), spotted sea trout, striped mullet, flounder, and shrimp. Detailed description of these species is found in Appendix C - Environmental.

Extreme Mississippi River flooding in 2019 necessitated the Bonnet Carré Spillway opening on two separate occasions. The first event was February 27 through April 11, with a maximum flow of 213,000 cubic feet per second (cfs), and a second event from May 10 through July 27, with a maximum flow of 161,000 cfs. The Mississippi Sound became inundated with freshwater from March through August of 2019, causing severe impact to multiple fisheries including large scale mortalities of oyster reefs, loss of brown shrimp recruitment, and the displacement of several commercially important species (MDMR, 2023). In September 2019, the U.S. Secretary of Commerce declared a Catastrophic Regional Fisheries Disaster for Mississippi, Louisiana, and Alabama for commercial fishing, seafood, and charter industries directly impacted by this event. Congress appropriated $165 million for fishery disasters which led to twelve MDMR proposed programs in 2020 to help fisheries recover from the 2019 disaster (MDMR 2021 Newsletter). MDMR staff continues to work with NOAA to develop a comprehensive recovery program to address the impacts from the 2019 event, including $5.1 million funding for restoration of the Mississippi oyster reef (MDMR, 2023).

3.9.2 Oysters

The Mississippi Gulf Coast has historically been home to some of the nation's most productive and valuable oyster resources. The Eastern Oyster, (*Crassostrea virginica*), is a bivalve mollusk of the family *Ostreidae*. Populations of the Eastern Oyster are found in the nearshore estuarine bays and sounds of the Gulf of Mexico with most concentrations in waters less than 30 ft deep (Pattillo *et al*., 1997). In the study area, Eastern Oyster beds are found at the confluence of Bay of St. Louis into the Mississippi Sound at Christian Pass, **Figure 3-13**. This sedentary benthic invertebrate attaches in clusters to shell reefs, firm mud/shell bottoms and other hard substrates (MDMR, 2021). Spawning typically occurs in April to October, although spawning has been reported during all months except February and March. Nursery areas for pelagic larvae and settled juveniles are found in estuarine waters. (NOAA, 2011). Oyster recruitment is the key driver for maintaining their population over time and occurs through the settlement of larvae from their natal reef or from other reefs within the system (Morgan and Rakocinski, 2022). The Eastern Oyster filter-feeds principally on small unicellular algae and incidentally on suspended detrital particles. Its planktonic larvae drift with the tides and currents until settling on solid substrate. Oysters are particularly vulnerable to microbial pollution as they bioaccumulate bacteria from pollution sources, leading to closure of some shellfish harvest areas due to high levels of fecal coliform bacteria in

surface waters (>14 fc bacteria /100 mL) (MDMR, 2021). This source of pollution is one of the leading causes of water quality impairments in the coastal waters of the Gulf of Mexico (NOAA, 2011 Gulf of Mexico Atlas). Increase or decrease in salinity may cause productivity slowdown, including spawning and spat development. For this Study, a HD modeling was conducted by USACE ERDC in May 2024 to address water quality in survey locations throughout the Mississippi Sound and included both salinity and water temperature values. A discussion of this modeling can be found in Section 3.7.3 for future without project, and Section 5.7.3 for future with project conditions. A detailed discussion of Mollusks is included in Appendix C - Environmental.

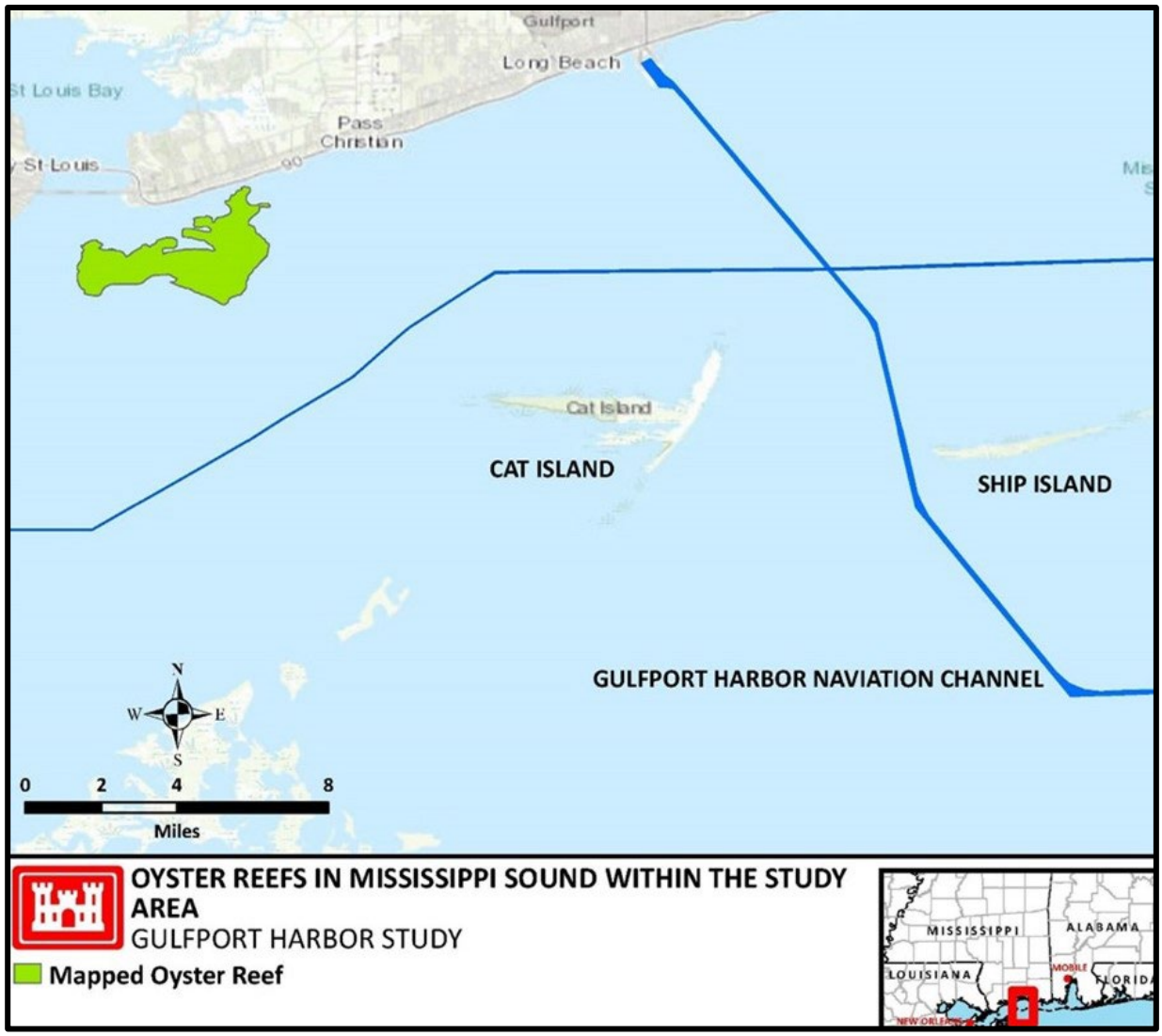

Figure 3-11. Oyster Reef in Mississippi Sound at Christian Pass
Source: MBRACE University of Southern Mississippi and University of Kentucky

3.9.3 Crustaceans

Crustaceans in Mississippi Sound include a variety of amphipods, isopods, shrimps, and crabs. Three commercially important species of shrimp and one commercially important species of crab are found in Mississippi coastal waters: the brown shrimp (*Farfantepenaeus aztecus*), the pink shrimp (*Farfantepenaeus duorarum*), the white shrimp (*Litopenaeus setiferus*), and the blue crab (*Callinectes sapidus*). The shrimp industry in the Gulf of Mexico suffered two severe blows in recent years. In 2005, Hurricane Katrina destroyed much of the shrimp boat fleet and processing facilities along the Gulf Coast. Also, in 2010, the massive Deepwater Horizon oil spill devastated aquatic organisms in the Gulf region (MS State University, 2016).

Landing statistics of shrimp, mostly white and brown from Mississippi Sound from 2016 through 2020 averaged over 9.1 million pounds and valued at a gross dockside around $19 million over the 5-year time period. During 2020, brown shrimp landings in the Bays and Sound occurred from May to December, peaking in August, when 1.42 million pounds were harvested, and the highest monthly value was $2.6 million (MDMR, 2021). The optimum growing conditions for brown shrimp occur when the salinities are above 10 ppt and water temperatures are greater than 68°F. Description of fish species, mollusks, and crustaceans that commonly inhabit waters in the Study area are detailed in Appendix C - Environmental.

3.10 Threatened and/or Endangered Species

Several species of threatened and endangered marine mammals, turtles, plants, snails, fish and birds occur in the Gulf of Mexico off the coast and inland areas of Harrison County, Mississippi including offshore waters of Mississippi and Louisiana that occur within the study area. NOAA NMFS-PRD lists seven species that may occur within the study area under their purview as threatened and/or endangered, obtained from the NMFS- Endangered Species Act (ESA) Section 7 Mapper website. Five of these listed species are also included in the USFWS Information for Planning and Consultation (IPAC) report with shared management between the two agencies (USFWS IPAC, 2023). **Table 3.4** includes the official listings of protected species generated by these two references. The official listing documents generated by these two agencies are included in Environmental Appendix C - Environmental.

There are 11 federally listed species, two critical habitat designations for piping plover and nearshore foraging habitat Gulf sturgeon, **Figure 3-14**, and two proposed critical habitat designations for green sea turtle and rufus red knot, that occur in the vicinity of the proposed project and could be affected by construction activities. Descriptions of the species listed in **Table 3.4** are provided in Appendix C - Environmental.

Table 3.4. Federally Listed Threatened and Endangered Species in the Project Area

Common Name	Scientific Name	Status[a] (Agency)	Area of Potential Occurrence	Habitat and Species Description
Mammals				
West Indian Manatee	*Trichechus manatus*	LT (USFWS)	Mississippi, Louisiana	Aquatic mammal occurs in coastal rivers, and nearshore estuaries of the Gulf of Mexico. Manatees have large, seal-shaped bodies with paired flippers and a round, paddle-shaped tail.
Birds				
Red Knot[b]	*Calidris canutus ssp. rufa*	LT (USFWS) PCH	Harrison County Mississippi	Sandy beaches, tidal mudflats, salt marshes, and peat banks. Medium-sized shorebird about 9 to 11 inches in length with a proportionately small head, small eyes, short neck, and short leg.
Piping Plover	*Charadrius melodus*	LT (USFWS) CH	Harrison County, Mississippi	Sandy beaches, tidal mudflats, salt marshes, intertidal mud flats, overwintering migrant. Small shorebird seven inches long, sand-colored plumage on back and crown, white underparts. Critical Habitat Unit MS14.
Eastern Black Rail	*Laterallus jamaicensis*	LT (USFWS)	Harrison County Mississippi, Chandeleur Island, Louisiana	Salt, brackish, and freshwater marsh habitats. Dense herbaceous vegetative cover allows for movement. Elevated refugia to escape high water. Adults range 10-15 cm length, wingspan of 22-28 cm. Pale to blackish gray, small blackish bill, bright red eyes
Fish				
Gulf Sturgeon	*Acipenser oxyrhynchus desotoi*	LT (USFWS and NMFS) CH	Mississippi, Louisiana, inshore and offshore waters	Rivers, estuaries, and Gulf of Mexico waters. CH Unit 8 encompasses Mississippi Sound, uses include migrating, foraging, and overwintering.
Reptiles				
Green Sea Turtle[b]	*Chelonia mydas*	LT (USFWS and NMFS) PCH	Mississippi Sound and oceanward,	Throughout the Atlantic, estuarine and shallow marine waters. Adults and neritic

			barrier islands, Louisiana waters	juveniles. Migrating and nesting activities.
Kemp's Ridley Sea Turtle [b]	*Lepidochelys kempii*	LE (USFWS and NMFS)	Mississippi Sound and oceanward, barrier islands, Louisiana waters	Nearshore and inshore waters of the northern Gulf of Mexico, Louisiana waters. Adults and neritic juveniles. Migrating and nesting activities.
Loggerhead Sea Turtle [b]	*Caretta caretta*	LE (USFWS) LT (NMFS)	Mississippi Sound and oceanward, barrier islands, Louisiana waters	Ocean beaches and estuarine shorelines with suitable sand and relatively narrow, steeply sloped, coarse-grained beaches. Adults and neritic juveniles, hatchlings. Migrating and nesting activities.
Leatherback Sea Turtle	*Dermochelys coriacea*	LE (USFWS and NMFS)	Mississippi Sound and oceanward, barrier islands, Louisiana waters	Throughout the Atlantic, estuarine and shallow marine waters. Adults and neritic juveniles, hatchlings. Migrating and nesting activities.
Hawksbill Sea Turtle [b]	*Eretmochelys imbricate*	LE (USFWS and NMFS)	Mississippi Sound and oceanward, barrier islands, Louisiana waters	Shoals, lagoons, lagoon channels, and bays with marine vegetation; can tolerate muddy bottoms with sparse vegetation. Adults and neritic juveniles. Migrating and nesting activities.
Sharks and Rays				
Giant Manta Ray	*Manta birostris*	LT (NMFS)	Mississippi, Louisiana, Offshore waters	Gulf of Mexico inshore waters. Adults and juveniles. Migrating and foraging, possible mating.

[a] LE = Listed Endangered; LT = Listed Threatened; CH = Designated Critical Habitat; PCH = Proposed Critical Habitat.
Sources: USFWS IPAC – MS and LA, 2023, 2020; NOAA ESA Section 7 Mapper Tool; SACS Project Aid Report.

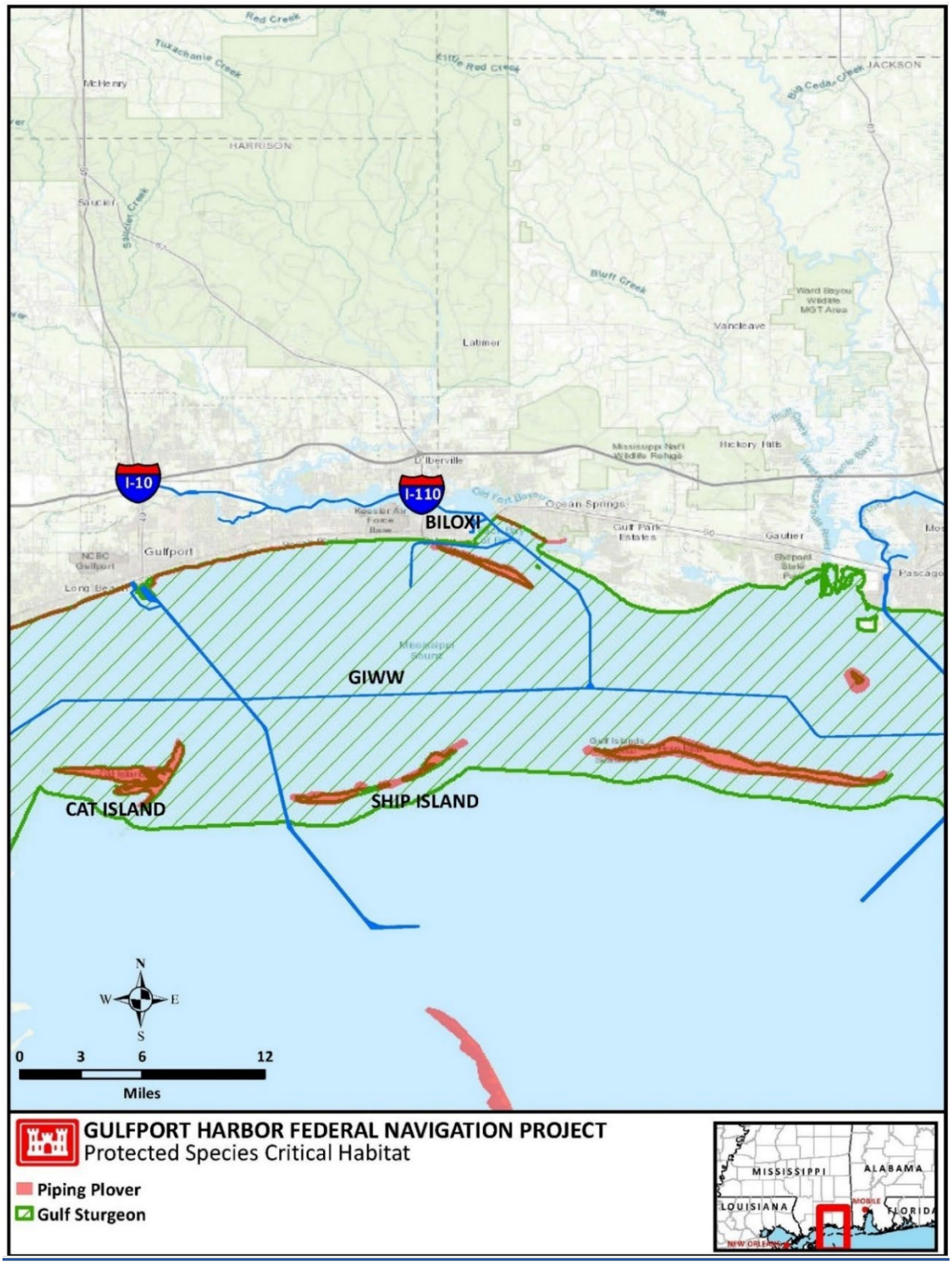

Figure 3-12. Endangered Species Act Designated Critical Habitat within the Study Area

Source: USFWS ECOS IPAC and NMFS-PRD ESA Section 7 Mapper

3.9.1 Species Not Discussed Further

Due to a lack of suitable habitat and their location in nearshore coastal estuarine or marine environments, the following species would not occur in or around the study area and are not further discussed:

USACE, Mobile District, does not anticipate sperm, Rice's, fin, or sei whales would be adversely affected by the varying dredging methods (i.e. hydraulic, hopper, and/or mechanical) described by the TSP outlined in Section 4.9 Furthermore, these species are not identified on the NMFS-PRD ESA Section 7 Mapper generated species listings as recommended for formal consultation. Previous coordination with NMFS-PRD, under the 2003 Gulf Regional Biological Opinion (GRBO) (amended 2005 and 2007) resulted in a determination that dredging activities have a "not likely to adversely affect" determination for whale species potentially within the project area. The possibility of collision with the dredge is remote since these are deepwater species and the likelihood for collision would be reduced by the highly mobile nature of these species. Also eliminated from further evaluation is the Eastern Black Rail, as it is heavily dependent on dense marsh habitat within coastal systems. As the scope of this study is focused on in-water environment, it is unlikely this rare, shy species of marshes associated with barrier islands is present away from its preferred habitat.

3.10 Marine Mammals

All marine mammals are protected under the Marine Mammal Protection Act (MMPA) of 1972, as amended, regardless of their status under the ESA. Although none of the listed whales are anticipated to occur within the study area, they are protected under both the ESA and MMPA by NMFS-PRD. The MMPA prohibits, with certain exceptions, the take of marine mammals in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the U.S. The marine mammal species listed in **Table 3.5** includes those species that may occur or are known to occur within the study area. Information of those species commonly occurring the study area are discussed in Environmental Appendix C – Environmental.

Table 3.5. Marine Mammals with known presence in northern Gulf of Mexico

Scientific Name	Common Name
Grampus griseus	Risso's dolphin
Stenella attenuate	Pantropical spotted dolphin
Stenella clymene	Clymene dolphin
Stenella coeruleoalba	Striped dolphin
Stenella frontalis	Atlantic spotted dolphin

Stenella longirostris	Spinner dolphin
Steno bredanensis	Rough toothed dolphin
Trichechus manatus	West Indian manatee [a]
Tursiops truncates	Atlantic bottlenose dolphin

Sources: MMS, 2000; NOAA Fisheries, 2022.
[a] Protected under the ESA of 1973 as endangered, USFWS ECOS 2022.

Based on NMFS-PRD aerial surveys, the most often sighted groups along the upper continental slope of the north-central Gulf of Mexico are Risso's dolphin (*Grampus griseus*), Atlantic bottlenose dolphin (*Tursiops truncates*), Atlantic spotted dolphin (*Stenella frontalis*), pantropical spotted dolphin (*Stenella attenuata*), striped spinner dolphin (*Stenella longirostris*), and clymene dolphin (*Stenella clymene*), (NOAA, 2022). The Mississippi coastal and estuarine waters are home to stable populations of Atlantic bottlenose dolphins because of their warm and protected waters (Miller *et al.*, 2010). Atlantic bottlenose dolphins inhabiting different areas of the bays and sounds form distinct communities in relatively fluid groupings within somewhat closed societies (Waring *et al.*, 2013).

Vessel collisions are a significant source of mortality for coastal large mammal species, particularly whales and manatees. The northern Gulf of Mexico is an area of considerably high amount of ship traffic, which may increase the risk of vessel-mammal collisions. Several important commercial shipping lanes travel through the primary marine mammal habitat into the northern Gulf of Mexico, particularly large commercial vessel traffic from ports in Gulfport, Pascagoula, Mobile, Pensacola, and east towards Tampa (NOAA, 2022). Other threats to marine mammals are anthropogenic caused such as overfishing and gear entanglement, high-speed boat strikes, chemical runoff, and noise pollution (Miller *et al.*, 2010).

West Indian manatees were originally listed as endangered by ESA throughout their range in 1967; but was downlisted to threatened in 2017. Manatees undertake large seasonal migrations with distribution controlled by temperature. In the summer and fall, they seek shallow grass beds with ready access to preferred feeding areas in coastal and riverine habitats of secluded canals, creeks, bayous, and lagoons (USFWS ECOS, 2022). Manatees require freshwater sources obtained from both natural and anthropogenic sources. As herbivores they forage heavily on SAV (i.e. turtle grass, shoal grass, manatee grass, and eel grass). Other common forage plants include cordgrass, algae, and herbaceous vegetation typically found in marshes or along coastal stream banks (USFWS ECOS, 2022).

Watercraft strikes, a major threat to manatees, account for over 33% of all adult deaths. Water control structures and navigation aides also are significant causes of mortality, as

are red tides and freezing incidents (Miller *et al.*, 2010). Poor nutrition is suspected to cause manatee mortality when their SAV forage resource is killed off by turbidity, salinity change, or pollution. The population's genetic diversity is also very low, which decreases their ability to adapt to changing conditions and rebound after unexpected mortality events such as hurricanes (McCormick Jr., 2024).

3.11 Wildlife Communities

3.11.1 Birds

The Gulf Coast, including the Mississippi Coast and associated watershed, provides feeding, nesting, resting, and wintering habitat for over 300 species of numerous resident and migratory bird species (MDMR, 2010). The Study area serves as part of an important corridor (i.e., the Mississippi Flyway) for birds migrating to and from tropical wintering areas in the Caribbean, Mexico, and Central and South America (USFWS, 2017). The coastal woodlands and barrier islands that lie scattered along the northern coast of the Gulf of Mexico provide important stopover habitat for these neotropical migrants (USACE, 2017). In the Mississippi Sound, the National Audubon Society has identified Important Bird Areas (IBA) which include the study area. The IBA designation is to spearhead an ambition effort to identify, monitor and protect the most important places for birds (National Audubon Society, 2024). As depicted in **Figure 3-15** one such IBA is located at the Port of Gulfport facility. Some migratory waterfowl may use the area for foraging and loafing in the upper portion of Mississippi Sound within the study area. Specific information regarding bird species and usage within the study area is found in Appendix C - Environmnetal.

3.11.2 Terrestrial Mammals

Diversity among mammal species is limited in the study area because of limited habitat within an urbanized environment. Species likely to be commonly found in the project area throughout Harrison County are opportunistic species such as bobcat (*Lynx rufus*), ground hog (*Marmota monax*), Eastern gray squirrel (*Sciurus caroliniensis*), nine-banded armadillo (*Dasypus novemcintus*), opossum (*Didelphis marsupialis*), and raccoon (*Procyon lotor varius*). Red fox (*Vulpes vulpes*) have been spotted in the Gulfport area. The swamp rabbit (*Sylvilagus aquaticus littoralis*) may be restricted to coastal low elevation marshes in the barrier islands. Other mammals that could occur in the region include the hoary bat (*Lasiurus cinereus*), eastern chipmunk (*Tamias striatus*), black rat (*Rattus rattus*), and rice rat (*Oryzomys palustris palustris*) (Animalia 2024). Invasive or non-native mammals in the region include feral house cats and hogs. While feral cats are known to exist within urban Gulfport, feral hogs are less likely to be present in high density development but could inhabit the extensive wetland forests away from the waterfront in less dense residential and undeveloped forested wetlands and ruderal areas in north Gulfport. Coyotes (*Canis latrans*) have presence in urban Gulfport, as reported in 2015 when a coyote was spotted on Second Street in Gulfport carrying a dead dog (Sun Herald, 2015).

3.11.3 Reptiles/Amphibians

Amphibians are restricted to freshwater damp habitats, so they are generally not present in the Mississippi Sound. Frequently, they are present in bayous and bays where salinity is reduced to brackish at confluences with freshwater sources (MDWFP, 2024). Amphibians are cold-blooded, smooth-skinned vertebrates that characteristically hatch as an aquatic larva with gills. The larvae then transform into an adult having air-breathing lungs. Reptiles are also cold-blooded vertebrates that usually lay eggs and have an external covering of scales or horny plates. In 2012 the Mississippi Department of Wildlife Fisheries and Parks (MDWFP) reported 146 species of amphibians and reptiles in Mississippi, home to the taxa of 31 frogs, 30 salamanders, 13 lizards, 41 snakes, 30 turtles (including sea turtles) and the American alligator (MDWFP MS). In addition, an exotic tropical frog species, greenhouse frog, (*Eleutherodactylus planirostris*) has established populations in south Mississippi, including Gulfport. (USFWS, 2011 rev. 2017).

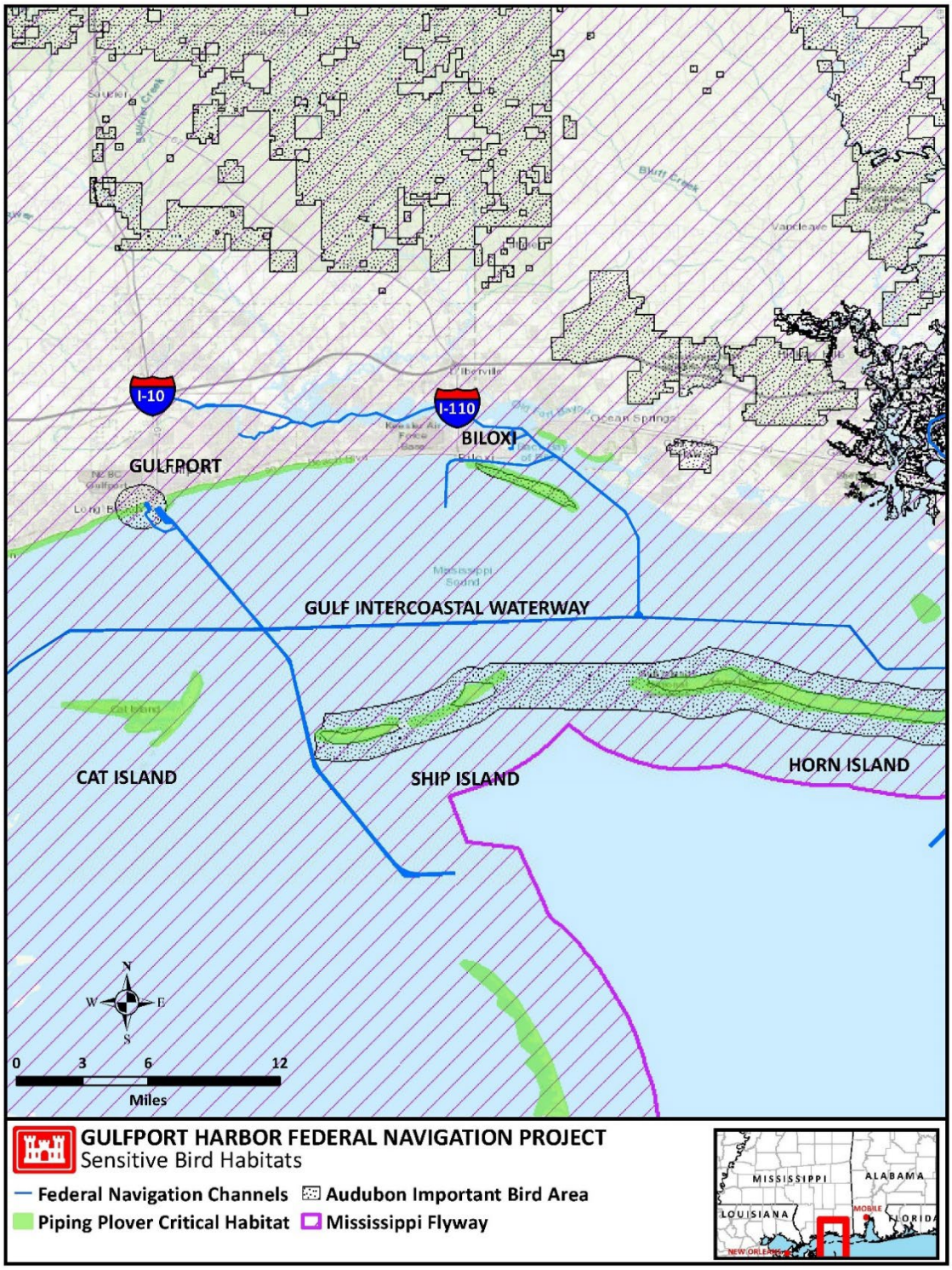

Figure 3-13. Sensitive Birding Habitat withing the Study area.

Sources: USFWS 2017, Natural Resource Program Center. Administrative Waterfowl Flyway Boundaries; National Audubon Society, 2024 Important Birding Areas.

3.12 Invasive Species

An invasive species is one that has been introduced by human activity – deliberately or accidentally – to geographic areas outside its native range and has caused ecological or economic impacts in that location. The discussion below focuses on invasive species that are known or could occur in the study area of both terrestrial and aquatic environments. Introduced or exotic species are plants and animals that generally adversely affect or alter the ecosystems they invade to the detriment of native (endemic) species. Negative ecological and economic impacts of introduced species result as they alter habitat, compete with, prey on, hybridize with, or infect endemic species (Simberloff *et al.*, 2005). A Study specific MDMR listing of invasive species that could occur in the Gulfport coastal region is included in the Appendix C - Environmental. The descriptions below are not an exhaustive list of species that could be present; rather, species discussed are those that could be in the Study area based on additional research.

3.12.1 Terrestrial Upland Invasive Species

The exotic invasive greenhouse frog, (*Eleutherodactylus planirostris*) has established populations in south Mississippi and is documented as present in Harrison County (USFWS, 2011 rev. 2017). A terrestrial, nocturnal amphibian, the greenhouse frog typically inhabits forests, riparian zones, and areas that offer shelter and moisture. The prolific greenhouse frog can thrive in an urban environment where they are commonly found in disturbed areas (USFWS, 2011 rev. 2017). They are also resilient to hot and dry conditions making them a formidable colonist species (Mississippi Herps, 2024). The greenhouse frog could be present in study area, as it seeks out isolated, small pools of waters or along building edges.

3.12.2 Marine Invasive Species

Marine invasive species can have a devastating impact on biodiversity, ecosystems, fisheries, human health, tourism and coastal development and are very difficult and costly to control (One Ocean, 2024). Rapid globalization and increasing trends of trade, travel, migration, and pollution have accelerated marine biological invasions by increasing rates of new introductions through various pathways, including:

- Shipping – through ballast water and biofouling of ship hulls
- Navigational Canals – transporting species via inland waterways
- Aquaculture – escape/overspill of non-native species introduced for farming
- Aquarium Trade – deliberate and accidental release of exotic species
- Plastic Pollution – transport of invasive species attached to plastic waste.

Shipping is the most common pathway for the introduction of marine invasive species. As much as 10 billion tons of ballast water is transported around the world per year, carrying up to 7,000 species of aquatic plants, microbes and animals daily (United Nations, 2017). Ships also transport invasive species via biofouling, in which species attach to ships hulls, anchors and other equipment. Plastic litter moves species around

the ocean in the same manner (NOAA 2024, Invasive and Exotic Marine Species). Discussion of invasive specific descriptions are provided in Appendix C - Environmental.

3.13 Air Quality

Ambient air quality is determined by the type and concentration of pollutants emitted into the atmosphere, the size and topography of the air basin in question, and the prevailing meteorological conditions in that air basin. Under the Clean Air Act (CAA), the USEPA establishes primary air quality standards to protect public health. USEPA also sets secondary standards of public welfare to protect ecosystems, including plants and animals, from harm, as well as protecting visibility and damage to crops, vegetation, and buildings. USEPA set national ambient air quality standards (NAAQS) for six principal air pollutants: Ground-Level Ozone (O_3), Particulate Matter (PM), Nitrogen Dioxide (NO_2), Sulfur Dioxide (SO_2), Carbon Monoxide (CO), and Lead (Pb).

To determine whether objectives of an area of the state meets the NAAQS for public information, the USEPA Air Now data mapping website (https://gispub.epa.gov/airnow/) Air Quality Index (AQI) provides reporting for public information, with collected background data and spatial considerations. Parameters on the USEPA Air Now website include an hourly O_3, PM, NO_2, SO_2, and CO data. The AQI composite scores of O_3 and $PM_{2.5}$ in the Gulfport area were found to range between good (0-50) and occasionally moderate (51–100) for the Gulfport region (USEPA AirNow data acquired May 2024). MDEQ monitors all of these pollutants with the exception of Pb (MDEQ ceased lead monitoring on June 30, 2016). In the Gulfport-Biloxi Pascagoula Metropolitan Statistical Area, MDEQ operates an O_3 monitoring station (Harrison County 280470008, Gulfport) which also provides a continuous $PM_{2.5}$ monitor to detect any changes in the ambient air monitoring network based on review of existing efforts (MDEQ, 2023). The data is currently reported for the Biloxi/Gulfport area on the MDEQ web site (https://www.mdeq.ms.gov/air/air-quality-forecast/).

The description of the criteria pollutants and their effects on public health and welfare and the NAAQS in compliance with 40 Code of Federal Register (CFR) 58.10 are included in the MDEQ Monitoring Network Plan of 2023. MDEQ monitors O_3 continuously from March 1 through October 31 each year at eight (8) monitoring sites throughout the state. For the Gulfport area, the design value is 60 parts per billion, which is considered low to moderate for the coastal region. PM consists of a mixture of larger material or “coarse particle” and smaller particles or “fine particles.” Fine particles, also known as $PM_{2.5,}$ include particles with diameters equal to or smaller than 2.5 micrometers (µm). Coarse particles have diameters ranging from 2.5 µm to more than 40 µm. Some are emitted directly form a source, while others form by complex chemical reactions in the atmosphere. $PM_{2.5}$ concentrations observed in May 2024 ranged from 4.1 µm/m^3 to 11.3 µm/m^3 resulting in an AQI score from 23 (good) to 55 (moderate) (USEPA AirNow, accessed May 2024).

3.14 Greenhouse Gas Emissions

The Council on Environmental Quality (CEQ) issued guidance to assist Federal agencies to consider effects of greenhouse gas (GHG) emissions and climate change when evaluating proposed major Federal actions in accordance with NEPA (Federal Register Vol. 88, No. 5 /Monday, January 9, 2023, pg 1196-1213). Details regarding the Executive Order (EO) 13990 - *Protecting Public Health and the Environmental and Restoring Science to Tackle Climate Change* is presented in Section 7.2.6 . Quantification of gross and net GHG via an emissions inventory with their associated social costs are addressed in the *Interim NEPA Guidance on Consideration of Greenhouse Gas Emissions and Climate Change* (CEQ, 2023). The Net Emissions Analysis Tool (NEAT) was developed by the USACE Air Quality and GHG Emissions Analysis Sub-Community of Practice (AQ/GHG Sub-CoP) to quantify all net GHG and air pollutant effects relevant to USACE Civil Works and Regulatory projects.

Total GHG emissions for the State of Mississippi for the year 2017 were 74.5 million metric tons (MMT) of CO_2 equivalent (CO_2e). The baseline year of 2017 was used as analysis because it was the year for which alternative data sources for comparison were available. The four largest sectors producing GHG emissions are power generation (32%), transportation (30.8%), industry (20%) and agriculture (8.9%). 83% of GHG emissions are from CO_2. Methane (CH_4) and N_2O account for 7.6% and 6.6% of GHG emissions, respectively. The remaining 2.7% of GHG emissions come from other gases. The extensive (19.3 million) forested areas of Mississippi serve as a GHG sink of approximately 79 MMT CO_2e, which is roughly equivalent to GHG emissions from all other sectors. As such, Mississippi's net GHG emissions are zero or even slightly negative (MDEQ, 2024). A GHG Neat analysis was conducted for this Study. The NEAT model data for this Study regarding existing conditions, are included in Environmental Appendix - C.

3.15 Noise

Noise sources in the project area include air noise which can impact humans and coastal birds, and underwater noise which can impact fish, marine mammals, and sea turtles. In general, noise levels are high around major transportation corridors along highways, railways, airports, industrial facilities, and construction activities. Noises in the study area consist of natural background sounds (e.g., the ocean, coastal winds, and fauna) and anthropogenic noise sources (e.g., fishing/shrimp boats, pleasure craft, dredges, cargo vessels, trains and roadway traffic, and aircraft from Keesler Air Force Base and Gulfport-Biloxi International Airport). Discussion of both airborne and underwater noise are detailed in Appendix C - Environmental.

3.15.1 Airborne Noise

Sound is measured in units of decibels (dB) and are typically weighted to correspond to the limits of human hearing known as the A-weighted decibel (dBA). A noise change of 3 dBA or less is not normally detectable by the average human ear. An increase of 5

dBA is generally not readily noticeable by humans, and a 10 dBA increase is "twice as loud" as before (US Department of Human Health and Services, 2019). The current noise ordinance for the City of Gulfport requires businesses to operate under 65 dB until 11 p.m., at which point it drops to 55 dB (Gulfport Code of Ordinances, Ch 14 Sec 14.35). Airborne noise levels in the portions of the open water channel are typically below this threshold where sensitive receptors are located.

3.15.2 Underwater Noise

Underwater (waterborne) sound is measured in dB when compared to a fixed reference level. Mechanical properties of water differ from those of air, and as a result, sound moves at a faster speed in water than in air. When underwater objects vibrate, they create sound-pressure waves that alternately compress and decompress the water molecules as the sound wave travels through the water. Low-frequency sounds travel farther than high-frequency ones. Temperature also affects the speed of sound, which travels faster in warm water than in cold water. Shallow water experiences a higher transmission loss than deep water areas, especially when sound-absorbing, soft bottom material is present.

3.16 Hazardous and Toxic Materials

Hazardous substances, including hazardous waste, are defined under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) as any substance or material that has been determined to be capable of posing an unreasonable risk to health, safety, and property (USEPA CERCLA, 2023). Hazardous waste is listed under the Resource Conservation and Recovery Act of 1976 (RCRA), meeting characteristics of ignitability, corrosivity, reactivity, or toxicity (USEPA rev. 05/2024). Dredged material is excluded from RCRA and regulated under the CWA and Marine Protection Research and Sanctuaries Act (Section 103) (MPRSA).

The Gulfport Harbor FNC, itself, does not generate hazardous materials. Petroleum products stored and used at the Port are considered hazardous and as such, are regulated so that the risk of spills or other releases are minimized. Shipping vessels have large quantities of fuel and other lubricants on board while traveling in the channel. Additionally, dredges used in the channel for new work and routine maintenance operations have minor quantities of these supplies on board.

3.17 Cultural and Historic Resources

The National Historic Preservation Act of 1966 (NHPA) has defined historic properties as prehistoric and historic archaeological sites, structures, buildings, districts, objects or any other physical evidence of human activity that is included in, or eligible for inclusion in the National Register of Historic Places (NRHP) maintained by the Secretary of the Interior.

Section 106 of the NHPA and its implementing regulations, 36 CFR Part 800, require an assessment of the potential impact of an undertaking on historic properties that are

within the proposed project's Area of Potential Effect (APE), which is defined as the geographic area(s) "within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties. The APE for the study area includes where dredging activities and the placement of dredged material would occur for the Gulfport Harbor FNC widening, deepening and new channel extension.

This area of the Gulf of Mexico has played a notable role in all the major periods of the Gulf region's maritime history beginning with the first European explorers. During the sixteenth century, the Spanish were the dominant European presence in the Gulf of Mexico region in the 16thcentury. Increased exploration and trade brought more European nations into the Gulf of Mexico. Often, operating irrespective of peace agreements in Europe, pirates raided the Gulf of Mexico coast in the 17th and 18th centuries. These pirates flew under Dutch, French, or English flags, and nearly as often they functioned independent of any nation. In the colonial period, the French used Ship Island, near the project APE and established a warehouse there. The French also discovered that the western tip of the island was an ideal anchorage and for centuries, mariners used this anchorage.

During the War of 1812, the ships of the British Navy congregated at Ship Island before invading New Orleans. Several decades later in the Civil War, the Union Navy mimicked this strategy when it launched its attack on New Orleans. Ship Island was valuable to the Union and Confederate forces as a foothold from which to wage war in the Gulf of Mexico.

Fort Massachusetts, built on Ship Island in the antebellum period, is a remaining symbol of the region's Civil War role. Ship Island was used as a prison camp for captured Confederates and their sympathizers. In the nineteenth century, a Lighthouse Station and Quarantine Station were constructed on the island.

The Ship Island anchorage remained one of the safest and largest on the northern Gulf of Mexico coast in the early twentieth century. A deepwater channel was dredged from Ship Island to Biloxi in 1902, and a harbor was created at Gulfport around this time. This signaled the end of Ship Island as a cargo offloading point for the Mississippi Coast. Maritime commerce along the Mississippi Gulf Coast expanded with the development of the Port of Gulfport in the late nineteenth and early twentieth centuries. A Phase 1 Cultural Resource survey was conducted for this Study; see Appendix C - Environmental for more information.

3.18 Protected Managed Lands

Several public lands and resources located in the study area are under protective jurisdiction by Federal and State agencies. Some of these areas fall within the Coastal Barrier Resources Act of 1982 (CBRA) that protect National Wildlife Refuges and Recreational lands as described below. The CBRA, under the jurisdiction of USFWS, restricts Federal expenditures and financial assistance within designated zones in the Gulf of Mexico and Atlantic Coasts. Ship Island is mapped as CBRA Unit MS-01P,

encompassing GINS, shown in Figure 3-13. A 2.3-mile segment of the Gulfport Harbor FNC runs through the western-most nearshore portion of Unit MS-01P. The southern portion and western tip of Cat Island are in CBRA Unit R-03. Additional discussion regarding project activity associated with this Study is discussed in Section 5.20 . In Louisiana, CBRA Unit LA-01 encompasses Isle au Pitre. CBRA Unit LA-03P includes Chandeleur Island, (Breton National Wildlife Refuge) managed by USFWS.

Gulf Island National Seashore (NPS). The GINS is a NPS managed public recreation area in the Gulf of Mexico extending from Cat Island, MS to Okaloosa County, Florida, excluding Alabama coastline. It includes the barrier islands in Mississippi, including Ship Island and Cat Island in the study area.

Breton National Wildlife Refuge (NWR). Established in 1904 by President Theodore Roosevelt, this refuge consists of several low islands and nearshore located in the Breton Sound off the Louisiana southeast coast in the Gulf of Mexico. Accessible by boat, it includes Breton Island and the Chandeleur Islands, part of the National Wilderness System. The exposed islands consist of open sand, shell beaches and overwash. A diversity of seabirds and shorebirds frequent the refuge's rich resources that provides important wintering habitat for the federally threatened piping plover (USFWS 2024 Breton NWR website).

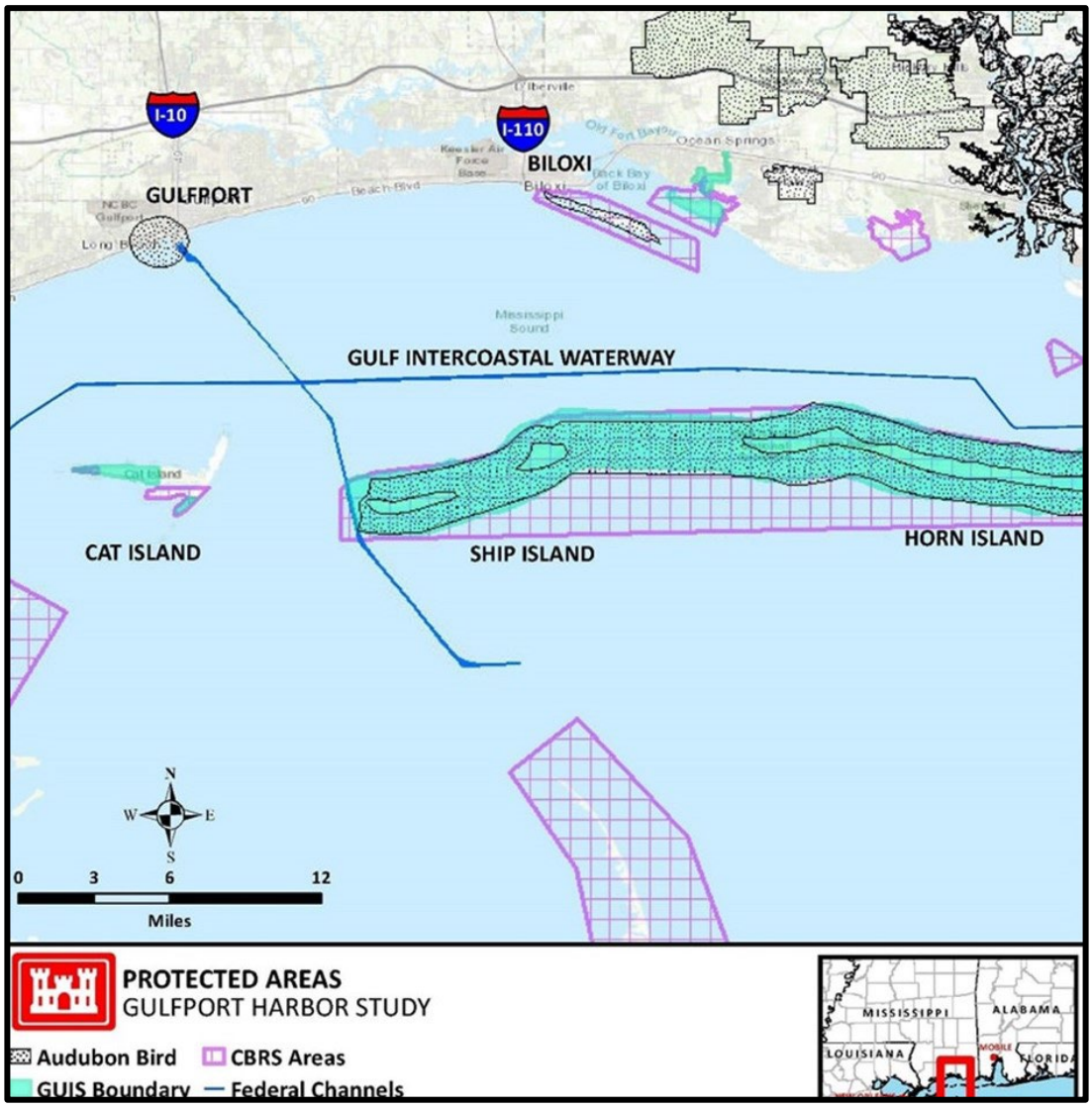

Figure 3-14. Protected Areas including Coastal Barrier Resources Act Units

Sources: USFWS CBRA, NPS GUIS (US DOI); National Audubon Society Important Bird Areas.

3.19 Aesthetics and Recreation

The tourism and recreation industry significantly contributes to coastal Mississippi's regional economy. Recreation opportunities include arts and entertainment, boating, golfing, swimming, wildlife viewing, shellfish harvesting, and fishing associated with Gulfport, Ocean City, Gautier, and the barrier islands. Aesthetically pleasing viewshed include the historical monument Fort Massachusetts and natural coastal landscapes encouraging photography and sightseeing. Coastal Mississippi has a rich diversity sport fishing with freshwater rivers, brackish bayous, estuarine inshore and offshore waters with over 62 miles of Gulf shoreline that provide 26 miles of beaches with sufficient public access to beaches and open waters of the (MSU Ext., 2024). From 2005 to 2013, the tourism and recreation sector grew significantly along the Mississippi coast, when

employment and gross domestic product increased ~10%. Subsequently, labor income grew 47.6% in the region during this time (NOAA ENOW, 2016).

3.20 Socioeconomics

This section summarizes the socioeconomic characteristics of the select geographical areas surrounding the study area that includes Gulfport, Harrison County, and the state of Mississippi. Additional demographic and socioeconomic data for the geographic area of interest can be found in Section 7 of Appendix B - Economics.

Table 3.6 below displays population estimates and projections for the areas of interest. Mississippi had a resident population of 2,844,658 as of 2022. Between the years of 2000 and 2022, Mississippi's population increased from 2.8 million to 2.9 million persons, which translates to an annual growth rate of 0.2%. During the same period, Harrison County experienced an annual growth rate of 0.5%, and the city of Gulfport experienced a 0.1% annual growth rate. Population projections obtained for 2050 indicate that the state will experience moderate growth through 2050 while Harrison County experiences slight negative growth.

Table 3.6. Summary of population density of Gulfport, Harrison County, MS

Geographic Area	2000 Population Estimate	2010 Population Estimate	2022 Population Estimate	2050 Population Projection
Mississippi	2,844,658	2,967,297	2,940,057	3,064,588
Harrison County	189,601	187,105	211,044	201,068
Gulfport	70,986	67,793	72,228	NA

Source: U.S. Census Bureau, Population Division (2000, 2010 Estimates); U.S. Census Bureau, 2022 American Community Survey 1-Year Estimates (2022 Estimate); University of Mississippi (2050 Projections)

Table 3.7 displays the distribution of the areas of interest by race and ethnicity. In general, Harrison County has a larger minority population than that of Mississippi while Gulfport has a slightly smaller minority population compared to the state.

Table 3.7. Population by Race and Ethnic Origin

Race/Ethnicity	Mississippi		Harrison County		Gulfport	
	Number	Percent	Number	Percent	Number	Percent
White	1,625,979	55%	129,901	62%	36,665	51%
Black	1,072,962	36%	43,850	21%	23,392	32%
American Indian and Alaskan Native	12,457	0%	1,182	1%	463	1%
Asian	25,217	1%	3,760	2%	1,056	2%
Native Hawaiian or Pacific Islander	397	0%	50	0%	0	0%
Some other race alone	9,501	0%	2,537	1%	348	1%
Two or More Races	96,367	3%	17,511	8%	6,812	9%
Hispanic or Latino	97,177	3%	12,253	6%	3,492	5%

Source: U.S. Census Bureau, 2022 American Community Survey 1-Year Estimates

3.21 Environmental Justice (EJ)

EJ is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income regarding the development, implementation, and enforcement of environmental laws, regulations, and policies, with no group bearing a disproportionate burden of environmental harms and risks. EJ and disproportionate impacts to disadvantaged communities are considered throughout the agency's Civil Works programs and in all phases of the project lifecycle.

Based on the Climate and Economic Justice Screening Tool used to identify disadvantaged communities, Harrison County is identified as having 26 disadvantaged tracts. However, the project boundaries for the Port of Gulfport project are North, at Interstate 10; South, at Highway 90; East of Beatline Road; and West of the Gulfport Biloxi International Airport. Therefore, 9 disadvantaged census tracts are identified as potentially having direct and indirect impacts to communities. **Figure 3-17** displays the economically disadvantaged communities as is relates to Gulfport Harbor. The estimated population is 27,600 with 45% identifying as Black or African American, 39%

identifying as White, 0.01% identifying as Asian, 0.05% identifying as Hispanic or Latino, and 0.02% identifying as two or more ethnicities. Detailed information of Environmental Justice applicable to the Study is found in Environmental Appendix – C1.

Figure 3-15. Gulfport Harbor Federal Navigation Project. Disadvantaged Communities.

3.22 Transportation

Transportation resources include roads, traffic, railroads, and airports. Interstate-10, routed along the coastline of the Gulf of Mexico, links the major seaports of Pensacola, Florida; Mobile, Alabama; Gulfport, Mississippi; New Orleans, Louisiana; and Houston,

Texas. Interstate-10 is located about 5 miles north of the Port of Gulfport with a direct route from the U.S. Highway 49 interchange to the Port. Interstate-10 also has interchanges at Lorraine Road and Canal Road that direct commercial traffic towards the Port by intersecting with U.S. Route 90 along the waterfront. The Coastal Transit Authority (CTA) is a non-profit provider of public transportation for populations the three coastal counties along the Mississippi Gulf Coast. CTA riders include young, elderly, minorities, low income and those without personal vehicles. Routes and covered shelter facilities are close to the Port of Gulfport, which encourages ridership for Port employees (CTA website, 2024).

The Gulf & Ship Island Railroad (G&SI) interchanges with the Kansas City Southern Railway at Gulfport. Pending development of a new CN intermodal facility will improve connectivity between the Gulf Coast, U.S. Midwest and Canada (Railway Age, 2023). The restoration of Amtrak passenger rail service across the southern Gulf coast will provide future service between New Orleans and Mobile on the CSX mainline (Southern Rail Commission, 2023). With scheduled stops in Gulfport, Amtrak will provide transportation for a diversity of riders and commuting Port workers.

The Gulfport-Biloxi International Airport (GPT), the second largest airport in Mississippi, services nearly 800,000 travelers annually. It features a 160,000 square feet terminal, two runways (9,000 feet and 4,900 feet), and cargo facility with access to rail service. The Mississippi Gulf Coast Aerospace Center at GPT at the airport, offers 241 developable acres. Foreign Trade Zone Site No. 92 has economic tax advantages to provide access to the Intracoastal Waterway, rail and highway systems, and the Port of Gulfport (GPT website, 2024).

3.23 Infrastructure

The existing infrastructure within the vicinity of the project area include subsurface and exposed utilities at the Port of Gulfport facility located in the Study area.

Two petroleum pipelines cross under the Gulfport Harbor channel. Both of the pipelines are owned and managed by the Chevron Pipeline Company, of Covington, Louisiana. The original Cal-Ky 20-inch pipeline crossing the Gulfport Harbor Channel was placed by Chevron Pipeline Company of New Orleans, Louisiana, in the early 1960's under USACE Department of Army permit MS62-00072-U. According to Chevron, this older crude oil pipeline originated from the Chevon facility in Pascagoula, Mississippi and crossed the Gulfport Harbor Channel in the Mississippi Sound north of the barrier islands at an estimated depth of -55 ft below MLLW. A segment of the petroleum pipeline was abandoned in situ circa 1993 when a new line replaced it in the vicinity. USACE permit DA SAM-2011-293-PAH was issued for approval of a horizontal directionally drilled installation of 5,810 linear ft of new 20-in. pipeline crossing the Gulfport Harbor FNC substrate. Installation of the new pipeline at the Gulfport Channel crossing is adjacent to the abandoned pipeline but reaches a depth greater than -80 ft below MLLW. This DA permit also included approval for abandonment of the old pipeline at the Gulfport Harbor FNC crossing. Chevron pipeline representatives have

stated that the original segment was abandoned in situ after being flushed and filled with inert seawater although they have not been able to find any records of this procedural event. A recent Phase 1 Cultural Resource survey for the Study determined the presence of a metal object at the edge of the channel. Further investigation of this anomaly will be conducted during the PED phase of this Study.

4.0 Plan Formulation

The mission of USACE in deep draft navigation is to provide safe, reliable, efficient and environmentally sustainable waterborne transportation systems. This is achieved through exploring improvements that lower transportation costs. The current depths of the Gulfport Harbor channel are inadequate resulting in transportation inefficiencies. The problems and opportunities addressed in this feasibility study are further described below.

4.1 Problems

Vessels are restricted to the maximum depth of 36 feet, the authorized project depth. Larger vessels that call upon the harbor experience delayed transits in the channel and are required to light-load or use smaller, less efficient vessels due to draft restrictions. Existing channel depths limit ship cargo capacity and thus lead to a loss of TCS available from economies of scale associated with larger, more efficient vessels or with the ability to load the existing fleet more efficiently.

The channel experiences sand shoaling from the western tip of Ship Island. This shoaling may increase in the future, and channel depth can be complicated to maintain in the Northern Gulf of Mexico. The approximately 21-mile channel passes to the west of Ship Island and requires annual dredging and disposal. The harbor and channel section north of the barrier islands have a history of fluid muds, which make it difficult to define available navigable depth.

The problem identified is that the existing federal project dimensions lead to:

- Transportation Inefficiencies
- Maneuverability Concerns
- Insufficient widths restrict larger vessels from calling at the Port of Gulfport.
- Accelerated Shoaling in Select Areas

4.2 Opportunities

Opportunities identified for the study include:

- Opportunity 1: Beneficial Use of Dredged Material (BUDM)
- Opportunity 2: Reduce the frequency of operation and maintenance (O&M) dredging intervals thereby reducing O&M costs.

Beneficial use of dredged material for habitat restoration, habitat creation, and coastal resiliency. Work with Non-Federal interests on identification of beneficial use of dredged material including habitat recreation and coastal resiliency.

4.3 Objectives

The objectives of this study for the 50-year period of 2035 through 2084 for the Gulfport Harbor are to:

- Reduce transportation costs
- Reduce operational inefficiencies

4.4 Constraints and Considerations

Constraints and considerations place boundaries on the planning process.

- Avoid or minimize negative impacts to environmental resources
- Avoid or minimize negative impacts to cultural resources
- Physical limitations on placement of dredge material
- Avoid or minimize impacts to existing utilities in the study area

4.5 Planning Strategy

For this feasibility study, a reasonable alternative is defined as an alternative that meets the objectives of the study and is under USACE authority to implement. A measure that could be implemented by others can be considered as long as it meets the objectives on its own or it can be a component of an alternative that meets the objectives in a way that is complete, effective, efficient, and acceptable. The definitions for these are:

- **Completeness.** Extent to which the alternative provides and accounts for all necessary investments or actions to ensure realization of the planning objectives
- **Effectiveness.** Extent to which the alternative contributes to achieving the planning objectives
- **Efficiency.** Extent to which the plan is the most cost-effective means of addressing the specified problems and realizing the specified opportunities, consistent with protecting the Nation's environment
- **Acceptability.** The extent to which the alternative plans are acceptable in terms of applicable laws, regulations and public policies
- Alternatives were formulated and refined by combining, adapting, and scaling management measures to best address four criteria described.

In accordance with 40 CFR 1502.14, the USACE will "rigorously explore and objectively evaluate all reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated."

4.6 Initial Alternative Array

The Gulfport Harbor Draft IFR/EA included evaluation of a future Without-Project condition that would not include changes to the current channel dimensions. The PDT screened the measures considered to develop an initial array of alternatives to be analyzed to develop a focused array of alternatives. Consequently, along with the non-structural measures, an array of structural measures was identified to address the

planning objectives and included modifications to the anchorage basin, sound channel, bar channel, and bends. Specifically, this included:

- Deepening – Based on the study objectives, the alternative depths to screen for analysis ranged from 40 feet to 46 ft with an additional 2 ft of depth in the Bar Channel due to increased wave action and strong opposing tidal currents.
- Widening - Based on the study objectives, the width to screen for analysis was 400 feet in the Sound Channel and 500 feet in the Bar Channel to allow for navigation by the design vessel.
- Bend Easing – Based on study objectives, widening (or easing) of the two bends in the Sound Channel would be considered to conform with engineering guidance and would allow for more efficient transportation.
- Anchorage Basin - Based on study objectives, modifications to the anchorage basin would be considered to conform to proposed design depth alternatives and the proposed design vessel.

The initial array of alternatives is displayed in **Table 4.1**

Table 4.1. Initial Alternatives

Initial Alternatives		
Structural Measures		Non-Structural Measures
Depth	Width	Nonstructural alternatives will match nonstructural measures list in Table 3-1.
• **40 ft to 46 ft in 1 ft increments** **(42 ft to 48 ft in Bar Channel)** • **Anchorage Basin Depth to match channel depth (also, modification as needed for design vessel)**	▪ 400 ft in Bay Channel ▪ 500 ft in Bar Channel ▪ Widen full channel length ▪ Bend easing	

4.6.1 Evaluation and Comparison of Alternatives

Alternative plans are evaluated by applying rigorous criteria. Per the *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies*, as stated in Section 3.2, four general criteria are considered during alternative plan screening: completeness, effectiveness, efficiency, and acceptability.

There are also specific technical criteria related to engineering, economics, and the environment, which also need to be considered in evaluating alternatives. These are:

Engineering Criteria:

- The plan must represent a sound, acceptable, safe, efficient and reliable engineering solution.

Economic Criteria:

- The plan must contribute benefits to NED.
- Tangible benefits of a plan must exceed economic costs.
- Each separable unit of improvement must provide benefits at least equal to costs.

Environmental Criteria:

- The plan will fully comply with all relevant environmental laws, regulations, policies, and executive orders.
- The plan represents an appropriate balance between economic benefits and environmental sustainability.
- The plan has been developed in a manner that is consistent with the USACE Environmental Operating Principles.

4.6.1.1 Screening of Initial Alternatives

For the stated evaluation criteria, there would be a significant amount of analysis required to fully evaluate the entire range of deepening and widening alternatives. In 2012, the USACE adopted a Specific, Measurable, Attainable, Risk-Informed, and Timely (SMART) Planning process to accelerate feasibility study execution. Based on guidance from this initiative, the number of alternatives to be analyzed were reduced considering information developed in previous study efforts, coordination with channel users, and vertical coordination.

After discussions within the PDT, it was determined that nonstructural measures alone or in combination with other measures would not increase effectiveness or efficiency at the port. Many of the measures have already been employed to address the limitations of the current channel dimensions. Light-loading and lightering are measures that are currently in use. Scheduling is a measure that is also currently employed by the port. The use of additional tugs would not add efficiency to the current operations. Future operations without channel modifications would be expected to require additional tugs with a resulting increase in vessel transit cost.

Consequently, the PDT determined that the best approach to achieve the project objectives would be to examine an array of structural measures which would include the existing condition, channel deepening, channel widening, and bend easing. The results of this analysis would develop a focused array of alternatives. While TCS may be realized for the existing fleet calling at Gulfport with deepening only, future larger

vessels with wider beams would be restricted without widening. TCS and efficiencies resulting from use of larger vessels will be foregone with deepening only. Thus, it was not expected that a deepening-only alternative will maximize net benefits.

The NFS performed an initial assessment of the existing dock structures specially related to the allowable dredge depths and future dredging efforts. The existing dock infrastructure is capable of achieving a -50 feet MLLW mudline in the federally maintained portion of the anchorage basin. The NFS indicated that deepening to -46 feet appeared to be the maximum that they could support with the allowable advance maintenance and allowable overdepth. It should be noted at this point that the NFS's desire to not deepen below 50 ft limited the benefit analysis to utilize the categorical exemption to the NED Plan per paragraph 3-2b(10) of Engineer Regulation (ER) 1105-2-100.

Based on this information and in coordination with the NFS, for environmental impact analysis, the PDT determined that the maximum project dimensions that could reasonably be expected would be a 46-foot-deep channel (with an additional 2 ft of depth in the Bar Channel) with an added 100 ft of width with bend easing and anchorage basin modification. This information was provided to the engineering and modeling team for their development of the environmental impact analysis.

4.6.2 Summary of Management Measures

A management measure is a feature or activity that can be implemented at a specific geographic site to address one or more planning objectives. They are generally categorized as structural or nonstructural. Structural measures identified to be considered for Gulfport Harbor include deepening the channel, widening the channel, bend easing in the Sound and Bar Channel, and modifying the anchorage basin. Nonstructural measures that could be considered include relocation of navigation aids, use of tugs, lightering, topping-off offshore, and scheduling. **Table 4.2** presents the structural measures that were considered for this study.

Non-structural measures to be considered for Gulfport Harbor include the no action alternative, additional tug usage, potential light loading of vessels, and lightering offshore. These measures were screened out as the present the least **Table 4.2** presents the non-structural measures that were considered for this study.

Table 4.2. Measures Considered

Structural Measures	Non-Structural Measures
• **Deepening**	• No Action
• **Widening**	• Additional tugs
• **Bend Easing**	• Light-loading

• **Sediment Trap**	• Lightering offshore

4.7 Final Alternative Array

The alternatives carried forward into the final are represented by incremental deepening and widening the channel by 100ft to accommodate a Post-Panamax Generation 3 Ship, the design vessel. Realigning the entrance channel and modifying the turning and anchorage basin were carried forward as part of the focused array of alternatives. **Table 4.3** shows the focused array with each channel dimensions and entrance station, and **Table 4.4** illustrates BU site capacities and associated costs for each option.

Table 4.3: Summary of Alternative features

Alternative	Deepen Bar Channel Depth (Feet MLLW)	Deepen Sound Channel (Feet MLLW)	Width of Channel (feet)	Deepen Turning and Anchorage Basin (Feet MLLW)	Channel Entrance (Station)
No Action	-38	-36	300-400	-32 to -36	Existing Alignment
Alt 8	-42	-40	400-500	-32 to -40	Existing Alignment
Alt 9	-43	-41	400-500	-32 to -41	1120+00
Alt 10	-44	-42	400-500	-32 to -42	1135+00
Alt 11	-45	-43	400-500	-32 to -43	1145+00
Alt 12	-46	-44	400-500	-32 to -44	1175+00
Alt 13	-47	-47	400-500	-32 to -45	1630+00
Alt 14	-48	-48	400-500	-32 to -46	1655+00

Table 4.4: Beneficial Use Site Capacities and Associated Costs

Placement Site	Approximate Capacity	Material Requirement	Placement Area (acres)
Pascagoula ODMDS*	3.0-8.0 MCY per year	N/A	11,520
La France Canal ^	300,000 – 400,000 CY	Mixed	TBD
Pelican Key^	13.4 MCY	Mixed	900
Cat Island North*^	26.0 MCY	Mixed	1,060
Cat Island South^	12.0 – 18.0 MCY	Sand	410
MSPA Pier Expansion^	10.0 MCY	Sand	178
Biloxi Marsh^(LA)	9.0 MCY	Mixed	815
Chandeleur Island^(LA)	3.9 MCY	Sand	5,400

* Placement site was included in the current cost estimate as the Federal Standard Base plan.
^ Placement site is considered beneficial use of dredged materials (BUDM).
(LA) Placement site located in Louisiana

4.8 Plan Evaluation and Comparison

Alternative plans were evaluated and compared across the four planning criteria of Completeness, Acceptability, Effectiveness, and Efficiency. Definitions for these criteria are addressed in 4.8.1 .

4.8.1 Completeness

All of the alternatives in the focused array are complete alternatives that account for the needed actions to achieve the planning objectives.

4.8.2 Acceptability

All of the alternatives are in compliance with those laws, policies, and regulations.

4.8.3 Effective

All the alternatives have included measures to increase operational efficiencies, such as a sediment basin near Ship Island. The TCS were measured in average annual TCS, shown in the benefits column of Table . Details on the development of the TCS are found in Appendix B: Economics.

4.8.4 Efficiency

Efficiency was measured through comparing the average annual equivalent (AAEQ) benefits to the AAEQ costs, which can be shown as benefit to cost ratio (BRC). The lower the BCR the less efficient the plan is at achieving the objectives. The costs include the first costs, such as new work dredging, material placement, and real estate, as well as operation and maintenance costs. The results of this are shown in **Table 4.5**.

Table 4.5: Channel Deepening Benefits and Costs

Alternative	Project Depth	AAEQ Benefits	AAEQ Costs	BCR
NAA	36’	$0	$0	N/A
Alt 8	40'	$13,101,000	$18,222,000	0.7
Alt 9	41'	*$17,983,000*	*$20,248,000*	0.9
Alt 10	42'	*$22,864,000*	$22,274,000	1.03
Alt 11	43'	*$25,606,000*	*$24,525,000*	1.04
Alt 12	44’	$28,348,000	$26,776,000	1.06
Alt 13	45’	*$31,439,000*	*$29,303,000*	1.07
Alt 14	46’	$34,180,000	$31,831,000	1.07

4.9 Plan Selection

Based on the analysis of the focused array, the PDT compared the plans across the 4 planning accounts of NED, RED, OSE, and EQ to select the Tentatively Selected Plan (TSP). The results for all the alternatives are summarized in Table 4-5.

National Economic Development (NED) benefits are contributions to NED that increase the value of the national output of goods and services. It is the primary basis for Federal investment in water resource projects and is measured in average annual equivalent (AAEQ) terms. The NED account takes the AAEQ Benefits and subtracts the AAEQ costs to get annual net benefits. The NED plan is the alternative that maximizes the net benefits, which is Alternative 14 with $2.35M in annual net benefits.

The RED account develops the benefits to the regional economy through assessing how the increased spending from the construction and increased maintenance would bolster the economy. RECONS was used to calculate RED benefits for each alternative plan. A summary of the benefits for each plan is included in Table 81 of Appendix B (ECON). This RED Plan is the alternative that maximizes this impact, which is Alternative 14.

The EQ account includes all the impacts and benefits an alternative would create, based on qualitative evaluation of the environment within the study area. There were no identified significant negative impacts for any environmental resource. However, through beneficial use of new work material, alternatives could create spatial areas of salt marsh aquatic habitat. Beneficial use of dredge material for marsh creation can support biodiversity by creating new habitat for breeding, nesting, and foraging areas for fish, crustaceans, waterfowl, and shorebirds. This may result in additional tourism and recreation as the Mississippi Gulf Coast is a tourist destination for bird observing. Marsh creation also assists in reducing the atmospheric carbon dioxide since marches store

carbon in sediments and plant biomass. In this case the EQ plan would be the one that maximizes environmental benefits, which is Alternative 14.

Table 4.6 illustrates an overview of each placement sites characteristics that were analyzed for the TSP.

The OSE account includes the impacts and benefits that an alternative to society not captured by other accounts. This includes effects on economically disadvantaged communities. All of these impacts are occurring within the without project condition, and there are not changes based on the actions taken across the proposed alternatives. Greater detail on these impacts is contained in Section 5.0 Environmental Effects*.

Table 4.6: Summary of 4 Planning Accounts

Alternative Plans (MLLW)	NED (Annual Net Benefits)	RED		EQ	OSE
		Output of Construction Spending	Output of O&M (Annual)		
No Action	$0	$0	$0	No Change	No Change
Alt 8: -40 ft	($5,121,000)	$205,602,000	$12,000,000	Acreage of Habitat: 185	No Change
Alt 9: -41 ft	($2,265,000)	$236,787,000	$12,945,000	Acreage of Habitat: 215	No Change
Alt 10: -42 ft	$590,000	$267,971,000	$13,890,000	Acreage of Habitat: 245	No Change
Alt 11: -43 ft	$1,081,000	$301,036,000	$14,993,000	Acreage of Habitat: 275	No Change
Alt 12: -44 ft	$1,572,000	$334,100,000	$16,096,000	Acreage of Habitat: 305	No Change
Alt 13: -45 ft	$2,135,000	$373,215,000	$17,214,000	Acreage of Habitat: 340	No Change
Alt 14: -46 ft	$2,349,000	$412,330,000	$18,331,000	Acreage of Habitat: 370	No Change

Using the results across the 4 accounts the comprehensive benefits plan, which is the alternative that maximizes benefits across all accounts, was identified as Alternative 14. Alternative 14 is also the TSP. The environmental effects of this plan are discussed in Section 5.0 . A summary of the placement areas and an estimate of the additional cost above the base plan for placing new work material into other beneficial use site is

summarized below. The incremental cost (**Table 4.7**) includes the cost for design and construction of the beneficial use site. Additional engineering design and analysis is required to develop a feasibility level design for the beneficial use placement sites. Costs will be refined prior to ADM.

Table 4.7: Placement Area CE/ICA for BU

Placement Option	Dredge Material Source	Capacity	Potential Habitat (acres)**	Federal Standard Placement Area	Incremental Cost Above Federal Standard
Pascagoula ODMDS	Bar Channel	3.0-8.0 MCY per year	NA	Pascagoula ODMDS	Federal Standard
La France Canal	Sound Channel, Anchorage Basin	300,000 – 400,000 CY	TBD	Cat Island North	*
Pelican Key BU	Anchorage Basin	13.4 MCY	900	Cat Island North	$5.00/cy
Cat Island North BU	Sound Channel, Anchorage Basin	26 MCY	1,060	Cat Island North	Federal Standard
Cat Island South BU	Sound Channel (Sand)	12 - 18 MCY	410	Cat Island North	$4.00/cy
MSPA Pier Expansion	Sound Channel (Sand)	10 MCY	NA	Cat Island North	*
Biloxi Marsh	Bar Channel	9.0 MCY	815	Pascagoula ODMDS	*
Chandeleur Island	Bar Channel	TBD (4 MCY)	5,400	Pascagoula ODMDS	*
Littoral Placement	Sound Channel (Sand)	12 MCY	NA	N/A	$4.00/cy
Littoral Island Creation BU	Sound Channel (Sand)	12 MCY	TBD	N/A	$0/cy
Cat Island Direct Placement BU	Sound Channel (Sand)	2 MCY	NA	N/A	*
Ship Island Direct Placement BU	Sound Channel (Sand)	500,000 CY	NA	N/A	*

* Site was screened from the cost estimating scope
** Potential Habitat in acres leveraged from existing documentation.

Table 4.8: Overview of Placement Site Characteristics.

Placement Site	Approximate Capacity	Material Requirement	Placement Area (acres)
Pascagoula ODMDS*	3.0-8.0 MCY per year	N/A	11,520
La France Canal ^	300,000 – 400,000 CY	Mixed	TBD
Pelican Key^	13.4 MCY	Mixed	900
Cat Island North*^	26.0 MCY	Mixed	1,060
Cat Island South^	12.0 – 18.0 MCY	Sand	410
MSPA Pier Expansion^	10.0 MCY	Sand	178
Biloxi Marsh^(LA)	9.0 MCY	Mixed	815
Chandeleur Island^(LA)	3.9 MCY	Sand	5,400

* Placement site was included in the current cost estimate as the Federal Standard Base plan.
^ Placement site is considered beneficial use of dredged materials (BUDM).
(LA) Placement site located in Louisiana

5.0 Environmental Effects*

5.1 Introduction

This section characterizes the affected environment in its existing condition. It provides descriptions of environmental, cultural, and socioeconomic resources in the Study area which includes the landward area in Gulfport and watered environment associated with the Port in Harrison County, Mississippi. More detailed information regarding resource assessments is presented in Environmental Appendix – C.

5.1.1 Description of No Action Alternative 1. (Future Without Project)

Under the No-Action Alternative 1, (FWOP), USACE would continue to maintain the existing Gulfport Harbor navigation channel at authorized dimensions utilizing existing disposal areas as described in Section 6.0. **Figure 1-2** depicts the existing channel and dredged material placement options used during routine O&M events.

5.1.2 Description of No Action Alternative (Future With Project)

As detailed in Section 6.0 the TSP consists of deepening the anchorage basin and Sound Channel to 46 feet MLLW and the Bar Channel to 48 feet. The TSP would also widen the channel by 100 feet achieving a width of 400 feet and 500 feet at the Sound and Bar Channels, respectively. Approximately 2 miles of Bar Channel will be abandoned, and approximately 12.2 miles of realigned Bar Channel will be constructed. The channel entrance will be extended to Station 1655+00. A total of approximately 38 million cubic yards (mcy) will be removed from the improved navigation channel. Of that material, approximately 17.8 mcy of new work material will be placed at the North Cat Island BU site while the remaining material would be placed at the Pascagoula ODMDS.

Future O&M of the Gulfport Harbor project would continue following the improvements with placement at the existing open-water disposal sites, littoral zone placement site, and the EPA Gulfport West ODMDS.

5.2 Geographic Setting

Neither the No Action Alternatives and/or the other considered alternatives nor the proposed TSP including the future O&M would change the current general setting within the project area. The proposed project would not directly affect land use. It is not anticipated that the proposed project alone would result in the conversion of additional natural areas to urban use. The analysis is based upon the existing throughput capacity estimated for Gulfport Harbor and the project itself would have no effect on the conversion of additional natural habitat.

5.3 Climate, Temperature, and Precipitation

The significance criterion for climate, including temperature and precipitation, would be a permanent disruption in the meteorological patterns of the coastal environment affecting winds, rainfall, temperature, and astronomic tides along the Mississippi Sound.

Generally, the scale and type of activities associated with the No Action Alternative, other alternatives and TSP, including future O&M activities would not result in impacts on regional climate, meteorological, or oceanic processes. The No Action Alternative, Other Considered Alternatives and the TSP would have no effect on climate, temperature and precipitation. Additional discussion pertaining to impacts to currents and waves are included below.

5.3.1 Currents and Waves

5.3.1.1 No Action Alternative

Under the No Action Alternative, there would be no impacts to astronomic tides or the Gulf of Mexico circulation patterns.

5.3.1.2 Preferred Alternative (Tentatively Selected Plan)

HD modeling was conducted by ERDC to characterize existing conditions (e.g., flows, circulation, waves, etc.) of the study area and determine the relative changes in those conditions due to proposed navigation channel modifications. The HD modeling evaluated the FWOP (Section 5.1.1 - No Action Alternative 1) at -40-foot depth, and Alternative 14 (FWP) at -46-foot depth. Results showed minimal to no changes in HD parameters, such as currents, waves, water levels, temperature, and salinity. Thus, there would be minimal to no impacts to currents and waves.

5.4 Sediment Transport

5.4.1 No Action Alternative

Under the No Action Alternative, current channel and harbor maintenance operations would continue. Generally, dredging and disposal operations would remain unchanged utilizing the current water quality certification for Gulfport Harbor.

5.4.2 Tentatively Selected Plan

Sediment transport will not be affected by the TSP being proposed.

5.5 Geology

The significance criterion for geology would be a permanent change in underlying bedrock or sediment stratigraphy that interferes with the natural movement and deposition of sediments. Under the No Action, other considered alternatives, and the proposed TSP including future O&M, no impacts would occur to the geological setting.

5.5.1 Soils

5.5.1.1 No Action Alternative

Under the No Action Alternative, there would be no change in existing conditions and no impacts on terrestrial soils. A Section 404(b)1 Evaluation has been prepared for the

O&M effort at Gulfport Harbor, which describes the existing sediment characterizations in the navigation channel and disposal areas.

5.5.1.2 Tentatively Selected Plan

The open water sediment profiles in the new work dredging areas would be altered as it would be removed and placed at the North Cat Island BU site or the Pascagoula OMDMS. Future O&M material would be placed at the existing disposal sites. Sediments placed within these disposal sites would result in a change of the surface sediments. However, terrestrial soils at the barrier islands and adjacent Ship Island Pass would be minimally impacted from dredging by the expanded footprint. This minor impact would be temporary as tide and wave energy would naturally stabilize movement reaching the landward edge of the islands. Placement of all dredged material would be within a watered environment at all other disposal sites, and natural currents would also disperse the sediment. Thus, no long-term impacts to terrestrial soils would occur from the proposed TSP. A draft Section 404(b)1 Evaluation Repot has been prepared for the proposed TSP, which describes the sediment characterizations in the navigation channel and placement areas. The draft Section 404(b)1 Evaluation Report is included in Appendix C - Environmental.

5.5.2 Sediment

The sediment profile in the new work dredging areas would be altered as all dredged material would be removed and placed in the Pascagoula ODMDS and identified BU site at Cat Island North. Underlying sediments will remain unchanged. Sediment quality in the project area, composed of the Gulfport Harbor Channel and the adjacent disposal areas, have undergone extensive physical, chemical, and biological testing and analysis from previous surveys. Analysis efforts are in response to past expansion events and O&M in response to MDEQ Section 401 water quality certification and the USEPA's Section 103 Concurrence pursuant to MPRSA. The results of these surveys concluded that no analysis of sediment collected from the project limits for metals or other pollutants have values that exceeded thresholds or enforceable standards for dredged material placement in open waters. As stated below, additional sediment quality analysis for this specific action will be conducted during the PED phase.

5.5.2.1 No Action Alternative

Under the No Action Alternative, current channel maintenance would continue. Dredging operations would remain unchanged utilizing current Sections 401 and 103 concurrences that are compliant with the CWA (Inland Testing Manual) and MPRSA (Ocean Testing Manual). Mississippi Sound is a shallow environment that is heavily subjected to wave and current energy, so sediment movement occurs in the vicinity of the existing disposal sites and navigation channel. Under this scenario, there would be no change to the sediment properties and conditions associated with the existing navigation channel.

5.5.2.2 Tentatively Selected Plan

During the PED phase, sediment testing, and evaluation will be conducted for material proposed for new work and future O&M. Material removed from the navigation channel must comply with guidelines in accordance with the MPRSA and CWA. Historical sediment sampling events that included project improvements were found to be suitable for placement in the waters of the U.S. and territorial sea. All current presumptions are that the proposed new work and future O&M material would be similar to that already tested.

USACE, Mobile District will be required to obtain a Section 103 concurrence from USEPA for placement at the Pascagoula ODMDS for new work and Gulfport West ODMDS for future O&M. Sampling will include physical sediment analyses, bulk sediment analysis, standard elutriate testing, water column bioassays, whole sediment bioassays, and bioaccumulations studies of dredged material. These tests will follow guidance in the *Inland Testing Manual* (EPA 1998); *Ocean Testing Manual* (USACE/EPA 1991); and the *Regional Implementation Manual, Requirements and Procedures for Evaluation of the Ocean Disposal of Dredged Material in Southeastern Atlantic and Gulf Coastal Waters* (SERIM) (USACE/EPA 2008). The new work testing will consist of sediment core samples to be taken at specific locations in Mississippi Sound (to a depth of –50 feet) and the Bar Channels (to a depth of –52 feet). Sampling and analysis of new work and future O&M will be conducted during the PED Phase, and appropriate coordination will be conducted with USEPA, Region 4.

5.6 Groundwater

As described, water supply usage in coastal Mississippi predominantly comes from groundwater aquifers. In southern Mississippi, Miocene aquifers in the highlands of southwestern Mississippi connect with aquifers supplying groundwater for Baton Rouge and municipalities in southeastern Louisiana. According to the USGS, groundwater depths range from 100 feet to greater than 1,000 feet in Harrison County, Mississippi. Under the No Action Alternative, other considered alternatives, and/or the TSP, groundwater would not be impacted by the proposed continued O&M or the improvements.

5.7 Water Quality

The significant criterion for water quality in the Gulfport Harbor and Bar channels would be a permanent or temporary decline in water quality that results in the loss of a protected species, marine mammal, or migratory coastal bird; or a significant decline in water quality that causes permanent impact to aquatic habitat (e.g., SAV).

Water quality data from previous sediment and water chemistry testing in 2006 and included in 2009 *Gulfport Harbor Navigation Channel Final SEIS*, was applied to this Study, as well as the 2013 *Evaluation of Proposed Dredged Material, Gulfport Bar Channel, Gulfport, Mississippi*. Additionally, HD modeling specific to this Study was conducted by ERDC in May 2024 which analyzed salinity and water temperature. A

detailed discussion on the HD modeling effort is included in Engineering Appendix A. The HD modeling and results evaluation is located in the Environmental Appendix C – Supplemental Information.

5.7.1 Dissolved Oxygen (DO)

5.7.1.1 No Action Alternative

As described in Section **Error! Reference source not found.**, DO in the Mississippi Sound is prone to low concentrations that contribute to periodic hypoxic conditions in the estuary. Under the No Action Alternative, there would be no change from existing conditions and no additional impact to DO related to this project.

5.7.1.2 Tentatively Selected Plan

Effects to water quality would be similar to those that were analyzed for the previous Gulfport Harbor improvements project of February 2009 and were evaluated in the Gulfport Harbor Navigation Channel Final Supplemental EIS (2009), from which this current document is tiered.

Changes in DO would be affected as a result of water quality mixing during dredging activities. DO concentrations could be decrease due to dredging activity by movement of sediment and anoxic waters in the water column; however, these impacts would be temporary and minor.

Other than the effects of implementing the TSP, future maintenance practices will be consistent with the current O&M dredging practices and would not be expected to cause any further changes to the overall DO conditions in the Sound.

5.7.2 Nutrients

5.7.2.1 No Action Alternative

Nutrient loading has been determined to be a significant contributing factor to degraded water quality. Under the No Action Alternative, there would be no change from existing conditions and no impacts on nutrient loads in the project area.

5.7.2.2 Tentatively Selected Plan

Concentrations of nutrients may increase locally for short periods following dredging and disposal of dredged material. However, the currents and waves in Mississippi Sound would quickly dilute material in the water column and not promote eutrophication from nutrient concentration. Available water quality data indicate that sediments and water in the area of the TSP do not have elevated concentrations of contaminants, such as hydrocarbons and metals. However, low concentrations of contaminants in sediments could be suspended in the water column during dredging activities. These contaminants would settle again following dredging activities, so that no adverse permanent impacts to water quality would be expected. Other than temporary and minor adverse effects of implementing the proposed TSP, dredging operations, future

maintenance and disposal practices will be consistent with the current O&M dredging practices and would not be expected to cause any long-term or permanent alteration to the overall nutrient concentrations in the Sound or Gulf of Mexico.

5.7.3 Salinity and Water Temperature

In May 2024, ERDC performed HD modeling that addresses salinity and water temperature that could affect aquatic habitat for oysters and SAV and is documented in the Engineering Appendix A. Further information of the HD data results applicable to this Study is discussed in Environmental Appendix C – Supplemental Information.

5.7.3.1 No Action Alternative

Under the No Action Alternative, there would be no change from existing conditions and no change of salinity levels or water temperature from background conditions, as described in Case 2 (FWOP), Section **Error! Reference source not found.**.

5.7.3.2 Tentatively Selected Plan

Results of simulations comparing the Without- and With-Project conditions of in Mississippi Sound characterizes changes of salinity in variable conditions. To assess changes in salinity distribution factoring in Future With Project (FWP, Cases 3 and 4) scenarios, model results were processed for mean salinity statistics during the minimum mean spawning period (May to September), the minimum monthly mean, and annual mean values as presented in Environmental Appendix C, Supplemental EA Information.

The mean salinity during the May to September oyster spawning period for the FWP (Cases 3 & 4) had similar results to the FWOP (Case 2) at all station locations, and all were above the minimum mean salinity threshold of 5 ppt. Lowest salinity was found at Station 2 (Oyster 2) near the confluence of St. Louis Bay at Pass Christian, although levels were above the minimum threshold for both FWOP and FWP. The remaining stations were above the minimum threshold with little difference in salinity values between FWOP and FWP. These results indicate a trend of greater salinity towards the southern limit of Mississippi Sound with reduction towards the northwest at the confluence of St Louis Bay. Freshwater from inland streams (Jordan and Wolf Rivers) may influence the spawning period at this location.

This trend of salinity reduction from south to north within the Sound is more pronounced in the minimum monthly mean salinity data. Station 2 (Oyster 2) near the St. Louis Bay confluence had the lowest minimum monthly mean salinity value, at 1.2 ppt for both FWP (Cases 3 and 4), which is below the 2 ppt threshold. For reference, a salinity level of 2.4 ppt was found at FWOP (Case 2). Salinity dramatically increased southward toward Cat Island to 13.1 ppt for FWP (Case 3) and 13.3 ppt (Case 4). The intermediate levels for FWP at the remaining stations had values above the threshold between 3.6 ppt and 6.5 ppt. Value differences for FWP were negligible between Cases 3 and 4, although levels with the FWOP (Case 2) were slightly higher.

Annual mean salinity for all cases were found to exceed the minimum threshold of 5 ppt. All stations except station 2 (Oyster 2) were found to reach or exceed the optimal salinity level. There is little value variation between FWOP (Case 2) and FWP (Cases 3 and 4). Similar to the previous variations, the southern-most sampling locations had the highest values for the FWOP (Case 2), and FWP (Cases 3 and 4), that exceeded the top optimal value limit. This trend of increasing salinity from north to south throughout Mississippi Sound persists annually, although salinity ranges are more moderate.

There is relatively little difference in the salinity results from all stations for Cases 3 and 4 FWP. Predictable changes in salinity and water temperature relative to the aquatic resources, such as SAV, benthic communities, oysters, and fish would occur during dredging and placement of material. These impacts would be temporary and localized and would recover through natural processes within several months after operations cease. No long-term or permanent adverse effects are anticipated to the aquatic habitat for resources as a result of implementing the proposed TSP.

Salinity relative to SAV (seagrass) at the stations located around Cat Island and Ship Island were all found to have values well above the minimum threshold of 9 ppt, and within 1 ppt for the FWOP (Case 2) and FWP (Cases 3 and 4). This data suggests that no impact would occur to seagrass beds located at the barrier islands adjacent to the Gulfport Harbor channel.

Water temperature at all stations for oyster application as well as SAV growth were found to be consistent with variation less than 2°C difference, averaging around 22°C.

Future maintenance practices will be consistent with the current O&M dredging practices and would not be expected to cause any further changes to the overall salinity or water temperatures conditions in the Mississippi Sound. Specific data resulting from the ERDC HD modeling can be found in Environmental Appendix C – Supplemental Information.

5.7.4 Turbidity and Suspended Solids

Turbidity in Mississippi Sound and surrounding waterbodies commonly occurs due to its shallow depth and the current and wave action resuspending sediments into the water column. Both O&M and improvement activities could have one or more dredges operating in various areas of the channel for extended periods. Dredging operations are likely to affect water quality from turbidity nearby the dredging and placement areas. The significant criterion for turbidity and suspended solids would be permanent loss of aquatic habitat that support resources such as SAV, mollusks, and crustaceans.

5.7.4.1 No Action Alternative

USACE is required to implement appropriate best management practices (BMPs) to minimize turbidity impact to the maximum extent practicable under the MDEQ Section 401 water quality certification conditions. To maintain compliance, USACE conducts required daily monitoring during O&M dredging activities to ensure turbidity does not

exceed MDEQ's water quality certification conditions that could adversely affect the aquatic environment. Should these conditions be exceeded, the USACE suspends operations and immediately notifies the MDEQ of any resultant work stoppages. Work would resume once turbidity levels return to a compliance standard. Under the No Action Alternative, there would be no change from the existing conditions.

5.7.4.2 Tentatively Selected Plan

Unavoidable, temporary, and localized impacts would result from material placement at the Pascagoula ODMDS and the North Cat Island BU site, such as increased suspended sediments and nutrients, loss of benthic organisms, and bathymetric changes in the ocean substrate. Increased turbidity would reduce light penetration in the water column, altering photosynthesis and surface water temperatures. This scenario could visually alter predator-prey relations; also, sediment adhering to fish gills could cause respiratory stress and deter natural movement of eggs and larvae. All of these described impacts are localized, minor and temporary; it is anticipated after placement operations cease, disturbed locations would quickly return to background conditions.

Future O&M impacts would be temporary and localized and would not increase long-term turbidity levels above that of the existing conditions. The USACE would continue to implement BMP and turbidity compliance measures as required by the MDEQ Section 401 water quality certification for the Gulfport Harbor project. No long-term or prolonged adverse impact to aquatic habitat is expected from implementing the proposed TSP.

5.8 Biological Resources

This section addresses potential impacts on upland biological communities resulting from the considered alternatives. Existing data on specific species occurrences in the project area are limited, and the discussion of impacts is based on the presence of (and changes in) habitat within the project area combined with reasonably foreseeable impacts from the alternatives. The discussion of potential impacts is descriptive in nature rather than relying on quantitative data.

5.8.1 Terrestrial Plant Communities

Upland terrestrial communities may be affected in three ways: temporary displacement of vegetation, habitat alteration, and exposure to contaminants. Terrestrial plant communities are limited to the areas within or immediately adjacent to the project area.

5.8.1.1 No Action Alternative

Under the No Action Alternative, existing conditions in the project area would continue as established vegetation. There would be no disturbance from dredging and placement of material and no associated displacement of upland species during such operations.

5.8.1.2 Tentatively Selected Plan

Navigational modifications within the Gulfport Harbor Channel and subsequent placement of new work sediments will be conducted entirely within the open waters of the Gulf of Mexico and Mississippi Sound. No placement of new work dredged material will occur on land; thus, the proposed TSP would have no effect to upland terrestrial plant communities.

Future maintenance of the project will utilize already existing and authorized open water dredged material placement sites. Therefore, no disturbance would occur from dredging and placement of sediments or associated displacement of any upland plant species during such operations.

5.8.2 Wetlands

The significance criterion for wetlands would be the permanent loss of identified wetland habitat affecting associated resources dependent up them.

5.8.2.1 No Action Alternative

Under the No Action Alternative, existing conditions in the project area would continue as established wetland systems. There would be no disturbance from dredging and placement of material into wetland habitat, and no associated displacement of wetland vegetative species during such operations.

5.8.2.2 Tentatively Selected Plan

Under the proposed TSP, material dredging and placement would be within a watered environment. The USFWS National Wetlands Inventory (NWI) mapping, Figure 3-6, depicts estuarine and marine deepwater habitat occurring in the Gulfport Channel and surrounding area between the barrier islands. However, this mapped area is 100% open deepwater and does not support any wetland vegetated communities. No intertidal flat or saltmarsh is within the dredging footprint. Although saltmarsh may be present at the fringing western edge of Ship Island and Cat Island, no direct impact is anticipated to occur to any estuarine wetland that may be present in this location. Indirect impact could occur from turbidity plume extending from the new work zone during operations, but would be monitored, localized and temporary, and not anticipated to cause long-term adverse effect to the shoreline of the barrier islands.

Placement of new work material at the Cat Island North BU site will breach the water surface at an elevation to promote emergent tidal marsh establishment. Emergent tidal marsh would provide additional nursery habitat in Mississippi Sound. Beneficially utilizing new work dredged material at the North Cat Island BU site would create additional wetland habitat, specifically 270 acres of emergent tidal marsh habitat. Additional HD modeling will be conducted during the PED phase to analysis the site's layout to minimize any impacts to Cat Island.

The proposed channel modifications do not pose potential adverse effects that could alter wetland habitat assemblages, distribution, or productivity. Salinity in Mississippi Sound is affected by wave, wind, and tides as well as periodic storm surges resulting from hurricanes and other weather events. These natural patterns of spatial and temporal salinity fluctuations resulted in the development of diverse and resilient wetland community types within the Sound. Potential effects in water quality resulting from proposed channel modifications are discussed in Section 5.7.

5.8.3 Submerged Aquatic Vegetation (SAV)

The significance criterion for SAV would be the permanent loss of estuarine seagrass habitat affecting associated resources dependent up them. Specifically, water quality criteria were evaluated to determine lethal levels contributing to mortality of seagrass species which did not indicate water quality degradation occurs within known beds.

Baseline conditions were assessed to determine potential effects of the proposed TSP on the SAV habitat establishment of known colonies, depicted in Figure 3-7. Salinity and water temperature tolerance thresholds were identified for local SAV species through a review of published literature. Additionally, HD modeling evaluated baseline water quality data and is summarized in Section 3.7 (ERDC, 2024; see Environmental Appendix C – Supplemental Information). Model results were used to estimate salinity and water temperature threshold values for SAV viability within the Mississippi Sound. The data compared both with and without project scenarios to locate SAV colonies that could be impacted by thresholds exceedance from implementation of the proposed TSP. No such exceedances were noted.

5.8.3.1 No Action Alternative

Under the No Action Alternative, existing conditions in the project area would continue with no expected environmental alteration to SAV in association with maintaining the navigation project.

5.8.3.2 Tentatively Selected Plan

Seagrass production occurs in the nearshore area of Cat Island and Ship Island. As shown in **Figure 3-10**, no seagrass beds occur within or immediately adjacent to the Gulfport Harbor Channel in the Ship Island Pass. Therefore, no direct impact from implementation of the proposed TSP would occur to established seagrass colonies associated with these barrier islands.

Indirect impacts to seagrass from water quality parameters including salinity, water temperature, and turbidity were analyzed. The HD Modeling (ERDC 2024, Engineering Appendix A) addressed the salinity and water temperature effect to SAV for both future without and with project which determined no lethal threshold would be exceeded in the locations of the seagrass beds from implementation of the proposed TSP. Section 5.7.3 discusses the modeling results to SAV at stations located at the barrier islands which supports this conclusion.

Indirect impacts to seagrasses, due to temporary increases in water column light attenuation or sedimentation, may occur near the dredged areas but are not physically disturbed by the dredging equipment (Hall *et al*. 2022). A ERDC (2013) study evaluated the relationship of light attenuation and turbidity associated with a dredging event using the USACE special purpose hopper dredge *Murden* in Tampa Bay, Florida (Schafer *et al.* 2016). The study findings indicate that light attenuation is strongly controlled by the turbidity variation, as expected. The study results determined the intensity and duration of light attenuation associated with the dredging operations were well within the normal range of values expected for seagrass beds in the absence of dredging activity. The study demonstrated that light penetration recovery after dredging operations returned to a near normal condition about 60 to 90 minutes post-activity (Schafer *et al.* 2016).

Turbidity from suspended solids in open water reduces available light needed for photosynthesis enabling plant productivity. Natural turbidity can occur in shallow estuarine environment that affects seagrass production. Seagrass can tolerate temporary durations of turbidity from waves, wind and storm surge that cause sediment to become suspended in the water column. In contrast, dredging operations can adversely affect seagrasses only if dredging-related turbidity exceeds the range of natural turbidity and sedimentation rates for an extended duration of activity (Erftemeijer & Lewis III 2006).

Turbidity from the dredging activity included in the proposed TSP would have temporary impact from suspension of sediment within the channel and at the proposed placement sites. The Pascagoula ODMDS (where no SAV is present) is anticipated to receive the majority of the dredged material, although the Cat Island North BU site will also receive materials as well. Compatible sand/silt material would be incorporated into the Cat Island North BU. Current mapping and previous surveys indicate no seagrass colonies are established in this proposed area where the BU material would be placed as contribution to this project.

Although unlikely due to their distance, implementation of the proposed TSP could have indirect impact to the SAV environment. Turbidity would be increased in the water column during dredging of the Ship Island Pass segment of the Gulfport Harbor Channel and at placement areas such the potential BU site at Cat Island. Turbidity monitoring during dredging and placement operations would be conducted to maintain compliance with MDEQ Water Quality Certification Section 401. These impacts would be temporary and minor, occurring only during this activity, and are expected to settle back to background levels once operations are completed at these locations.

While low levels of DO in the water column can cause mortality, and can impact the Sound system, SAV, like all vascular plants, produce oxygen and some release oxygen from their roots under low oxygen conditions. The DO conditions would need to be persistently very low to create stressful condition for SAV. As discussed in Section 5.9.1, DO concentrations historically range from 6.7-7.1 mg/L. These concentrations of DO would not have an impact on the SAV species present.

Future maintenance dredging of the navigation channel and placement of material in the existing placement sites will result in temporary increases of suspended sediments, the loss of benthic organisms, increases in nutrients, and bathymetry changes in open-water placement sites. The increase in turbidity will reduce light penetration through the water column, thereby reducing photosynthesis, surface water temperatures, and aesthetics. However, these conditions will be no greater than existing conditions and are far removed from existing SAV areas considered in the study. No additional impacts are expected.

5.8.4 Artificial Reefs and Structural Habitats

5.8.4.1 No Action Alternative

Under the No Action Alternative, existing conditions in the project area would continue with no expected adverse impacts to hard bottom or artificial reef structures in the immediate region to the project area.

5.8.4.2 Tentatively Selected Plan

Indirect impacts to the manmade hardbottom habitats, as described in Section 3.8.3, associated with dredging and placement activities are expected to be minimal and short term. These impacts would occur from turbidity resulting from the dredging and placement operations of material from the Gulfport Channels. There would be no appreciable changes in water quality parameters such as salinity and DO. These same parameters apply to the hardbottom and structural resources, therefore, no impacts to the hardbottom and structural biological resources would result from implementation of the TSP, which includes the future O&M.

5.8.5 Essential Fish Habitat

The significance criterion for EFH in vicinity of the Gulfport Channel as detailed in Section 0 would be permanent change or loss in the habitat designated as EFH such that one or more species of fish would undergo a substantial population decline within Mississippi Sound.

5.8.5.1 No Action Alternative

Under the No Action Alternative, existing conditions in the project area would continue with no expected environmental changes in association with maintaining the Gulfport Harbor project.

5.8.5.2 Tentatively Selected Plan

Similar to the findings in the Gulfport Harbor Supplemental EIS (2009), dredging enhancement of the Gulfport Harbor Channel would temporarily adversely affect the EFH in the vicinity of the proposed TSP. However, there is ample habitat available in the vicinity to accommodate these temporarily displaced animals, as the fish would move out of the area during dredging activities and would be able to return to the channel area after activities cease. No estuarine emergent wetlands, oyster reefs, or

SAVs would be adversely affected by the proposed TSP. Placement operations would cover benthic organisms with dredged material. However, as detailed in Section 5.8.7 , no significant long-term impacts to this resource are expected as a result of the TSP implementation. Increased water column turbidity during dredging would be temporary and localized. The spatial extent of elevated turbidity is expected to be within 750 ft of the operation, with turbidity levels generally returning to ambient conditions soon after completion of the dredging activities. Only a small area of aquatic ecosystem, estimated to be less than 1% of the Mississippi Sound, would be affected; thus, no significant long-term impacts are expected to occur.

BU of dredged material placement near Cat Island would result in a positive impact to EFH near those areas. Material would be placed at an elevation to establish emergent tidal marsh habitat. The sediment would help renourish habitat areas for larval and juvenile stages of managed species and protect those areas from erosional forces.

In accordance with the MSFCMA, USACE, Mobile District is currently consulting with NMFS-HCD. Based on findings, the impacts are considered less than significant.

Future maintenance will continue similar to existing dredging and placement practices. Dredging and placement will result in temporary and localized increases of suspended sediments, loss of some benthic organisms, and minor bathymetry changes in open water placement sites. No additional to impacts to the Mississippi Sound fishery are expected from future maintenance operations.

5.8.6 Plankton and Zooplankton

The significance criterion for plankton, zooplankton and algae in the Gulfport Channel vicinity would be changes in biomass, community composition and trophic structure that could cause permanent loss or changes in plankton and zooplankton habitat and the resources dependent upon them.

5.8.6.1 No Action Alternative

Under the No-Action Alternative, background conditions would not result in overall increases in turbidity or salinity within Mississippi Sound and surrounding waterbodies, which would not have a negative impact on plankton or zooplankton in the project area. Algal blooms that currently occur in the Mississippi Sound would continue unchanged by the no action alternative.

5.8.6.2 Tentatively Selected Plan

Elevated turbidity levels and decreased light transmission during construction could result in a temporary localized reduction in phytoplankton and zooplankton abundance. Turbidity and suspended solids were measured as part of a 1975 USACE study, which was evaluated for the Gulfport Harbor Navigation Channel Supplemental EIS of 2009. The study included an evaluation of water quality and plankton in dredging and placement areas over a 40-mi^2 grid centered on the Gulfport Harbor Channel in the Mississippi Sound and found that sediment plumes of silts, clays, and sands were

identified in localized areas tended to settle rapidly. Furthermore, levels of turbidity and suspended solids with a high percentage of fines returned to background levels at placement sites within two to three hours. The study concluded that no observable effects on the resident plankton and zooplankton community were observed in stimulatory effects, species composition, or community structure (USACE, 1975).

Nutrients released during placement could indirectly support a localized temporary increase in algae and phytoplankton. Planktonic and algae organisms would be carried into and out of the project area during construction. Previous and current HD modeling data has predicted that nutrient and salinity levels in the project area would not be affected by the expansion of the Gulfport Harbor Channel. Impacts would be restricted to localized areas of plankton; therefore, any impacts would not be significant.

Future maintenance would be conducted similar to existing O&M activities. Thus, no negative impact on plankton, zooplankton, or algae in the area is anticipated.

5.8.7 Benthic Invertebrates

The sediment present in the project area of the TSP provides habitat for multiple species of infaunal and epifaunal invertebrates. Past studies of the benthic invertebrate community of the Gulfport Harbor project area were characterized by dredged material disposal surveys for the navigation channel conducted in 1993 and 2004 (USACE Final Supplemental EIS 2009).

An increase in benthic density and diversity at pre-dredge levels in 2006 for the expansion project was observed 4 to 6 months following dredging, but the increase was attributed to seasonal variation masking any minor effects of the dredging activities (USACE Final Supplemental EIS 2009). The benthic macroinvertebrate assessment indicates post project conditions suggest mean bottom salinity increases of 1 to 3 ppt. The greatest salinity increases are projected within the transitional and estuarine zones where benthic macrofaunal assemblages are dominated by polychaete worms.

5.8.7.1 No Action Alternative

Under the No Action Alternative, existing conditions in the project area would continue. There would be no expected environmental changes to aquatic resources in the benthic community associated with maintaining the Gulfport Harbor navigation project.

5.8.7.2 Tentatively Selected Plan

Factors affecting habitat quality and the salinity balance within an estuary include severe storms, sediment changes, and development. Alterations to marine deepwater habitat (e.g., channel deepening) can affect biotic communities adapted to salinity zones by changing their taxonomic composition and distributions. Important estuarine biota includes benthic invertebrates, which are relatively stationary. Their abundances and distributions serve as an indicator of aquatic habitat health as they provide important resources for bottom-feeding fishes and crustaceans. Alteration to invertebrate distributions and abundances could affect these higher trophic organisms.

Dredging to widen and deepen the Gulfport Harbor Channel and subsequent placement of the dredged material would cause a temporary disruption to the benthic community located in and along the channel, and in adjacent areas planned for channel expansion. Both infauna and epifauna invertebrates would be displaced during dredging activities. However, impacts are primarily short-term in nature and would be a temporary loss of benthic invertebrate populations in the dredging areas. Recolonization of the channel substrate would commence immediately after operations cease. There would likely be some incidental loss of individuals (especially infauna invertebrates) during dredging operations.

Due to a minor area of the overall Mississippi Sound that will be affected by the project, and anticipated rapid recovery rates by benthic species, no significant long-term impacts to the benthos, motile invertebrates, and fishes are expected to occur as a result of the proposed action.

Future maintenance would result in similar environmental conditions as current O&M activities. Thus, no additional environmental changes are anticipated. However, it is predicted that the future SLR scenarios over the next 50 years would cause changes in salinity and other water quality parameters which result in impact to the benthic invertebrate communities and distributions as the SLR occurs. As sea level continues to rise benthic habitat will be exposed to higher salinities due to increased depths.

5.9 Fish and Fisheries Resources

5.9.1 Fish

The significance criteria for commercial and recreational fishing in the project area would be an effect to the species or a change to the habitat structure leading to a change in species composition or long-term changes in revenue for fisheries within Mississippi Sound.

5.9.1.1 No Action Alternative

The fish community in Mississippi Sound in the vicinity of the Gulfport Harbor Channel would not be affected by the No-Action Alternative. There would be no change to the current aquatic habitat available to the fish community or to the resources the habitat supports.

5.9.1.2 Tentatively Selected Plan

Notwithstanding the potential harm to some individual organisms, no significant impacts to managed species of finfish or shellfish populations are anticipated from the proposed TSP. No direct impact would occur due to temporary disruptions to fish activity in or adjacent to the project area, as the fish would move out of the area during dredging activities and would be able to return to the channel area after activities cease. Placement of dredged material at BU site at Cat Island would result in a beneficial impact to fish usage near the sites. The sediment would help renourish habitat areas for

larval and juvenile stages of managed species and protect those areas from erosional forces.

5.9.2 Oysters

The Eastern oyster is one of the more valuable shellfish resources of the Gulf coast and is addressed in Section 3.34. The significance criteria for crustaceans would be a permanent change in any of these conditions: 1) the health of population; 2) community structure and composition; 3) trophic structure; and 4) system function.

5.9.2.1 No Action Alternative

Oyster recruitment is the key driver for maintaining oyster population over time. Recruitment occurs through the settlement of larval from their natal reef (intra-reef recruitment), or from other reefs within the system (inter-reef recruitment). Intra-reef recruitment has been shown to be relatively low, indicating that inter-reef recruitment is crucial for sustaining oyster populations in hydrodynamically-driven systems. Understanding the oyster larvae movement and reef recruitment dynamic is critical towards understanding how potential project actions will impact oyster populations within a project footprint.

The significance criteria for oysters would be a permanent change in any of these conditions: 1) the health of population; 2) community structure and composition; 3) trophic structure; and 4) system function.

Under the No Action Alternative, existing conditions in the project area would continue. The region west of the Port of Gulfport at the confluence with St Louis Bay are where oyster resource occurs in the Mississippi Sound. There would be no expected environmental changes in association with maintaining the Gulfport Harbor navigation project. Under current conditions, there would be no changes to salinity, temperature, and DO levels that would cause any impacts to mollusks in the project area.

5.9.2.2 Tentatively Selected Plan

In general, the Eastern oysters require conditions similar to that of the oysters which is described in detail in Section 3.9.2. These organisms live within the sediments and in the water column. USACE ERDC (2024, Engineering Appendix A) conducted field studies and analyses looking at changes in water quality and hydrodynamics to evaluate the potential for impacts. Based on the water quality values established in Section 3.7.3 for the Mississippi Sound, the salinity minimum tolerance threshold for oyster survival of greater than 2.4 ppt, and the minimum DO value no lower than 2.4 parts per million (ppm), would assure no significant impact to this resource. In the Gulf of Mexico waters, hypoxia (DO less than 2 ppm) may occur during the late spring and summer months (USGS, 2021). Although the USEPA estimates that 4% of the bottom waters in the Gulf of Mexico estuaries may reach hypoxic conditions or low DO, these hypoxic areas are limited to the western Gulf along the Louisiana coastline near the confluence of the Mississippi River (USEPA, 2013). Salinity values were found within

the tolerance ranges for the TSP, based on tolerance thresholds. The Water Quality, Section 3.7.3 discusses salinity and water temperature thresholds and tolerances for oyster production in the Mississippi Sound.

Reproduction is highly dependent on water temperature, with a reported range of spawning occurring from 15 to 28 °C. Most spawning occurs at temperatures greater than 25 °C in the Gulf of Mexico, and normal egg development reported between 18 and 30 °C (USGS, 2021). The ERDC HD Modeling data found that water temperature at all stations for oyster application as well as SAV growth were found to be consistent, averaging around 22°C, with variation less than 2°C difference between no action and with project scenarios.

No substantial impacts to aquatic resources within the study area are anticipated due to project implementation, as the area of greatest potential changes to environmental conditions are already adapted to natural shifts in salinity and other factors as well as conditions resulting from the existing navigation channel. No significant impact is expected to alter water temperature in the project area that could adversely affect oyster production as a result of implementing the proposed TSP.

Future maintenance will be similar to current O&M activities. The existing oyster reefs which are able to handle temporary, localized turbid water conditions will not experience adverse impacts. USACE will avoid dredging and placement of material in areas that would impact existing reefs.

5.9.3 Crustaceans

Abundant crustaceans in the Mississippi Sound include a variety of amphipods, isopods, shrimps, and crabs, as described in Section 0. Four commercially important species occurring in Mississippi coastal waters are the brown shrimp (*Farfantepenaeus aztecus*), the pink shrimp (*Farfantepenaeus duorarum*), the white shrimp (*Litopenaeus setiferus*), and the blue crab (*Callinectes sapidus*). The significance criteria for crustaceans would be a permanent change in any of these conditions: 1) the health of population; 2) community structure and composition; 3) trophic structure; and 4) system function.

5.9.3.1 No Action Alternative

Under the No Action Alternative, existing conditions in the Gulfport Harbor project area would continue. There would be no expected change to population or habitat of the identified crustaceans associated with maintaining the Gulfport Harbor navigation channel.

5.9.3.2 Tentatively Selected Plan

In general, crustaceans require aquatic habitat conditions similar to fish and mollusks as described below. These organisms live on the estuarine substrate and in the water column. Numerous field studies and analyses have been conducted in the project area of the TSP or in nearby locations that address sediment and the watered environment

that support these species. These studies were conducted between 2004 and 2015 in response to projects that occurred in the footprint of the TSP, including expansion of the Gulfport Harbor Channel, as well as eco-restoration at Cat Island and Ship Island. The studies addressed environmental effects to aquatic resources by implementation of proposed actions that were similar to the TSP. Results of the impact assessments for these resources indicate those areas would not be negatively impacted as discussed in Sections 3.8.2 and 3.8.3.

Dredging the Gulfport Harbor navigation channel footprint and placing material in the approved placement sites would result in temporary increases of suspended sediments and nutrients, the loss of benthic organisms, and bathymetry changes in open water placement sites. The increase in turbidity would reduce light penetration through the water column, thereby reducing photosynthesis, surface water temperatures, and aesthetics. There would be no additional changes in salinity and DO levels as they would stay well above the minimum thresholds during dredging and placement activities, as determined from the results of the HD modeling (USACE ERDC 2024, Engineering Appendix A). These conditions would be no greater than what exists post-project construction, and no additional impacts to crustacean in the project area are expected to occur. Shrimp and crabs utilize the wetlands and SAV areas as nursery grounds. Impacts of Gulfport Harbor Channel modifications on benthic macrofauna due to salinity intrusion are predicted to be negligible, with no effects on higher trophic levels, such as fish, shrimp, and crabs as prey availability and distributions are unlikely to be affected. Considering the habitats widely used by the crustaceans, no negative long-term impacts to these species would be expected by the implementation of the TSP.

Future maintenance dredging of the Gulfport Harbor navigation channel and placement of material in the approved placement sites will result in temporary increases of suspended sediments, the loss of benthic organisms, increases in nutrients, and bathymetry changes in open water placement sites. The increase in turbidity will reduce light penetration through the water column, thereby reducing photosynthesis, surface and water temperatures. There would be no additional changes in salinity and DO levels as they would stay well above the minimum thresholds during future maintenance activities. These conditions will be no greater than what exists after project construction and no additional impacts to crustacean in the project area would be expected to occur. Placement of dredged material in the Cat Island North BU site could result in a positive effect for restoring benthic habitat once the areas recover from initial disturbance. Once recovered, these areas would attract predator species such as Gulf sturgeon in the nearshore, similar to the outcome observed along the barrier islands post restoration (USACE ERDC, 2021).

5.10 Threatened and/or Endangered Species

This section addresses potential impacts on species listed as threatened or endangered by the USFWS and NMFS-PRD pursuant to Section 7 of the ESA. **Table 3.4** identifies the species that could be affected by implementation of the TSP. Watered environment

in Mississippi Sound is designated Gulf sturgeon critical habitat. Shoreline on Cat and Ship Islands is designated critical habitat for piping plover and proposed critical habitat for rufus red knot.

Criterion of impact is based on the presence of and potential changes in habitat within and immediately adjacent to the project area resulting from implementation of the TSP. All protected species with known or historical occurrences near the project area were considered in this evaluation.

5.10.1 No Action Alternative

Under the No Action Alternative, existing conditions in the project area would continue. There would be no expected environmental changes to listed species found in the project area in association with routine maintenance of the Gulfport Harbor navigation project that could imperil their continued presence or designated critical habitat.

5.10.2 Tentatively Selected Plan

The TSP proposes to conduct deepening and widening of Gulfport Harbor through dredging and placement of material. This would be accomplished by utilizing mechanical, hydraulic pipeline and/or hopper dredge to dispose of dredged material in the previously certified Pascagoula ODMDS and Cat Island North BU site. Multiple dredges could be utilized at once.

The overall potential impacts from the proposed project to threatened and endangered species are discussed below. The species will likely avoid the area during construction and return shortly after construction has completed. Consultation with the USFWS for species under their purview has been initiated; see Environmental Appendix C. A Biological Assessment (BA) was drafted with USACE's determination that the proposed action is "not likely to adversely affect" the West Indian manatee, Piping plover, and Red knot. For those protected species under NMFS-PRD's purview, a BA was drafted with USACE's determination that the proposed action is "likely to adversely affect" sea turtles and Gulf sturgeon due to potential lethal takes during hopper dredge operations.

The USACE, Mobile District finds that the proposed activity may affect but is not likely to adversely affect (MANLA) West Indian manatees, piping plovers and red knot while hopper dredging activities associated with the improvement project is LAA Gulf sturgeon and sea turtle species, and MANLA giant manta rays. USACE's determination is listed in **Table 5.1**.

Table 5.1: Threatened and Endangered Species

LISTED SPECIES	SCIENTIFIC NAME	STATUS	DETERMINATION
Marine Mammals			
West Indian manatee	*Trichechus manatus*	Endangered	**MANLA**
Reptiles			
Kemp's ridley sea turtle	*Lepidochelys kempii*	Endangered	**MALAA**
Loggerhead sea turtle	*Caretta caretta*	Threatened	**LAA**
Green sea turtle	*Chelonia mydas*	Threatened	**LAA**
Leatherback sea turtle	*Dermochelys coriacea*	Endangered	**LAA**
Hawksbill sea turtle	*Eretmochelys imbricate*	Endangered	**No Effect**
Fish			
Gulf sturgeon	*Acipenser oxyrinchus desotoi*	Threatened	**LAA**
Birds			
Piping plover	*Charadrius melodus*	Threatened (CH)	**MANLA**
Rufa red knot	*Calidris canutus ssp. rufa*	Threatened (PCH)	**MANLA**
Sharks and Rays			
Giant manta ray	***Manta birostris***	**Threatened**	**MANLA**

5.10.2.1 Sea Turtles

Proposed channel improvements exceed the congressionally authorized project dimensions identified in the *Gulf Regional Biological Opinion for Dredging of Gulf of Mexico Navigation Channels and Sand Mining Areas Using Hopper Dredges by COE Galveston, New Orleans, Mobile, and Jacksonville Districts (Consultation Number F/SER/2000/01287)* dated November 19, 2003 (amended 2005 and 2007); therefore, USACE is consulting with NMFS-PRD specifically on the proposed TSP, which includes the future O&M. USACE, Mobile District recommends to implement similar terms and conditions for sea turtles and Gulf sturgeon as identified in NMFS-PRD's GRBO.

The northern Gulf of Mexico is an area of considerably high amount of ship traffic in addition several important commercial shipping lanes pass through foraging sea turtle habitat, particularly vessel traffic from ports in Gulfport, Biloxi, Pascagoula, and GIWW

in Mississippi Sound. In general, hazards from vessel collisions due to large vessel traffic in the world fleet would continue. Increased number of Post Panamax vessels and the forecasted transition to larger vessels in the Gulf of Mexico are anticipated to occur with or without the proposed channel improvements. These improvements would allow for those vessels to move more efficiently through Gulfport Harbor channel and carry more cargo per call. Thus, the total number of vessels required to meet the demand at the Port could decrease. Therefore, the proposed channel improvements are not expected to increase the risk of vessel collisions to foraging sea turtles.

Green, loggerhead, and Kemp's ridley sea turtles are regularly documented in the waters surrounding the barrier islands of GINS. Of these, only loggerhead sea turtles have been confirmed as nesting on the islands in the Mississippi Sound and they are the only species with designated critical habitat of Horn and Petit Bois Islands (USGS 2020). Green sea turtle nests have been found on the Mississippi islands; however, these nests are likely uncommon. Though never documented, Kemp's ridley sea turtles could nest on the islands. Leatherback and hawksbill sea turtles may be seen in the barrier island waters, but there are no confirmed nest records within the barrier island project area (USGS, 2020). Although not common, a leatherback sea turtle has been documented in the project's vicinity when it was captured in a trawling net. Loss or degradation of suitable nesting habitat may be the most important factor affecting sea turtle nesting population in northern Gulf of Mexico. Overall, the loss of nesting beaches, hatchling disorientation from artificial light, drowning in fishing and shrimping trawls, marine pollution, plastics, and Styrofoam have led to the decline of all species of sea turtles found in the Mississippi Sound.

5.10.2.2 Gulf sturgeon

Mechanical and hydraulic cutterhead pipelines dredges have not been identified as equipment that would directly impact Gulf sturgeon. Adverse impacts associated dredging utilizing hopper dredges have been addressed in the GRBO, and similar impacts would be anticipated with the proposed action.

5.10.2.3 Gulf sturgeon Critical Habitat

The project area is partially within designated Gulf sturgeon critical habitat in Mississippi Sound but terminates south of the barrier islands in the Gulf of Mexico, Figure 3-11. Placement of material in the Pascagoula ODMDS would not breach the water surface; however, placement at the Cat Island North BU site would breach the surface. Sandy areas are considered the principal habitats of benthic species that comprise prey for Gulf sturgeon. A detailed description is presented in Appendix C - Environmental. that discusses environmental consequences to benthic habitat by the TSP. Direct loss of the benthic habitat from implementing the TSP would be minor and localized to the project footprint for both the dredging operation and material placement during construction. Dredging impacts would be localized and would affect the benthic community within the immediate footprint of the project. These affects would be temporary in areas that would remain underwater, as sediment composition pre- and

post-construction would be similar, and benthic communities are known to recover quickly. From previous coordination in Gulfport Harbor and Pascagoula Harbor for similar project types, NMFS-PRD concurred with the USACE's determination of may affect but not likely adversely modify or destroy critical habitat.

5.10.2.4 Giant Manta Ray

Minor and temporary disturbances to Giant manta rays may occur during dredging and placement activities associated with the proposed action. Giant manta rays are a motile species and will likely avoid the area during construction operations and return shortly after construction has completed.

5.10.2.5 West Indian manatee

West Indian manatees are known to exist throughout the entire project area as they move during warmer periods of the year. Manatees are frequently reported in the bayous and bays along the northern shoreline of the Mississippi Sound. Although unlikely given the project location occurs mostly in the Sound and Bar Channels, West Indian manatee could possibly be encountered during the project construction. Given this possibility, the USACE has historically agreed to implement "Standard Manatee Construction Conditions" during maintenance dredging and placement operations; thus, no adverse impact to West Indian manatees is anticipated.

5.10.2.6 Eastern Black Rail, Piping Plover and Red Knot

Piping plover critical habitat and rufus red knot proposed critical habitat are present on the Mississippi barrier islands. These listed species are known to overwinter on Cat Island and Ship Island, adjacent to the Gulfport Harbor channel in the Ship Island Pass. These species could be at the Cat Island North BU site when it breaches the water surface. Minor and temporary disturbances to Piping plover, and Red Knot may occur, but the species will likely avoid the area and return after construction has completed. The USACE, Mobile District has made the determination that the proposed Gulfport Harbor navigation project may affect but is not likely to adversely affect these bird species.

5.11 Marine Mammals

Marine mammals are covered under the MMPA, regardless of their status under the ESA. Although six threatened or endangered whale species (i.e., whale species protected under both the ESA and MMPA) occur in the Gulf of Mexico, no whale species are known to occur in the project area. The West Indian manatee is also listed as endangered and, therefore, is protected under the ESA. A more detailed discussion of marine mammals, their habitats, and status is included in Section 3.10

5.11.1 No Action Alternative

Under the No Action Alternative, marine mammals would continue to utilize the area without additional disruption from localized temporary impacts.

5.11.2 Tentatively Selected Plan

A dredge transiting to the offshore ODMDS could encounter a marine mammal but such interactions are rare. Noise generated from dredging equipment has the potential to harm marine mammals, including large whales. Although behavioral impacts are possible (i.e., a whale changing course to move away from a vessel), the number and frequency of vessels present within a given project area is small and any behavioral impacts would be expected to be minimal. Furthermore, for hopper dredging activities, endangered species observers would be on board and would record all large whale sightings and note any potential behavioral impacts.

Dredging contractors would adhere to the standard manatee conditions during construction in order to avoid vessel strikes. The standard manatee conditions apply annually from 1 June to 30 September. The dredging contractors will be instructed to take the necessary precautions to avoid contact with manatees. If manatees are sighted within 100 yards of the dredging activity, all appropriate precautions would be implemented to insure protection of the manatee. The Contractor would stop, alter course, or maneuver as necessary to avoid operating moving equipment (including watercraft) any closer than 100 yards to a manatee. Operation of equipment closer within 50 feet of a manatee shall necessitate immediate shutdown of that equipment. The future maintenance of the navigation channel and placement of material in the approved placement sites will continue and use the same placement areas as with the current maintenance practices. As with project construction, USACE does not anticipate that any marine mammals would be adversely affected by material placement activities within the proposed disposal areas. There is a very low likelihood of possibility that a collision between marine mammals and the dredge or pipelines would occur since these are deepwater species. USACE does not anticipate the TSP will adversely affect these species. Additionally, future maintenance operations will continue to implement the manatee precautions to avoid animal within the dredging and placement areas.

5.12 Wildlife Resources

The Gulf coast, including Mississippi Sound and adjacent coastlines, are host to diverse wildlife communities. The coastal marshes, islands, and beaches provide resources and habitat that are utilized by moderate populations of mammals, birds, amphibians, and reptiles.

5.12.1 Birds

Over 300 species of birds have been reported as migratory or permanent residents within the area, including several species that breed here. Migratory birds utilize the Mississippi Sound and adjacent landforms such as intertidal flats, marshes, beaches, and shrubby wetlands found in nearshore and coastal areas. The project area falls within the National Flyway, as shown on **Figure 3-15**. Coastal habitats provide feeding, nesting, resting, and wintering habitat for numerous resident and migratory bird species.

Shorebirds found in the area include osprey, great blue heron, great egret, piping plover, sandpiper, gulls, brown and white pelicans, American oystercatcher, and terns.

5.12.1.1 No Action Alternative

Under the No Action Alternative, year-round and migratory birds would continue to utilize the area without additional disruption from localized temporary impacts.

5.12.1.2 Tentatively Selected Plan

Marine and coastal birds commonly use the project area of the TSP for foraging, and adjacent islands for nesting, roosting, or stopovers during migration. Foraging birds may be disturbed during dredging activities. Noise from dredging may deter birds from frequenting the vicinity during operations. Increased turbidity from dredging would temporarily decrease foraging birds from foraging in deep-water areas. However, there are ample foraging opportunities available elsewhere in the Gulf and Mississippi Sound. Upon completion of new work activities, birds would be expected to resume normal use of the area. Any impacts would be expected to be localized, temporary, and negligible.

Placement of material in the Pascagoula ODMDS is not close enough to any birding habitat to cause disruption of migratory or resident bird life activities. Placement of material at Cat Island North BU site would occur in the nearshore and not directly on the barrier island. Any impacts to nesting and roosting behavior would be temporary and negligible.

5.12.2 Terrestrial Mammals

Terrestrial mammal species likely to be found in the project area are common on adjacent Mississippi coastline and barrier islands and are opportunistic species such as the nine-banded armadillo (*Dasypus novemcinctus*), opossum (*Didelphis marsupialis*), and raccoon (*Procyon lotor varius*) (NPS GINS, 2021). Additionally, Fox (*Vulpes sp*.) and coyotes (*Canis sp)* may inhabit the area. The swamp rabbit (*Sylvilagus aquaticus littoralis*) may also be found throughout the coastal marshes of Mississippi.

5.12.2.1 No Action Alternative

Although the project area is contained within a watered environment, adjacent lands, such as the barrier islands and mainland beaches, support terrestrial mammals and their preferred habitat. Under the No Action Alternative, terrestrial mammals would continue to utilize these areas without additional disruption from localized temporary impacts.

5.12.2.2 Tentatively Selected Plan

Under the proposed TSP, the project area occurs within the watered environment but there are adjacent lands, such as barrier islands and mainland beaches in vicinity of the operations. The proposed TSP would unlikely disturb these terrestrial animals from using the habitat. Cat Island North BU site would create additional habitat for future use by these terrestrial animals.

5.12.3 Reptiles and Amphibians

Reptiles and amphibians inhabit marshes, beaches, and intertidal marshes found in coastal Mississippi. For example, the Gulf coast toad (*Incilius nebulifer)* occurs in a wide range of habitats, both natural and human-altered including coastal prairies, barrier beaches in towns and natural communities of southern coastal Mississippi. These types of habitats provide resources for breeding, foraging, and protective shelter from predators for a diversity of reptile and amphibian species present within the project area of the TSP.

5.12.3.1 No Action Alternative

Reptiles and amphibians may inhabit adjacent shoreline habitat. Under the No Action Alternative, reptiles and amphibians would continue to utilize the area without additional disruption from localized temporary impacts by routine maintenance events.

5.12.3.2 Tentatively Selected Plan

Under the proposed TSP, which includes future O&M, reptiles and amphibians would continue to utilize the areas without disruption.

5.13 Invasive Species

As described in Section 3.12.1, the exotic greenhouse frog (*Eleutherodactylus planirostris*) has been documented as present in Harrison County. It is known to inhabit urban areas. Marine invasive species are also documented to be present in the Gulf of Mexico and could be within the waters of project area. Species include the spotted jellyfish, (*Phyllotrhiza punctata*), and Lionfish (*Pterois volitans and P. miles).* Specific details regarding these species and habitat are presented in Environmental Appendix - C.

5.13.1 No Action Alternative

Under the No Action Alternative, existing conditions in the watered project area would continue. There would be no expected environmental changes that would cause proliferation or reduction of invasive species in association with maintaining the navigation project. In addition to federal guidelines, the Ports Operations and Procedures manual provides direction for managing overseas waste in Part 301, Chapter 32: Overseas Waste/Garbage.

5.13.2 Tentatively Selected Plan

Port of Gulfport implements the USCG regulations that prohibit water discharge, including ballast water, into the Harbor and channel to prevent the spread of invasive aquatic species. Ballast water is the largest single vector for nonindigenous species transfer and, under the provisions of the National Invasive Species Act, the USCG requires all vessels, foreign and domestic, equipped with ballast water tanks that operate within U.S. waters to comply with 33 CFR Part 51 regarding treatment and

management protocols (as described in Section 3.8.2). The USCG final rule regarding discharge of ships' ballast water was effective on June 21, 2012 (77 Fed. Reg. 17254).

Port customers and shippers also follow U.S. Department of Agriculture regulations to prevent invasive species from entering through cargo. Customs and Border Protection enforces these standards by monitoring the Port continuously. The Port also outlines their direction for managing overseas wastes in the MSPA Statute of Operations and Procedures manual that addresses foreign generated refuse in order to isolate any potential materials that could cause the introduction or spread of exotic invasive plant or animal species into Mississippi from foreign lands or waters. With these safeguards in place, it is unlikely implementation of the TSP would introduce or cause the continued existence or spread of invasive non-native species or noxious weeds into the environment.

Future maintenance will not result in additional impacts greater than current O&M activities of introduce or cause the continued existence or spread of invasive non-native species or noxious weeds into the environment.

5.14 Air Quality

5.14.1 No Action Alternative

Under the No Action Alternative, the proposed project would not be constructed. No air quality impacts from construction and enhanced channel improvements would occur. Maintenance operations would continue.

Due to the anticipated economic growth in the future, it is anticipated that on-port vessel calls would increase. It should be noted that this predicted increase could be conservatively high because of future increased usage at the Port. However, combustion engines used for vessels, trucks, locomotives, and non-road equipment could be lower fume emitting as a result of implementation of emission control programs on both Federal and state levels. The use of cleaner engines would partially offset the adverse emission impacts from an increased demand of harbor operational activities in the future.

5.14.2 Tentatively Selected Plan

The proposed deepening and widening of the Gulfport Harbor Channel would be a major construction project requiring either mechanical, hydraulic pipeline, and/or hopper dredges to be operating in the project vicinity over several years. Since the proposed dredging operation emissions would not take place along the channel at the same location for a long duration, impacts are considered minor and temporary resulting in less than significant air quality impacts to the community along the channel.

Increases in air emissions from additional equipment could occur, but due to the existing air quality and the minimal amount of population over the general project area, these increases would be minor and likely would not generate any additional health risks. Although a slight increase in risk to public and occupational health and safety may

occur during the construction process, this increase could be managed and would be insignificant and temporary.

Due to the upcoming increase of the number of Post Panamax vessels in the world fleet and the opening of the Panama Canal expansion, the transition of larger vessels in the Gulf of Mexico is anticipated to occur with the proposed channel deepening. Previous navigation analyses indicate that channel improvements alone will not have an impact on the forecasted demand of commodities handled at a particular port. The proposed channel improvements at Gulfport Harbor would allow for commodities to be transported through the harbor to move more efficiently. With this efficiently (carrying additional cargo per call), the total number of vessels meeting anticipated demand at the port during the 50-year period of analysis will decrease compared to the current channel configuration. As a result, it is predicted that the short-duration daily emissions at the Port, including vaporized volatile organic compounds released during the fueling process, could increase as a result of introducing large vessels, but the overall annual emissions associated with ship traffic would likely be no greater than the No Action Alternative under implementation of the TSP.

The modernized channel would deliver shipping efficiencies by allowing larger vessels, and by extension, more cargo per transit at the port, requiring more outbound transportation of the additional cargo by rail, cargo vessels, heavy-duty diesel trucks, and private automobiles.

5.15 Greenhouse Gas Emissions

CO_2 is the reference gas for climate change, as it is the GHG emitted in the highest volume. The effect of other (non-CO_2) GHGs on global warming is the product of the mass of their emissions and their global warming potential (GWP). The GWP indicates how much a gas is predicted to contribute to global warming relative to the amount of warming predicted to be caused by the same mass of CO_2. Net GHG emissions were calculated using the USACE NEAT version 1.1 which calculates net emissions and the social cost of GHG based on short-term construction and long-term operational emissions. The NEAT model leverages the benefits of pre-existing models by transitioning output from publicly available air pollutant and GHG emissions data sources, then integrates that data to compute net effects. The USACE ECO-PCX recently certified NEAT for national use in December 2023. A copy of the NEAT model data report for the Gulfport Harbor Feasibility Study, including output regarding existing conditions, is included in Environmental Appendix – C.

5.15.1 No Action Alternative

Under the No Action Alternative, the proposed project would not be constructed. No additional GHG emissions from construction and enhanced channel improvements would occur. Maintenance operations would still continue as shown in the FWOP scenario.

5.15.2 Tentatively Selected Plan

5.15.2.1 Construction and O&M Gross and Net Emissions.

The NEAT model calculated gross emissions for the Study are defined as short-term GHG emissions from construction plus long-term operational emissions. The 50-year operational GHG emissions were then subtracted from the gross emissions to calculate the net emissions for each action alternative. There are no impacts to wetlands or newly created wetlands to consider that could provide any carbon sequestration benefits. It is assumed that channel modifications will increase the efficiency of ship traffic, thereby reducing GHG emissions, but this reduction in emission could not be quantified.

All four alternatives would result in a temporary increase of GHG emissions during construction, consisting primarily of CO_2 from internal combustion engines as summarized in **Table 5.2**. Channel construction typically consists of at least one dredge and associated pump-out equipment, tugboats, barges, and other support vessels.

Table 5.2. Gulfport Harbor Feasibility Study GHG Emissions for FWOP and Four Alternatives

Alternatives	*Gross GHG Emissions (CO2e)	**Net GHG Emissions (MT CO_2e)	Review of Emissions calcs
FWOP	332,663	Not Applicable	Not Applicable
Alternative 10	660,325	317,428	327,662
Alternative 11	831,592	485,225	498,929
Alternative 13	965,984	616,900	633,321
Alternative	1,067,763	716,593	735,073

*Emissions units in metric tons of CO2 equivalent. Gross emissions = sum of the short-term construction + 50-yr O&M. No carbon sequestration potential identified.
**Net emissions = subtracted FWOP from Gross emissions.

5.15.2.2 Social Cost of Greenhouse Gases

The social cost of greenhouse gases (SC-GHG), calculated using the NEAT model, is defined as the monetary value of the net harm to society associated by adding a small amount of GHG to the atmosphere in a given year. It includes the value of all climate change impacts, such as (but not limited to) net agricultural productivity, human health effects, property damage from flood risk natural disasters, disruption of energy systems, risk of conflict, environmental migration, and ecosystem function. Gross SC-GHG emissions were calculated for the FWOP, whereas gross and net SC-GHG were calculated for the four alternatives by summing the net emissions from the GHGs and multiplying by the social cost of each GHG for the year in which they were generated. Social costs identified from the Interagency Working Group on total gross social costs for the FWOP and each alternative are summarized in **Table 5.3**. The FWOP and the

four action alternatives would result in long-term increase of GHG emissions. Channel modifications could increase efficiency of ship traffic, thus reducing emissions but this reduction could not be quantified.

Table 5.2. Gulfport Harbor Feasibility Study *Social Cost (SC) of GHGs for FWOP and Four Alternatives

Alternative	Gross SC-GHG (2020 US Dollars)	**Net SC-GHG (2020 US Dollars)
FWOP	$69,672,006	Not Applicable
Alternative 10	$142,312,731	$72,640,725
Alternative 12	$180,447,034	$110,775,028
Alternative 13	$209,040,509	$139,368,502
Alternative 14	$233,544,617	$163,872,611

*SC-GHG defined as monetary value of net harm to society associated with adding a small amount of that GHG to the atmosphere in a given year.
**Net SC-GHGs are calculated by subtracting the FWOP SC-GHG from the Gross SC-GHG.

5.16 Noise

This section describes the potential impacts to the airborne and underwater ambient sound environment.

5.16.1 No Action Alternative

5.16.1.1 Airborne Noise.

Under the No Action Alternative, current channel and harbor maintenance operations would continue. Traffic levels on main throughfares and surface streets are projected to slowly increase. Likewise, the projected port vessel calls would likely increase moderately in accordance with general population growth trends. According to the noise fundamentals, doubling source strength or traffic volume would result in a 3 dBA noise increase, which is a barely perceptible change to human hearing. Therefore, the anticipated increase in noise levels would be less than significant.

5.16.1.2 Underwater Noise

Under the No Action Alternative, there would be no increased dredging in Gulfport Harbor channel. Maintenance activities would continue as routinely scheduled. Under operational conditions, the underwater noise from individual vessels would remain consistent since it is anticipated that similar types of vessels would be present in the Harbor. Subsequently, under the No Action Alternative, no adverse underwater noise impacts would occur.

5.16.2 Tentatively Selected Plan

5.16.2.1 Airborne Noise

Direct impacts to noise levels would occur under the TSP. Noise impacts would be limited to project areas adjacent to Gulfport Harbor, where more population could be exposed. During construction, noise levels would increase from dredging and material placement activities. Sources of noise include dredge machinery (i.e. propulsion, pumping and aggregate handling). Although noise levels would temporarily increase, they would be minor and cease once construction operations are completed.

Direct impacts during future maintenance activities would occur near the harbor area, as few sensitive noise receptors are located near the channel. Noise at the harbor would increase while dredging was actively occurring. The possible addition of another dredge to complete maintenance activities would have a minimal impact on noise levels. Once the harbor portions of the maintenance dredging were complete, noise levels would return to normal. Since maintenance dredging already occurs within Gulfport Harbor, no additional impacts to airborne noise are anticipated. No indirect impacts to air noise are anticipated.

The future on-road traffic volumes along the truck routes used at the port were predicted to be slightly more than double the existing 2016 levels (see Section 5.21). Since a doubling of traffic volume would result in approximately a 3-dBA increase in traffic noise, it is anticipated that the future traffic noise increase along the truck routes would be slightly over 3 dBA but well below the 15-dBA substantial traffic noise increase that requires noise abatement. The on-road traffic noise impacts under the TSP would not be significant.

5.16.2.2 Underwater Noise

It is anticipated that the maintenance dredges presently being used in the harbor would also be used for harbor deepening and widening, with the addition of some dredges as necessary. The underwater noise levels for the TSP during the construction period would, therefore, be comparable to the No Action Alternative. Given the temporary nature of dredging activities, underwater noise impacts would be less than significant. The underwater noise conditions around Gulfport Harbor would essentially remain the same under the TSP with the exception of the likely presence of some large ships as compared to the current ship mix. Based on the available levels measured for a variety of marine vessels in a range of 157 to 182 dB at a distance of 3 ft, the noise levels from large ships are still below the range of Permanent Threshold Shift and Temporary Threshold Shift thresholds developed by the NMFS resulting in less than significant underwater noise impacts.

5.17 Hazardous and Toxic Materials

5.17.1 No Action Alternative

Under the No Action Alternative, current channel and harbor maintenance operations would continue. The levels of hazardous materials and petroleum products traveling through the channel and harbor would remain similar. Over the next 50 years, channel traffic may increase independently of a deepening and widening project. Therefore, under the No Action Alternative, hazardous materials in the channel may increase slightly, but would only be related to vessels traveling in the channel and would be insignificant. Unless there is an unavoidable accident or other unforeseeable conditions, the transportation of hazardous materials and petroleum products should not harm human health or the environment.

Indirect impacts associated with hazardous materials and petroleum products in Gulfport Harbor channel are possible. If the channel is not widened and deepened, it is possible that the larger container ships would choose another available harbor for loading and unloading. This would result in less maritime traffic and less rail and vehicular traffic associated with the port. This would result in a decrease in the amounts of hazardous materials and petroleum products traveling in the project vicinity, but this decrease would be insignificant.

5.17.2 Tentatively Selected Plan

Under the TSP, no direct impacts to hazardous materials would occur. However, direct impacts associated with petroleum products would occur. During construction, petroleum product levels could increase in Gulfport Harbor channel area due to construction dredging and placement activities. Dredge equipment carrying fuels and other lubricants could be present in larger numbers, as additional dredges could be utilized, these increases would be minimal. These impacts would also be temporary. Once implementation of the TSP is complete, the equipment would leave the area and/or continue to conduct maintenance in other areas of the channel. Although petroleum product levels could temporarily increase, these increases would not be significant as levels would return to normal after dredging is complete. Although exposure risks may increase slightly due to the potential for more vessels in the channel and harbor during dredging operations, this increase would be minor.

With the improvements associated with the implementation of the TSP, it is anticipated that volume of petroleum products passing through Gulfport Harbor may increase. The level of increase at the various terminal would be limited by tank capacity, dock availability, and available land for expansion. Likewise, ships should be able to load to greater capacities and potentially increase the volume of products passing through the Port. The increased volume would be limited by the availability of storage space at the terminal.

All shipping and handling activities would require compliance with applicable Federal and state hazardous materials regulations. With compliance of state and Federal

regulations related to the transport and handling of hazardous materials, minor impacts would be associated with any additional volumes of hazardous materials associated with implementation of the TSP.

Direct impacts associated with hazardous materials and petroleum products due to future maintenance dredging required to maintain the new depth and width of the channel would be similar to those during construction operations and current maintenance activities. These temporary increases in petroleum products would be insignificant. Indirect impacts associated with hazardous materials and petroleum products are unlikely during maintenance dredging.

5.18 Cultural Resources

5.18.1 No Action Alternative

Under the No Action Alternative, the proposed project would not be implemented. Dredging O&M would remain unchanged within the current Gulfport Harbor Channel. Under this scenario no historic resources would be disturbed or impacted.

5.18.2 Tentatively Selected Plan

The APE of the widening, deepening and new extension of the Gulfport Harbor Channel has a potential for cultural resources, including prehistoric sites on now-submerged landforms as well as historic shipwrecks. A Phase I submerged cultural resources survey was conducted within the APE for the widening and extension of the Gulfport Harbor Channel. Results of the survey are forthcoming. Section 106 coordination and consultation will be conducted with the Mississippi and Louisiana SHPOs and Tribal Partners.

5.19 Coastal Barrier Resources

A 2.5-mile segment of the Gulfport Harbor channel runs through CBRA Unit MS-01P, as depicted on **Figure 3.13** and described in Section 3.18 . No future maintenance dredge material will be placed in any identified CBRA units.

5.19.1 No Action Alternative

Under the No Action Alternative, current channel and harbor maintenance operations would continue to utilize the identified placement areas under the current MDEQ Section 401 water quality certification for Gulfport Harbor. USACE will continue to implement BMPs and turbidity measures in compliance with the current MDEQ water quality certification for the Gulfport Harbor O&M project.

5.19.2 Tentatively Selected Plan

The 2.5-mile segment of the channel within CBRA Unit MS-01P could be affected by the proposed TSP. This project is under navigation servitude. Section 6 of CBRA permits certain Federal expenditures and financial assistance within the CBRS, but only after consultation with the USFWS. Specifically, “maintenance or construction of

improvements of existing Federal navigation channels (including the Intracoastal Waterway) and related structures (such as jetties), including the disposal of dredged materials related to such maintenance or construction. A Federal navigation channel or a related structure is an existing channel or structure, respectively, if it was authorized before the date on which the relevant System Unit or portion of the System Unit was included within the CBRS (16 U.S.C. § 3505(b))." The USACE, Mobile District will consult with the USFWS pursuant to CBRA.

5.20 Protected Managed Lands

Both the No Action Alternative and the TSP are within a watered environment. There would be no expected environmental changes to protected lands managed by resource agencies in association with maintaining the navigation project.

5.21 Aesthetics and Recreation

Opportunities for recreation along the Gulfport coast include arts and entertainment, boating, golfing, sightseeing, picnicking, swimming, bird watching, and fishing. Mississippi's Gulf Coast borders the Mississippi Sound and the Gulf of Mexico, which provide ample opportunity for boating, swimming, and fishing on coastal beaches. Mississippi's coastline is home to beaches along the Gulf which provides quality of life for many local and visiting tourists that contributes greatly to the State's economy, being recognized as valuable eco-tourism asset. Both the No Action Alternative and the TSP would have a slight impact to aesthetics but only short-term and localized impacts; and therefore, not significant.

5.22 Socioeconomics

This section describes the potential impacts to socioeconomics should the proposed TSP or No Action Alternative be implemented. Components of socioeconomic resources analyzed include population, employment, and income. The Region of Interest (ROI) encompasses the city of Gulfport in Harrison County, which is the geographic area where predominant social and economic impacts of the TSP are likely to occur.

5.22.1 No Action Alternative

Under the No Action Alternative, the existing socioeconomic conditions would be expected to remain as present for the short-term. However, medium to long-term detrimental economic impacts may result from the No Action Alternative as the Port may not reach full potential which could negatively affect the State of Mississippi's share of global trade. International trade could hinder long-term growth trends causing an indirect negative impact to employment levels, salary levels, and tax collections in the ROI and state.

5.22.2 Tentatively Selected Plan

The direct economic impact associated with dredging activities would be short-term, minor, and beneficial to the local economy. Materials and services (primarily fuel) may be purchased locally. Onsite transient construction workforce would increase during project activities, indirectly benefiting the hospitality and service industries for accommodations, food, and entertainment purchases. Future maintenance of the navigation channel would be no greater than current conditions after project construction and no additional impacts in the project area are expected to occur. The adverse environmental impacts of implementation of the proposed action during construction are minimal and temporary in nature and include reduced air quality, increased noise from dredging operations and increased traffic from workers. These environmental impacts can contribute to socioeconomic impacts. Traffic would not be impacted due to the small amount of workers changing rotations on the dredge equipment, such that air quality, noise and traffic impacts would not contribute to adverse socioeconomic impacts. Overall, socioeconomic impacts from implementation of the RP are anticipated to be positive and short-term during construction although small relative to the total economy of the coastal Mississippi.

5.23 Environmental Justice

This section provides a summary of the potential impacts to the Environmental Justice (EJ) communities in the project's area of influence should the No Action Alternative or proposed TSP be implemented. A more detailed analysis concerning Environmental Justice is presented in Environmental Appendix C1.

5.23.1 No Action Alternative

Under the No Action Alternative, the existing conditions in the proposed project area would remain the same. Due to the projected economic growth, it is anticipated that on-port vessels calls would increase. Therefore, increasing landside traffic, accidents, and other factors with respect to underserved communities could occur in the Gulfport area over a medium to long-term period of time. See Appendix C1 for a detailed EJ Analysis.

5.23.2 Tentatively Selected Plan

The adverse environmental impacts of implementation of the Recommended Plan are minimal and temporary in nature. These include air quality, increased noise from dredging operations and increased traffic from temporary workers. See Appendix C1 for a detailed EJ Analysis of potential impacts due to the proposed Gulfport Harbor expansion.

5.24 Transportation

5.24.1 No Action Alternative

Under the No Action Alternative, no changes to the current transportation system would occur. Maintenance dredging of the harbor and channel would continue. Future channel

traffic and harbor operations will increase independently of a deepening and widening project, possibly leading to increased traffic on local roads and railroads. Vehicular traffic volumes in the Gulfport area will also increase proportionally but would be insignificant.

5.24.2 Tentatively Selected Plan

During construction, harbor operations are expected to continue without construction related interruption. Normally, one dredge operates in the channels for maintenance activities but the TSP may require multiple dredges. Dredges are required to not obstruct navigation. Therefore, no significant change to existing transit methods and ingress and egress routes of goods in the harbor are anticipated. Additional workers may be required during construction but would not impact existing road traffic characteristics in the area. No change in surface transportation routes used to and from the harbor are anticipated as a result of construction. Direct impacts to harbor traffic and surrounding transportation systems would be minor with implementation of the TSP. Direct impacts to transportation over the long-term are possible. Although the harbor and channel improvements are not predicted to increase the volume of shipped products through the harbor, the larger vessels could alter transporting larger volumes at once. This may increase local roadway traffic during loading/unloading operations as more longshoremen may be required for handling the larger vessels. Although fewer unloadings may occur, each would require more service vehicles.

Indirect impacts during construction would be insignificant as dredging equipment would yield to vessel traffic, thus minimizing altering water or land transportation patterns. The increase of workers commuting to/from the project area would not increase traffic on area roadways. Port traffic associated with improvement is expected to increase in post-construction operations. An anticipated reduction in the number of large shipping vessels over time as shipping larger volumes per call enhances Port efficiency. Overall, switching from a higher number of smaller to fewer larger vessels would not be considered a significant impact to transportation.

5.25 Infrastructure

This section provides a summary of the potential impacts to the area's utilities and infrastructure should the proposed TSP or No Action Alternative be implemented.

5.25.1 No Action Alternative

Under the No Action Alternative, no changes to the current infrastructure system would occur. Maintenance dredging of the harbor and channel would continue. Maintenance of existing facilities and surrounding access corridors would continue to occur but would be insignificant.

5.25.2 Tentatively Selected Plan

There is an existing active petroleum pipeline that crosses the Gulfport Harbor Sound channel just north of Cat and Ship Island, as described in Section 3.23 The active

pipeline is at a depth of -80 ft below MLLW at the channel crossing and poses no threat of impact to the TSP. An older pipeline was abandoned in-situ and is located approximately -55 ft below MLLW in the Sound channel crossing. The TSP includes a measure to address the abandoned pipeline by its removal as necessary to provide the needed clearance of the proposed deepened and widened channel depth.

No direct or indirect adverse impacts to utilities are anticipated from implementation of the proposed TSP or from future maintenance and operations activities. Any possible future installation of utilities would require coordination with USACE.

5.26 Public and Occupational Health and Safety

5.26.1 No Action Alternative

Routine Gulfport Harbor Channel maintenance operations would continue under the No Action Alternative. Other than routine operation and maintenance, no additional Federal dredging operations would occur in the Gulfport Harbor area. Therefore, no increased risks to public and occupational health safety are expected to occur.

5.26.2 Tentatively Selected Plan

Indirect impacts to public health and safety could occur with implementation of the proposed TSP. Additional workforce may temporarily increase traffic in the Gulfport area during activities which could lead to an increased risk of accidents. These minor risk increases to public and occupational health and safety would be temporary during construction activities and would be insignificant. The proposed action would expand the channel width in the project area allowing for increased vessel safety and maneuverability. With the compliance with Federal safety regulations and appropriate safety programs and processes, impacts associated with the implementation of the TSP on public and occupational health and safety would be minor.

6.0 Tentatively Selected Plan (TSP)

As stated in Section 4.9, Alternative 14 is the TSP and the details of its components are discussed in the following sections.

6.1 Plan Components

The TSP would deepen the channel by 10 feet and widen it by 100 feet, while maintaining existing side slopes. This will allow 1-way ship traffic of Post Panamax Generation 3 ships. **Table 6.1** shows both the current and new dimensions of the TSP for each channel segment.

Table 6.1: Tentatively Selected Plan Channel Dimensions by Segment

Channel Segment	Stations	Side Slopes	Current Depth (MLLW)	New Depth (MLLW)	Current Width	New Width
Anchorage Basin	9+20 to 50+75	1V:1H	-36	up to -46	300-400	400-500
Sound Channel North	50+75 to 362+00	1V:3H	-36	-46	300	400
Sound Channel South	362+00 to 612+00	1V:5H	-36	-46	300	400
Bar Channel	612+00 to end	1V:7H	-38	-48	400	500

Like the current channel project, the TSP includes 2 feet of advanced maintenance plus 2 feet of allowable overdepth, for a total of 4 additional feet of dredging beyond the proposed depth. These make the resulting maximum dredging depth -50 feet MLLW for the Sound Channel South, Sound Channel North, and the Anchorage Basin with the Bar Channel having a maximum dredging depth of -52 ft, MLLW. The Sound Channel South would have one bend from Station 440+00 to 477+50. The bar channel will be realigned by going from 2 bends to 3 bends, with a net extension of 10 miles. The first bend is from station 699+36 to 734+54, the second from station 1022+84 to 1051+80, and the third from 1167+00 to 1226+63.

Further, the TSP will construct a sedimentation basin near Ship Island from approximate station 625+00 to 665+00 along the eastern side of the channel. The sediment basin would have an additional 6 ft of depth, with a depth of -54 ft MLLW, with side slopes of 1V:7H. This catchment basin will allow high shoaling areas to be better maintained throughout the project life. Key TSP components in the Bar Channel are shown in

Figure 6-2 through **Figure 6-6**. Further details for the TSP components are found in Section 4.2 of Appendix A.

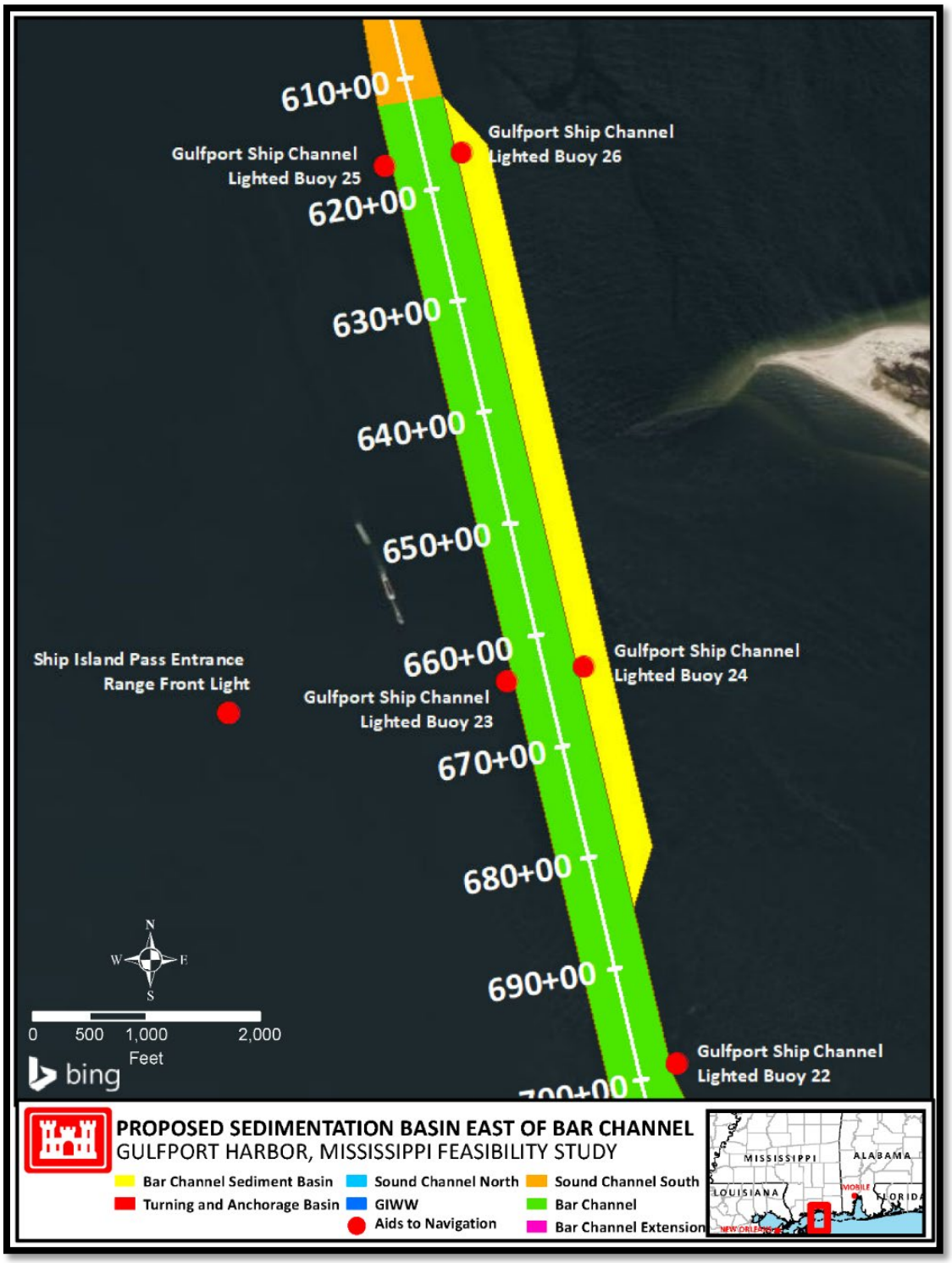

Figure 6-2: Sedimentation Basin

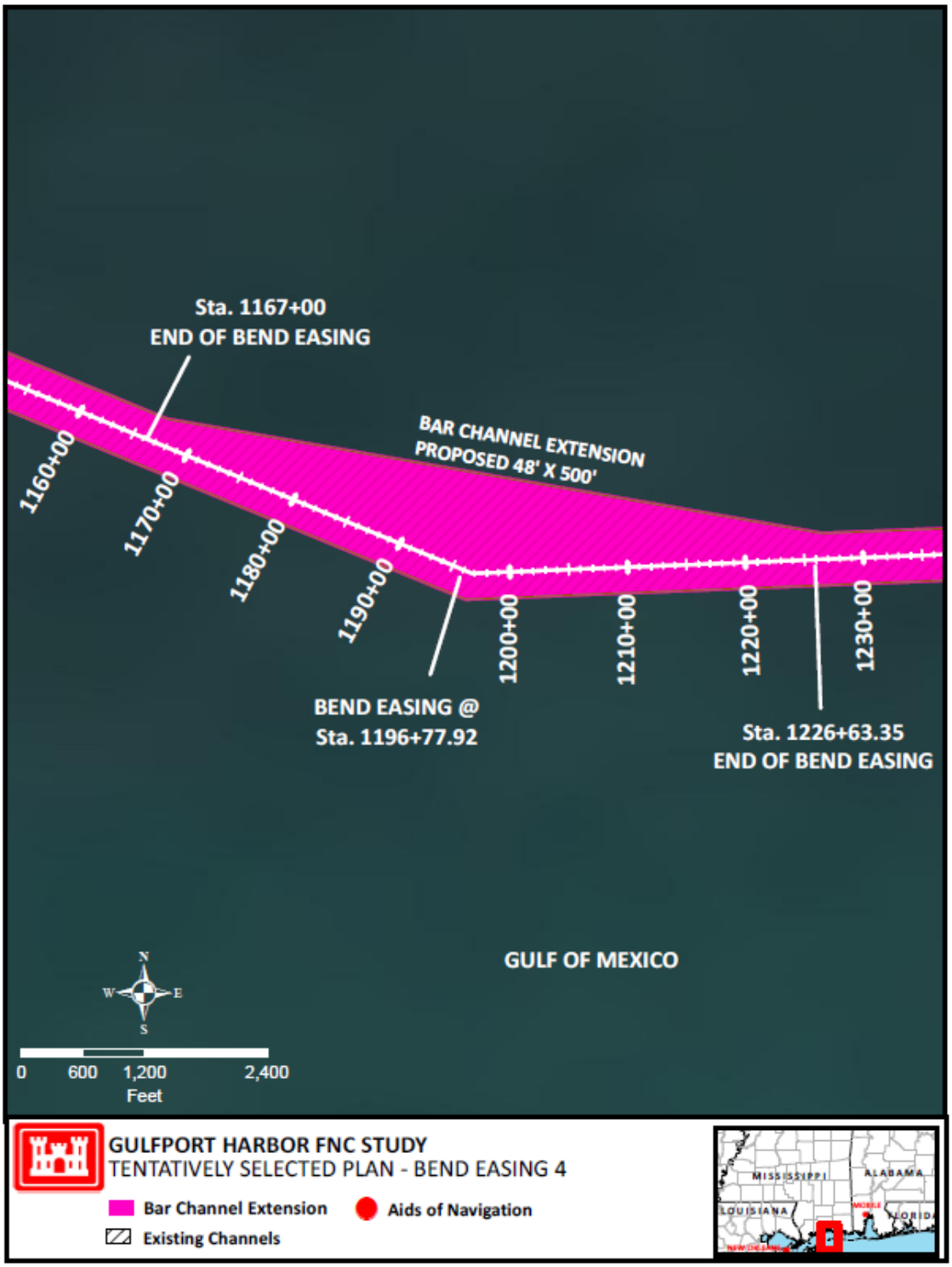

Figure 6-3: Bend 4 - New Bend in Bar Channel

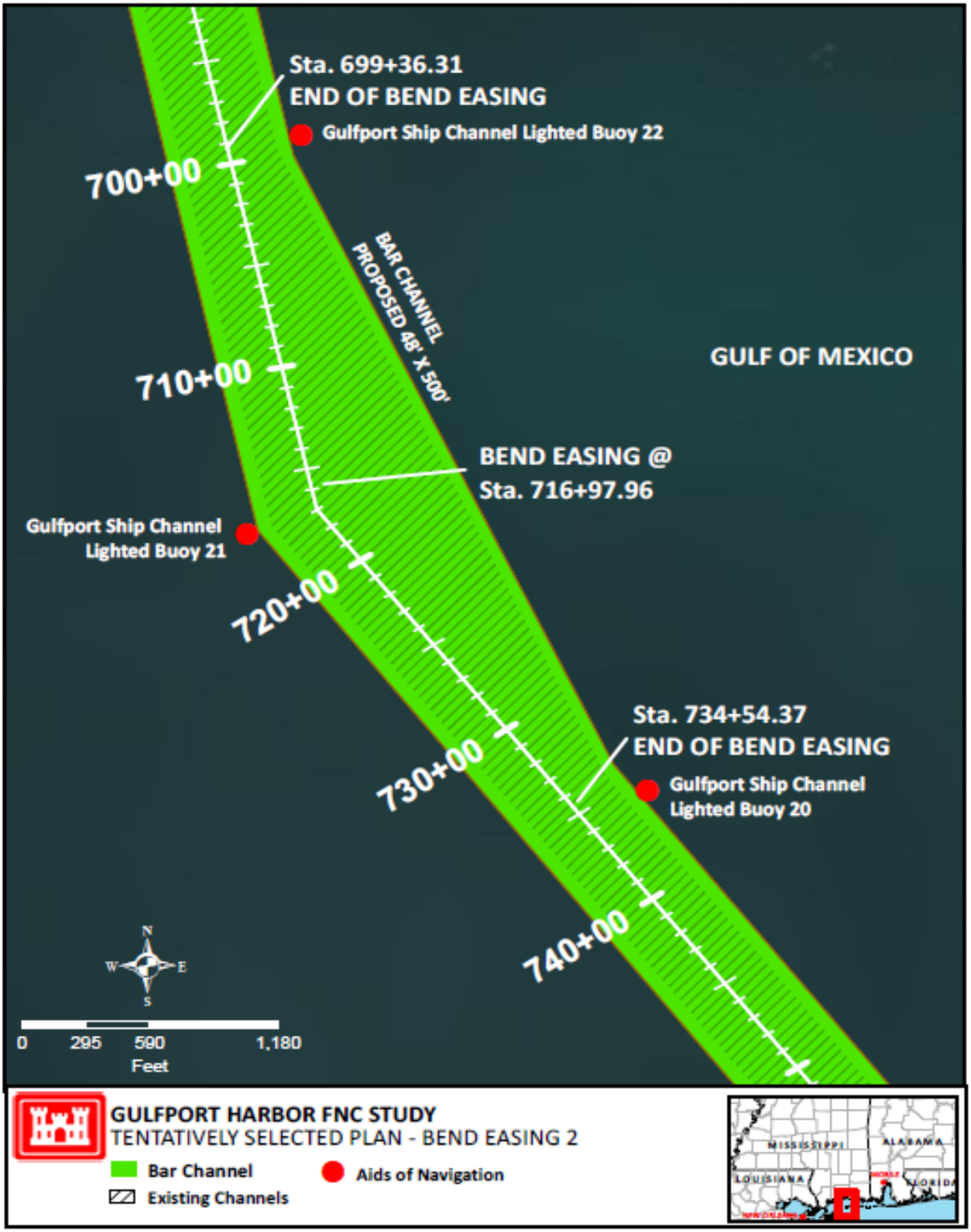

Figure 6-4: Bend 2 – Bend Easing for Bar Channel

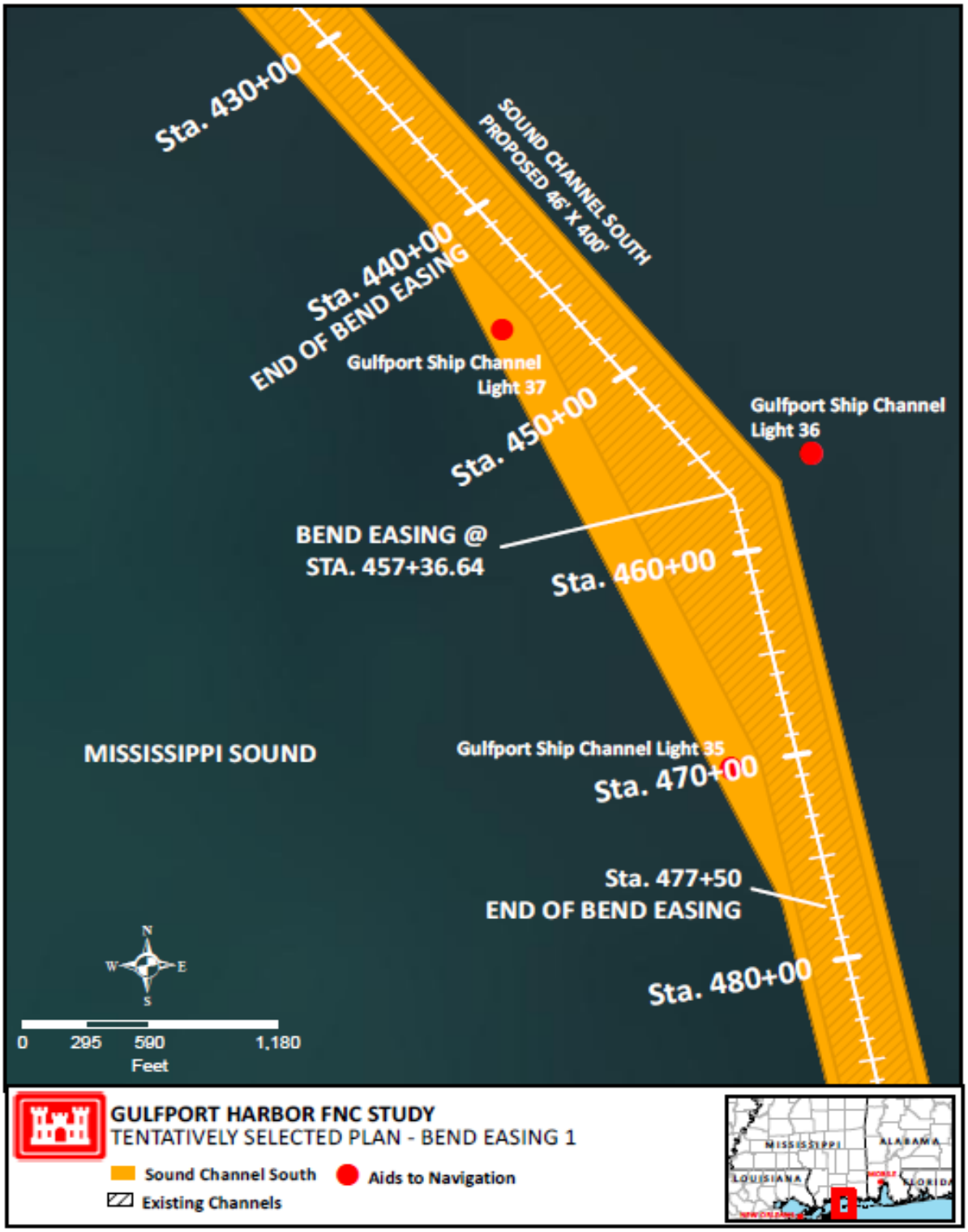

Figure 6-5: Bend 1 - Bend Easing for Sound Channel South

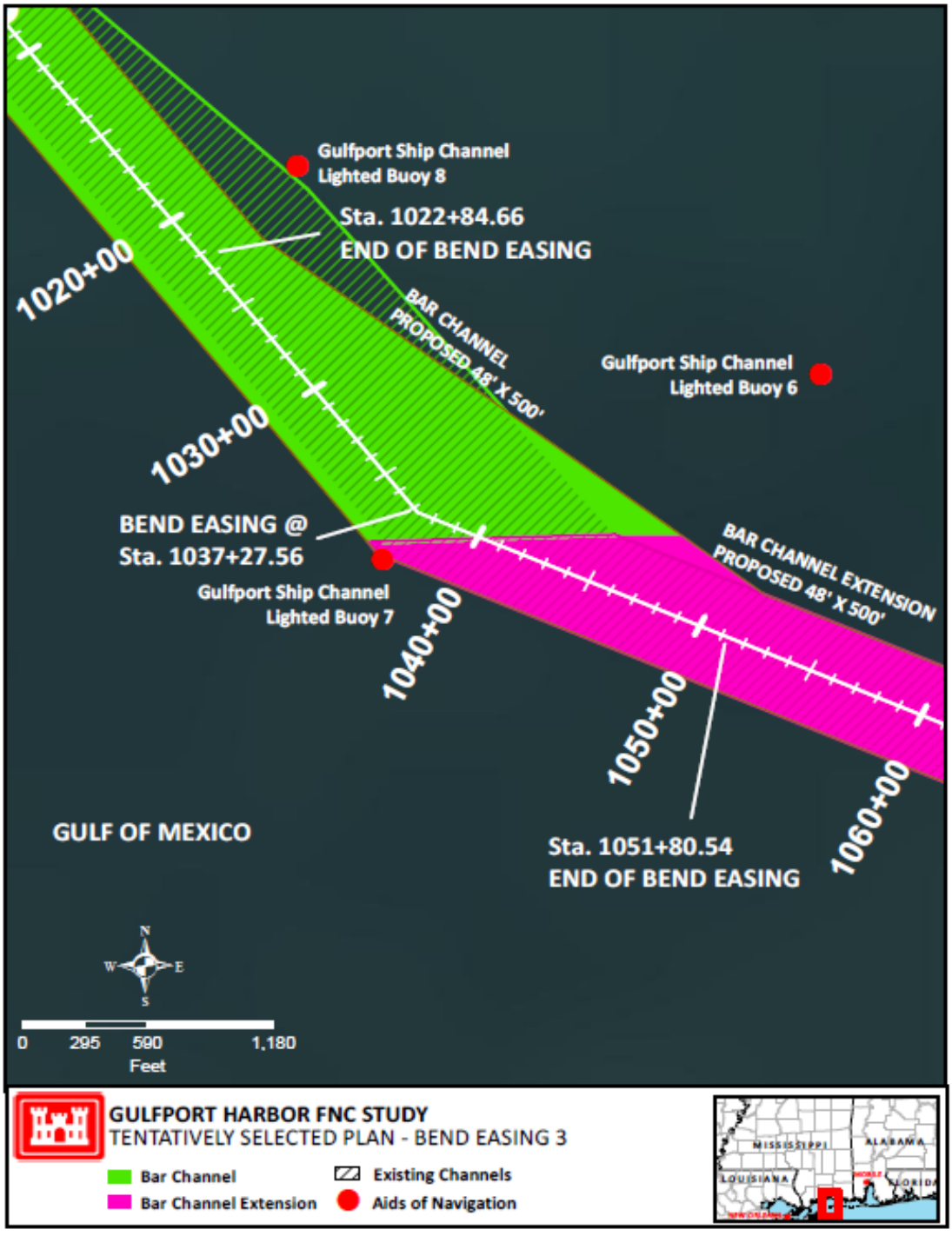

Figure 6-6: Bend 3 - Bend Easing for Bar Channel

6.2 Dredging and Dredged Material Management for the TSP

There is approximately 38 MCY of “new work” material. This material would be removed along with O&M material. Material placement was evaluated on a least anticipated cost framework, which is detailed in Appendix A1, to establish the federal standard. The evaluation included use of existing placement sites and beneficial use sites within the general Mississippi Sound area, shown in **Figure 6-7**.

Areas that were approximately the same distance from the channel as the Pascagoula ODMDS were screened out as they would have additional costs for containment above the placement cost. Cat Island North and South BUs, and direct placement on Cat Island are represented in **Table 6.2**.

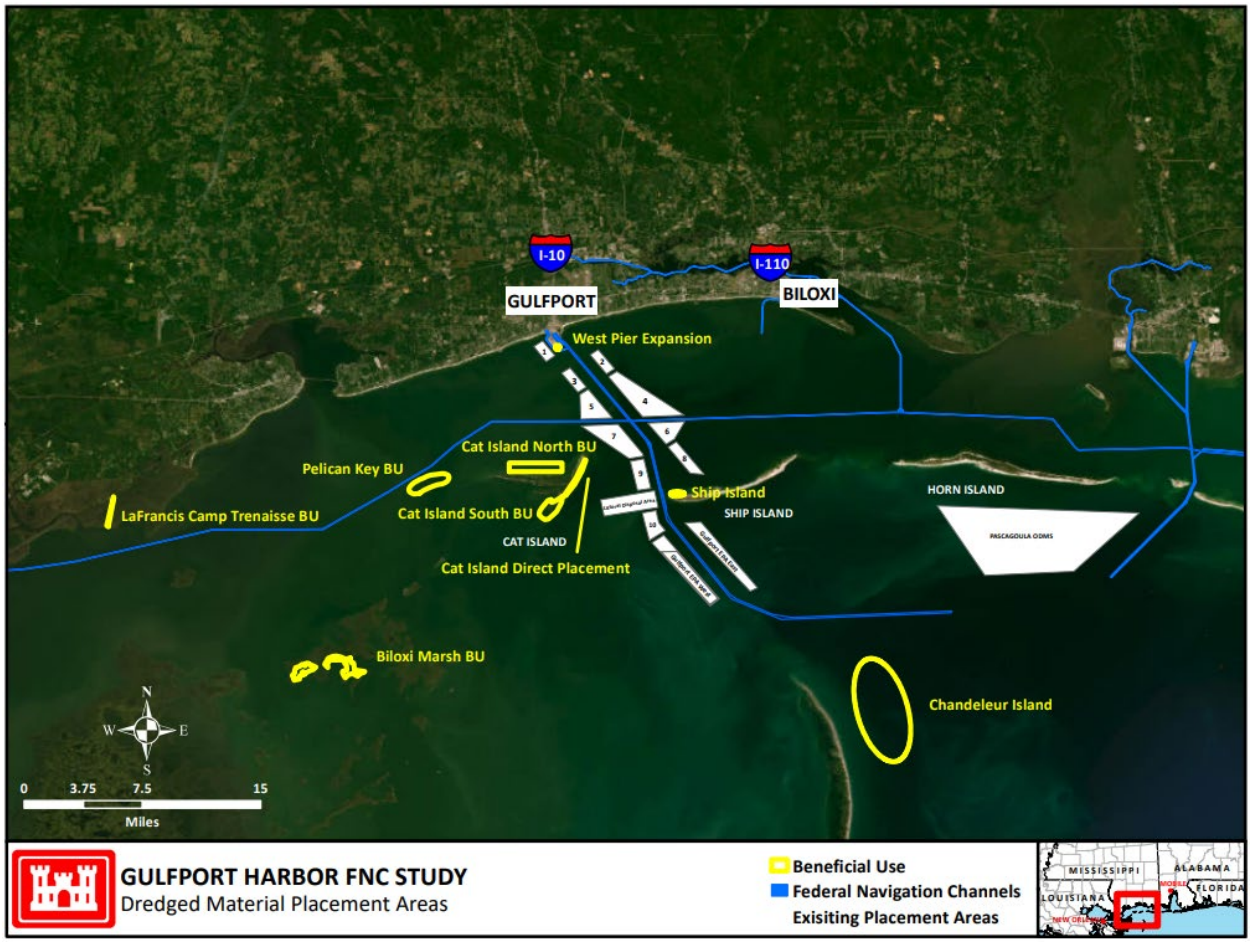

Figure 6-7: Potential Beneficial Placement Use Sites

Table 6.2: Beneficial Placement Comparison

Placement Option	Dredge Material Source	Capacity (MCY)	Containment Structure Cost	Total Cost
Cat Island North BU	Sound Channel, Anchorage Basin	26	$28.9M	$169.5M – $343M
Cat Island South BU	Sound Channel (Sand)	12 – 18	$13M (ALT 10) $36.9M	$164M – $406M
Cat Island Direct Placement BU	Sound Channel (Sand)	2	N/A	$184.5M – $420.4M

Since the Cat Island North BU site is the least cost placement option for the anchorage basin and sound channel material, it would be the preferred placement site for those reaches. In addition to being the least cost placement option, inclusion of beneficial use sites into the TSP increases project benefits. Beneficial use of dredge material for marsh creation can support biodiversity by creating new habitat for breeding, nesting, and foraging areas for fish, crustaceans, waterfowl, and shorebirds. This may result in additional tourism and recreation as the Mississippi Gulf Coast is a tourist destination for bird observing. Marsh creation also assists in reducing the atmospheric carbon dioxide since marches store carbon in sediments and plant biomass. The bar channel would still be transported to the Pascagoula ODMDS (**Table 6.3**).

Table 6.3. New Work Quantities by Channel Segment

Channel Segment	Quantity (MCY)	Placement Location
Turning and Anchorage Basin	1.6	Cat Island North BU
Sound Channel North	8.6	Cat Island North BU
Sound Channel South	7.6	Cat Island North BU
Sediment Basin/Bar Channel	20.2	Cat Island North BU & Pascagoula ODMDS
Total New Work Volume	**38**	
Note: Quantities include the authorized depths plus advanced maintenance and allowable overdepth.		

6.2.1 New Work Material Placement Options

Several placement site alternatives were evaluated for placement of new work material for the TSP. These included seven beneficial use areas (**Figure 6-7**) and the Pascagoula ODMDS. Further discussion on these elements is provided in the following paragraphs. Details of the capacity estimates for the beneficial use sites and the Pascagoula ODMDS are discussed in this report in Section 2.4.4 and Section 4.11, Engineering - Appendix A. The quantities and placement locations of new work dredged material described in the following sections represent the least costly placement alternatives that are consistent with sound engineering practices and meets all federal environmental requirements (i.e., the Federal Standard).

6.2.1.1 Beneficial Use Sites

The Cat Island North beneficial use project is intended to create tidal marsh habitat off the northwestern shore of Cat Island while providing beneficial use of dredge material for future dredging events, see **Figure 6-7**. Cat Island North is a 1,060-acre beneficial use site identified during a study to determine viable beneficial use options in the Western Mississippi Sound for MDEQ. (MDEQ, 2018) The site is located approximately 3,000 feet north of Cat Island and 11,500 feet from the Gulf Intracoastal Waterway centerline. Water depths in the area vary from 6 to 14 feet. The Cat Island North beneficial use site has the potential to create approximately 1,060 acres of marsh habitat. Construction of this site would create productive marsh habitat for various species of birds, fish, crustaceans, and other invertebrates. It is anticipated that this site could accept a single placement of approximately 26,000,000 cubic yards of dredge material. Additional placement events could occur to accept O&M dredge material depending on settlement rates occurring over time within the containment area. The Cat Island North site would be contained on the northern-facing side by 18,000 linear feet sand containment with rip rap protection and the remainder of the 19,000 linear feet of berms would be traditional sand containment berms. No sediment characterization requirements have been identified at this time. The preliminary design includes containment berms with a sediment core armored with stone which is typically allows for a mixture of both fine- and coarse-grained sediment. Further design for this site will be needed as this site was identified as the least cost option for placement of material from the turning and anchorage basin as well as the sound channel.

6.2.1.2 Pascagoula ODMDS

The Pascagoula ODMDS is located within the area surrounded by Horn Island to the north, the Pascagoula entrance channel to the east, the navigation safety fairway to the south and a north-south line running through Dog Key Pass to the west, see **Figure 6-7**. The existing ODMDS was selected by the USACE, Mobile District, under Section 102 of the Marine Protection Research and Sanctuaries Act (MPRSA). The site encompasses approximately 18.5 square nautical miles (15,680 acres) with water depths varying from 30 to 52 feet. Due to the large size of the site, the site can receive 3-5 MCY annually over the next 10 years without capacity concerns. If the placement volume exceeds

projections by more than 25%, capacity will need to be considered. (USACE, 2016) The Pascagoula ODMDS site is located approximately 12 miles east of the federal navigation channel. The material will be bottom dumped in this location which is the least-cost option for the new work material from the bar channel and bar channel extension. This site may also be used for future O&M material placement. The material to be placed within the site consists of mixtures of silts, clays, and sands in varying percentages.

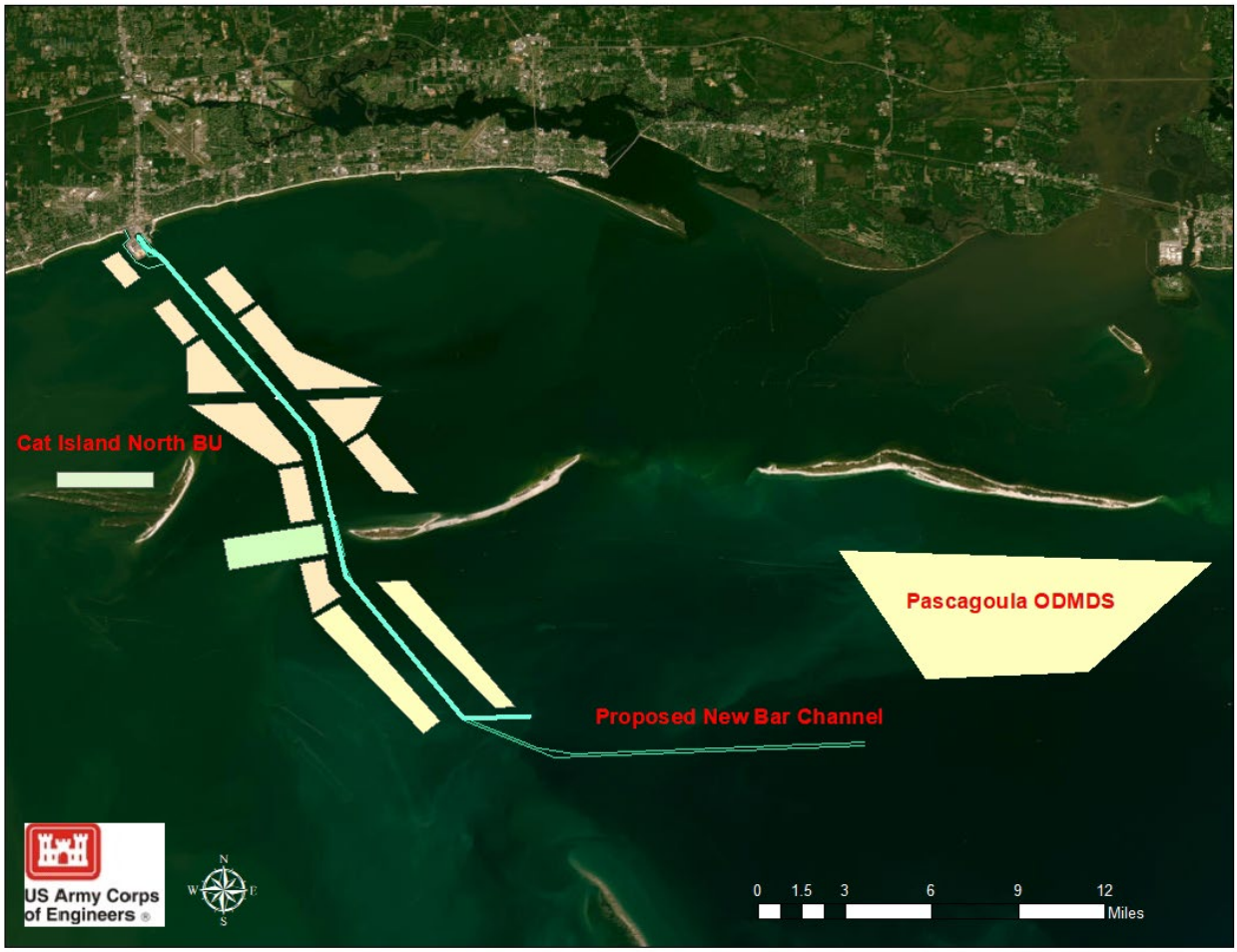

Figure 6-1. Preferred Alternative new work placement sites – Cat Island North BU and Pascagoula ODMDS

6.2.1.1 Open Water Placement (Federal Standard O&M)

A portion of the material dredged as part of the routine maintenance of the Sound Channel (primarily fine-grained sediments) is currently placed in the open water placement areas DA No. 1-10 adjacent to the channel (the remaining material is placed in the ODMDS). Sand from the bar channel is placed in the Littoral Disposal Area west

of the navigation channel. During the study, the team also considered adding an alternative to create a sand island within the footprint of the littoral zone to create habitat. O&M material for the sound or bar channel can also be placed in the ODMDS sites adjacent to the bar channel. The ODMDS sites are shown as EPA East and EPA West. NOAA nautical charts were reviewed for the open water placement sites. Based on the size, maintenance material characteristics and sediment transport within the Mississippi Sound capacity is not a concern for the next 20 years.

6.3 Construction Methodology

The Gulfport Harbor Channel Deepening is anticipated to be constructed in three (3) phases over 54 months. The phases of work will include Phase 1 – Sound Channel, Phase 2 – Anchorage Basin, and Phase 3 – Bar Channel. The Cat Island North containment structure will be included in the Phase 1 – Sound Channel construction contract. The work will be constructed utilizing various types of dredges.

6.4 Responsibilities and Cost Share

Navigation project costs up to 50ft in depth are cost shared at 75% Federal and 25% Non-Federal. The NFS is responsible for the costs to address any Lands, Easements, Rights-of-Way, or Relocations (LERR) as part of their 25% of the cost share. The breakdown of the costs is shown in **Table 6.4**.

Table 6.4: Federal and Non-Federal Cost Share Breakdown

Account	Federal (75%)	Non-Federal (25%)	Total
Construction	$265,700,721	$88,566,907	$354,267,628
PED	$4,014,093	$1,338,031	$5,352,124
Construction Management	$2,162,434	$720,811	$2,883,245
LERR's	$0	$6,023,216	$6,023,216
Total First Cost	**$271,877,248**	**$96,648,965**	**$368,526,213**

6.4.1 Federal Responsibilities

The Federal responsibilities include the design of the beneficial use sites, channel realignment, and beneficial use sites. It is also responsible for the dredging of the new channel depth, alignment, and sediment catchment basin. This includes maintenance dredging up to the authorized depth including advanced maintenance and allowable overdepth with placement of that material.

6.4.2 Non-Federal Responsibilities

The NFS is responsible for obtaining all LERRs needed to implement the project. This includes the relocation of any pipelines within the dredging template. They would also be responsible for continued upkeep and maintenance of all their berths and landside facilities associated with this project.

7.0 Environmental Compliance*

7.1 Cumulative Impacts

Cumulative impact is defined as the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or persons undertake such action. The regulations further state that cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time. As stated in Section 1.0, this integrated study has been prepared in accordance with NEPA and the 2024 40 CFR 1500-1508 regulations. In compliance, a thorough cumulative assessment to consider past, present, and future actions affecting the study area was conducted. Spatial bounds of the area are set by the completion of the improvements to the Gulfport Harbor Channel. Initial dredging of the federally authorized Gulfport Harbor Navigation Channel defines the baseline (past) whereas the future bound was set at 50 years.

A qualitative ecosystem analysis and social impact analysis were used to analyze effects to the resources. As noted in the MSPA's Draft EIS 2015, USACE's Supplemental EIS 2009, and other Federal and state documents, past activities within the surrounding area include the continued O&M of federally authorized navigation channels such as GIWW, Biloxi, Pascagoula Harbor, and Gulfport Harbor; navigational improvements to Gulfport Harbor in 2011, Port of Gulfport Restoration Project, City of Gulfport's Small Craft Harbor redevelopment, widening of the Pascagoula Lower Sound/Bayou Casotte Channels, Gulfport Harbor Bend Easing, and MSPA's anchorage basin deepening; BU sites such as the Biloxi Marsh; Mississippi Coastal Improvements Program projects such as the Shearwater Bridge erosion control, Long Beach Canals, Harrison County Beaches and Dunes, Deer Island ecosystem restoration, Courthouse Road flood damage protection and ecosystem restoration, Forrest Heights Levee, and Barrier Island Restoration (Ship and Cat Islands); infrastructure improvement projects such as roadway expansions, KCS Rail Improvement, ecosystem restoration efforts such as Acquisition and Restoration of flood-prone properties for Greenspace, Oyster Bayou restoration, Biloxi River/Tchoutacabouffa River/Henderson Point Greenways, and Blakeslee Preserve Habitat Restoration. The Maritime Commerce Center, Mississippi Department of Transportation's Interstate 310 project, and other widening efforts of Interstate 10 are considered foreseeable future projects. Construction of the comprehensive Deer Island ecosystem restoration is considered another reasonably foreseeable action as funding has been allocated for the project. The USACE Mobile District also has funding to complete a beach restoration project along Harrison County and is currently in the design phase.

Two noteworthy resources to evaluate for cumulative effects of the physical environment are (1) hydrology and (2) water quality. Other resources considered include geology and soils, climate, air quality and GHGs, and hazard materials; however, cumulative impacts were not identified for these resources and are not

discussed further. Though Gulfport Harbor's strategic location along the Gulf of Mexico has been a destination for vessels for more than 300 years, the present date Port was officially established in 1902. Since that time, the navigation channel has had various channel improvements and routine O&M dredging. Minimal to no changes in circulation, salinity and temperature were recorded as part of the HD modeling performed by ERDC. The majority of environmental impacts associated with the project will be temporary, and in some cases, result in beneficial impacts to the region. One of the long-term cumulative impacts associated with the projects will be increased economic opportunity in terms of the number of jobs created and stimulus to the local economy. The proposed TSP will likely contribute temporary and localized adverse impacts to air quality, traffic, and noise. It is anticipated that the proposed TSP, in combination with other evaluated projects, will not have significant cumulative adverse effects on environmental resources. Existing governmental regulations will address the issues that influence local and ecosystem-level conditions. Natural resources in the area are provided protection through coordination with stakeholder groups, local organizations, and State and Federal regulatory agencies implementing regulations such as the CWA, ESA, NEPA, CZMA, and the CAA. This collaboration and regulation of impacted resources should avoid and minimize impacts that could contribute negative cumulative impacts in the region.

7.2 Environmental Regulatory Compliance

This section provides an overview of the laws, regulations and EOs reviewed to ensure compliance by this IFR/EA and implementation of the TSP. If applicable, the compliance actions and consultation activities taken by the USACE are noted.

7.2.1 National Environmental Policy Act of 1969 (NEPA), as amended, 42 U.S.C. 4321 et. seq.

This Draft IFR/EA and FONSI have been prepared in accordance with NEPA guidance to disclose and analyze environmental impacts. Analysis of potential impacts from the TSP found that the total impacts are not considered significant. Most impacts are minor, localized or temporary in nature, with no long-term or permanent loss of protected species or habitat, and no degradation to environmental quality within or immediately adjacent to the project footprint. These findings determined that preparation of an EIS is not required. Upon approval, the District Commander will sign a FONSI.

7.2.2 Clean Water Act

The CWA authorizes USEPA and USACE to regulate activities resulting in a discharge to navigable waters. Section 401 Water Quality Certification will be obtained for the TSP from MDEQ. A Section 404 (b)(1) evaluation report is included in Environmental Appendix C. The report indicates no further physical, biological, or chemical testing is required pursuant to the 404(b)(1) guidelines. Based on information presented, no mitigation requirements have been identified or are planned at this time.

7.2.3 Federal Coastal Zone Management Act (CZMA), 16 U.S.C. 1451 et. seq

The CZMA (16 U.S.C. § 1451 et seq.) was enacted by Congress in 1972 to develop a national coastal management program to comprehensively manage and balance competing uses and impacts to coastal areas or resources. According to the requirement, 16 U.S.C. § 1456, Federal actions must be consistent with a state's federally approved coastal management program to the maximum extent practicable. MDMR implements the state coastal management program in partnership with NOAA. USACE, Mobile District determined the proposed TSP is consistent with the Mississippi Coastal Program to the maximum extent practicable and is requesting concurrence with this determination.

7.2.4 Coastal Barrier Resources Act (CBRA) of 1982

The CBRA (PL 97-348) restricts Federal expenditures and financial assistance within designated CBRA zones on the Gulf and Atlantic Coasts. -Coordination with USFWS will be conducted as part of this study.

7.2.5 Clean Air Act (CAA) as amended 1990, 42 U.S.C. 7401 et. seq.

The CAA authorizes USEPA, delegated to the states, to regulate emissions of airborne pollutants. Under the CAA, states must develop State Implementation Plans (SIPs) to regulate and remediate areas exceeding applicable air quality standards. The project area is in attainment for all NAAQS. The potential air quality impacts resulting from this project are discussed in Section 5.14.2 that concluded emissions from implementation of the TSP would be minor and temporary.

7.2.6 EO 13990 – Protecting Public Health and the Environmental and Restoring Science to Tackle Climate Change

On January 20, 2021, EO 13990 was signed, which rescinded CEQ's 2019 guidance on GHGs and climate change related to NEPA. On January 9, 2023, CEQ released *NEPA Guidance on Consideration of Greenhouse Gas Emissions and Climate Change* (GHG Guidance) (CEQ, 2023)ts. GHG emissions analysis was conducted for this feasibility study and is presented in Section 3.14 and Section 5.15

7.2.7 U.S. Fish and Wildlife Coordination Act, 16 U.S.C.661-666(c)

The Fish and Wildlife Coordination Act (FWCA) of 1934, as amended, requires consultation and coordination with USFWS and state fish and wildlife agencies (16 U.S.C. § 662(a)). On February 21, 2024, USFWS submitted the initial Planning Aid Letter (PAL) for the preparation of the EA as part of this integrated report; a copy of the USFWS PAL can be found in Environmental Appendix C. The Draft Fish and Wildlife Coordination Act Report (FWCAR) is included in Environmental Appendix C.

7.2.8 Endangered Species Act of 1973

ESA, administered by USFWS and NMFS-PRD, establishes a national policy to protect and conserve threatened and endangered species and their habitats. USACE, Mobile District is consulting with both USFWS and NMFS-PRD.

7.2.9 Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), 16 U.S.C.1801 et seq.

MSFCMA requires Federal agencies assess potential impacts to EFH for NMFS-HCD managed commercial fisheries and requires EFH requires consultation for any Federal action that could be adversely affected. Analysis of EFH is found in Section 0. USACE, Mobile District will consult with NMFS-HCD pursuant to MSFCMA.

7.2.10 Anadromous Fish Conservation Act (AFCA), 16 U.S.C. 757, et seq.

The AFCA authorizes cooperative agreements with states and other non-Federal interests for conservation, development, and enhancement of anadromous fishery resources vulnerable to water resources developments, or by Federal government commitments to international agreements. One anadromous fish species (Gulf sturgeon) occurs in the project area. Based on the evaluation of potential impacts there would be minor and temporary impacts on these fish species. Because the overall impacts would not be significant, the TSP is compliant with the Act.

7.2.11 Marine Mammal Protection Act (MMPA), 16 USC 1631 et seq.

MMPA protects all marine mammals in U.S, waters and restrict importing them and their products into the U.S. Incorporation of safeguards used to protect threatened or endangered species during project implementation would also protect any marine mammals in the area; therefore, the TSP complies with this act.

7.2.12 Section 106 and 110(f) of the National Historic Preservation Act (NHPA), 54 U.S.C. 300101 et seq.

NHPA provides for the NRHP to include districts, sites, buildings, structures, and objects significant in American history, architecture, archaeology, and culture. The law seeks to preserve the historical and cultural foundation of the U.S. According to EO 11593 of 1991 (*Protection and Enhancement of the Cultural Environment)*, the Federal Government will provide leadership in preserving, restoring, and maintaining the historic and cultural environment. Consultation with the Mississippi SHPO has been initiated concerning the specific aspects of the TSP.

7.2.13 Marine Protection, Research and Sanctuaries Act (MPRSA)

MPRSA prohibits release of dredged material into the ocean that could degrade or endanger human health or the marine environment. Ocean disposal for dredged material cannot without a permit USEPA issued under the MPRSA. USEPA is

responsible for designating ODMDSs as well as inspection, and monitoring in compliance with dredged material placement permit conditions.

Previous sediment investigations in 2005 and 2011 indicated the Gulfport Harbor channel material is mostly free of pollutants. Dredged materials that are not feasible for BU will be placed at the Pascagoula ODMDS. Sediment testing to meet the MSRPA Section 103 ocean dumping criteria for placement in the Pascagoula ODMDS will be conducted during the PED phase.

7.2.14 EO 13112, Invasive Species

This EO was issued in 1999 to prevent the introduction of both flora and fauna invasive species; provide for their control; and minimize the economic, ecological, and human health impacts associated with their establishment. This order, through management established by the Invasive Species Council, defines invasive species, requires Federal agencies to address concerns, and to prohibit new actions that could introduce identified species into the environment. Invasive species discussed in Section **Error! Reference source not found.**were considered during the development of the TSP. The TSP would not provide introduction or spread of invasive species and would comply with this EO.

7.2.15 EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations; EO 14008 Update

EO 12898 sets forth the responsibility of Federal agencies to “make achieving environmental justice part of their missions by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of their programs and policies. EO 14008, signed by President Biden on January 27, 2021, established the White House Environmental Justice Interagency Council and White House Environmental Justice Advisory Council to help inform and oversee the Federal program on environmental justice to be led by the CEQ. EO 14008 makes clear that disadvantaged communities face numerous challenges because they have been marginalized by society, overburdened by pollution, and underserved by infrastructure and other key services. In March 2022, the Assistant Secretary of the Army (Civil Works) established an environmental justice policy in the memorandum entitled, “Implementation of Environmental Justice and the Justice40 Initiative.” The Justice40 is a whole-of-government effort to ensure that Federal agencies work with states and local communities to provide at least 40 percent of the overall benefits from Federal investments to disadvantaged communities. An EJ Analysis was conducted on the proposed project to determine potential impacts as it relates to underserved communities. See the Environmental Appendix C1.

7.2.16 EO 13045, Protection of Children from Environmental Health Risks and Safety Risks

EO 13045, issued in 1997, directs each Federal agency to ensure that its policies, programs, activities, and standards address disproportionate risks to children that result

from environmental health or safety risks. The potential environmental health or safety risks to children resulting from implementation of a restoration alternative are addressed. Based on this evaluation, USACE has determined that the TSP sufficiently addresses EO 13045.

7.2.17 Migratory Bird Treaty Act, 16 U.S.C. 703 et seq.

MBTA of 1918 established Federal responsibility to protect birds migrating between the U.S. and Canada. In the U.S., the MBTA, protects 836 bird species, 58 of which are game birds, along with their eggs and nests. The MBTA prohibits “take” (to hunt, pursue, wound, kill, possess, or transport by any means) listed bird species, their eggs, feathers, or nests unless otherwise authorized, such as within legal hunting seasons. The project area is entirely within the open water but adjacent to two barrier islands that support migrating birds throughout the year. It would be highly unlikely that any impacts to migratory birds, including the piping plover, rufus red knot, or least tern, would occur. The TSP is in compliance with the Act.

7.2.18 Rivers and Harbors Act

Section 10 of the Rivers and Harbors Act of 1899 prohibits construction of structures or obstructions in navigable waters without the consent of Congress (33 U.S.C. § 407). Structures include wharves, piers, jetties, breakwaters, bulkheads, etc. The Rivers and Harbors Act also includes any changes to the course, location, condition, or capacity of navigable waters and includes dredge and fill projects in those waters. USACE oversees implementation of this law. The TSP is in compliance with Section 10 of the Rivers and Harbors Act of 1899.

7.2.19 Sunken Military Craft Act

The Sunken Military Craft Act (SMCA) was enacted on October 28, 2004. Its primary purpose is to preserve and protect from unauthorized disturbance all sunken military craft that are owned by the U.S., as well as foreign sunken military craft that lie within U.S. waters. The purpose of the SMCA is to protect sunken military vessels and aircraft and the remains of their crews from unauthorized disturbance. Its scope is broad, protecting sunken U.S. craft worldwide and sunken foreign craft in U.S. waters defined to include the internal waters, territorial sea, and contiguous zone (up to 24 nautical miles off the U.S. Coast). No sunken military craft is present within the TSP footprint.

7.3 Public Involvement, Agency Consultation, and Public Review

This section outlines the outreach strategy for the Gulfport Harbor, MS Feasibility Study to engage the public and resource agency stakeholders in the planning phase of the project.

7.3.1 Agency Coordination Scoping and Resource Meetings

7.3.1.1 Agency Scoping Meeting

An Interagency Scoping Meeting was held virtually on June 9, 2023, to introduce the preparation of the Gulfport Harbor, MS Feasibility Study for evaluating the deepening and widening of Gulfport Harbor Channel, including the preparation of a NEPA Document. The purpose of the meeting was to establish cooperating agency status per NEPA guidance, and to fulfill Section 1005 of the Water Resources Reform and Development Act (WRRDA) of 2014 Interagency Meeting Requirements. Federal and State of Mississippi resource agencies participated in the meeting presented by USACE, Mobile District along with the Non-Federal sponsor, the Mississippi State Port Authority (MSPA). The meeting discussed a variety of topics regarding the Port potential expansion of the Harbor and Federal Navigation Channel for improved operations and future growth of shipping as well as other economic interests while maintaining protective stewardship of environmental and cultural resources. The meeting was conducted via teleconference and webinar from the Mobile District, 109 Saint Joseph Street, Mobile, Alabama on June 09, 2023. A copy of the Interagency Scoping Meeting agenda, list of attendees, and minutes are included in Environmental Appendix C.

7.3.1.2 Public Scoping Meeting

USACE, Mobile District held a public NEPA scoping meeting on June 29, 2023, from 5:00 pm to 7:00 pm at the Westside Community Center, 4006 8th Street, Gulfport, MS 39501. The purpose of the informal workshop was to gather information to define issues and concerns for analysis during the Study in compliance with the NEPA guidelines. The general public were encouraged to provide scoping comments and information about environmental and cultural resources, and important features within the described project area. The USACE, Mobile District met with the public and also accepted written scoping comments regarding the proposed project via email sent to CESAM-gulfportharbormsfeasibilitystudy@usace.army.mil or by U.S. mail through July 21, 2023.

7.3.1.3 Resource Interagency Meetings

Recurring resource agency meetings were virtually hosted by the USACE, Mobile District after completion of the Study scoping phase signified by achieving the Alternative Milestone in June 2023. The overall purpose of the 30-minute meetings were to reacquaint the resource agencies with the Study objectives and progress, and to provide periodic updates of environmental topics of concern. A summary of the meetings and discussion topics is presented in **Table 7.1.** Meeting materials such as agenda, minutes, and supporting information are included in Environmental Appendix C.

7.3.1.4 Focus Group Meetings (Environmental Justice)

Focus group meetings have been held throughout the study process (**Table 7.2**). Focus Group Meetings to address Environmental Justice concerns within the Gulfport Community). Focus groups have included community interests and environmental non-

governmental organizations, Gulfport property owners and residential interests, and Environmental Justice communities. Details the focus group meetings are included in Appendix C1.

7.3.1.5 Comments Received and Response

All public comments received through the public involvement process and their general concern is addressed in this report can be found in Environmental Appendix C.

Table 7.1. Summary of Virtual Resource Interagency Meetings

Date of Meeting	Agencies Represented	Focus Topic
20 Nov 2023	Fed: USEPA, USFWS, NOAA, USACE State: DMDR, SHPO, MDEQ Other: MSPA, D.Hayes	Summary of Alternative Milestone Meeting, (19 Jul 2023). Included Focused Array of Alternatives: Modeling, BCR, Beneficial Use, Advanced Maintenance to be evaluated. Presented estimated timeline.
15 Dec 2023	Fed: USEPA, USFWS, NOAA, USACE, NPS State: DMDR Other: MSPA, D.Hayes	Environmental Regulatory Compliance underway: FWCA, ESA species lists, EFH data collection. Other updates: Environmental Justice recap of outreach meeting benefits and concerns; Engineering status of modeling underway.
23 Feb 2024	Fed: USEPA, USFWS, NOAA, USACE, NPS State: DMDR, MDEQ Other: MSPA, D.Hayes	Beneficial Use sites feasibility: Presented potential sites list and location information. Outlined the Federal Standard relative to costs; provided estimated material volumes. Open discussion with participants.
15 Apr 2024	Fed: USEPA, USFWS, NOAA, USACE State: DMDR Other: MSPA, D.Hayes	Summary of Geotechnical physical data of sediment surveys within and adjacent to the Gulfport Harbor Channel and open water disposal sites from 1956 to 2019. Addressed O&M and new work.
20 May 2024	Fed: USEPA, USFWS, NOAA, USACE State: None Other: MSPA, D.Hayes	Benthic Community associated with Gulfport Harbor surveys summary of data from within Study area, Port expansion and channel improvement projects, and Ship Island restoration monitoring.
15 July 2024	Fed: USEPA, USFWS, NOAA, USACE State: DMDR Other: MSPA, D.Hayes	ERDC Hydrodynamic Modeling draft results presentation. Modeling approach leveraged existing model and data. Four scenarios simulate future with and future without project to assess water quality for oysters and SAV. Outcome readjusted NEPA level from EIS to EA.

Table 7.2. Focus Group Meetings to address Environmental Justice concerns within the Gulfport Community

Date	Attendees	Purpose
11 December 2023	Selected Community Residents in Wards 1 and 2	Listening sessions to determine the community's concerns of the feasibility study and provide study updates.
22 January 2024	Selected Community Residents in Ward 3	Listening sessions to determine the community's concerns of the feasibility study and provide study updates.

8.0 List of Preparers

The PDT for the Gulfport Harbor Mississippi Feasibility Study was extensive. The PDT members providing substantial text to the GRR/SEIS are listed in **Table 8.1**.

Table 8.1. List of Preparers

Name (First Last)	Affiliation
David Newell	Coastal Resiliency Team Lead, Civil Works Programs and Project Management Branch, Mobile District
Mary Beth Sullivan	Project Manager, Civil Works Programs and Project Management Branch, Mobile District
Matt Lang	Lead Plan Formulator, Plan Formulation Branch, Mobile District
Tom Jester	Plan Formulator, Chief, Plan Formulation Branch, Mobile District
Valerie Morrow	Lead Coastal Engineer, Hydrology and Hydraulics Branch, Mobile District
Micah Wiggins	Engineer, Hydrology and Hydraulics Branch, Mobile District
Jennifer Purcell	Economist, Regional Economist, Southwest Division, Fort Worth District
Jennifer Jacobson	Chief, Environment & Resources Branch, Planning & Environmental Division, Mobile District
Kathleen McConnell	Lead Environmental Planner, Environmental Resources Branch, Mobile District
Valerie Powe	Environmental / EJ Coordinator, Planner, Environmental Resources Branch, Mobile District
Wendy Weaver	Archaeologist / Cultural Resources, Environmental Resources Branch, Mobile District
James McConnell	Geotechnical Engineer, Environmental Resources Branch, Mobile District
Lauren Walker	Cost Engineer, Technical Support Branch, Mobile District
Travis Dyess	Operations Manager, Operations Management Branch, Mobile District
Mike Alexander	Coastal Engineer, Hydrology and Hydraulics Branch, Mobile District
Russell Blount	Realty Specialist, Acquisition Branch, Mobile District
Jesse Hufstedler	Office of Counsel

9.0 Recommendation

I concur with the findings presented in this report. I recommend that the existing deep-draft navigation project at Gulfport Harbor be modified as described in this IFR/EA. Upon consideration to all significant aspects in the overall public interest, including environmental, social, and economic effects; and engineering feasibility; the TSP consists of the following modifications to the Gulfport Harbor Federal Navigation Channel:

- Deepen the existing Bar Channel (over station 615+00), Sound Channels (station 50+70 to 615+00), and Anchorage Basing (station 9+20 to 50+75) by 10 ft to project depths of -46, -46, and -48 ft MLLW, respectively, with an additional 2 ft for advanced maintenance plus 2 additional ft of allowable overdepth for dredging (total depths of -50, -50, and -52 ft MLLW, respectively).
- Abandon the existing bar channel from station 699+36 to its current end
- Incorporate bends as part of a new bar channel alignment at stations 699+36 to 734+54, 1022+84 to 1050+00, 1167+00 to 1226+63) in the Bar Channel
- Widen the Bay Channel from 300 ft to 400 ft for the sound and bar channels
- Creation of a sedimentation basin on the east side of the channel from station 625+00 to 665+00 (the vicinity of Ship Island) with a depth of -54 ft MLLW
- Development of an intertidal salt marsh in at Cat Island North using dredged material

Error! Reference source not found. thru Figure 6-5 provide key information and illustrate the general locations of the most important changes to project features.

The TSP conforms to the essential elements of the U.S. Water Resources Council's Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies and complies with other Administration and legislative policies and guidelines on project development. If the project were to receive funds for Federal implementation, it would be implemented subject to the cost sharing, financing, and other applicable requirements of Federal law and policy for navigation projects including WRDA 1986, as amended and would be implemented with such modifications, as the Chief of Engineers deems advisable within his discretionary authority. Aids to navigation are to be funded by the U.S. Coast Guard. Federal implementation is contingent upon the NFS agreeing to comply with applicable Federal laws and policies. Prior to implementation, the NFS shall agree to:

a. Provide, during the periods of design and construction, funds necessary to make its total contribution for commercial navigation equal to 25 percent of the cost of design and construction of the GNFs.

b. Provide all LERRs, and perform or assure the performance of all relocations, including utility relocations, all as determined by the Federal Government to be necessary for the construction or operation and maintenance of the GNFs.

c. Pay with interest, over a period not to exceed 30 years following completion of the period of construction of the GNFs, an additional amount equal to 10 percent of the total cost of construction of the GNFs less the amount of credit afforded by the Government for the value of the LERR as provided by the NFS for the GNFs. If the amount of credit afforded by the Government for the value of LERR, and relocations, including utility relocations, provided by the NFS equals or exceeds 10 percent of the total cost of construction of the GNFs, the NFS shall not be required to make any contribution under this paragraph, nor shall it be entitled to any refund for the value of LERR and relocations, including utility relocations, in excess of 10 percent of the total cost of construction of the GNFs.

d. Provide, operate, and maintain, at no cost to the Government, the local service facilities in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and state laws and regulations and any specific directions prescribed by the Federal Government.

f. Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the NFS owns or controls for access to the project for the purpose of completing, inspecting, operating and maintaining the GNFs.

g. Hold and save the U.S. free from all damages arising from the construction or operation and maintenance of the project, any betterments, and the local service facilities, except for damages due to the fault or negligence of the U.S. or its contractors.

h. Keep, and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project, for a minimum of 3 years after completion of the accounting for which such books, records, documents, and other evidence are required, to the extent and in such detail as will properly reflect total cost of the project, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and local governments at 32 CFR, Section 33.20.

i. Perform, or ensure performance of, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 USC 9601–9675, that may exist in, on, or under LERR that the Federal Government determines to be necessary for the construction or operation and maintenance of the GNFs; however, for lands, easements, or rights-of-way that the Government determines

to be subject to the navigation servitude, only the Government shall perform such investigations unless the Federal Government provides the NFS with prior specific written direction, in which case the NFS shall perform such investigations in accordance with such written direction.

j. Assume complete financial responsibility, as between the Federal Government and the NFS, for all necessary cleanup and response costs of any hazardous substances regulated under CERCLA that are located in, on, or under LERR that the Federal Government determines to be necessary for the construction or operation and maintenance of the project.

k. Agree, as between the Federal Government and the NFS, that the NFS shall be considered the operator of the local service facilities for the purpose of CERCLA liability.

l. To the maximum extent practicable, perform its obligations in a manner that will not cause liability to arise under CERCLA.

m. Comply with Section 221 of PL 91-611, Flood Control Act of 1970, as amended, (42 U.S.C. 1962d-5b) and Section 101(e) of the WRDA 86, PL 99-662, as amended, (33 U.S.C.2211(e)) which provide that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the NFS has entered into a written agreement to furnish its required cooperation for the project or separable element.

n. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, PL 91-646, as amended, (42 U.S.C. 4601-4655) and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way necessary for construction, operation, and maintenance of the project including those necessary for relocations, the borrowing of material, or the placement of dredged or excavated material; and inform all affected persons of applicable benefits, policies, and procedures in connection with said act.

o. Comply with all applicable Federal and state laws and regulations, including, but not limited to: Section 601 of the Civil Rights Act of 1964, PL 88-352 (42 U.S.C. 2000d), and Department of Defense Directive 5500.11 issued pursuant thereto; Army Regulation 600-7, entitled “Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army”; and all applicable federal labor standards requirements including, but not limited to, 40 U.S.C. 3141-3148 and 40 U.S.C. 3701-3708 (revising, codifying and enacting without substantive change the provisions of the Davis-Bacon Act (formerly 40 U.S.C. 276a et seq.), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 et seq.), and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c)).

p. Provide the NFS share of that portion of the costs of mitigation and data recovery activities associated with historic preservation, that are in excess of 1 percent of the total amount authorized to be appropriated for the project.

q. Not use funds from other Federal programs, including any non-Federal contribution required as a matching share therefore, to meet any of the NFS's obligations for the project unless the Federal agency providing the Federal portion of such funds verifies in writing that such funds are authorized to be used to carry out the project.

The TSP contained herein reflects the information available at this time and current departmental policies governing formulation of individual projects. It does not reflect program and budgeting priorities inherent in the formulation of a national civil works construction program or the perspective of higher review levels within the executive branch. Consequently, the recommendation may be modified before it is transmitted to the Congress as a proposal for authorization and implementation funding. However, prior to transmittal to the Congress, the State of Mississippi, the MSPA (the NFS), interested federal agencies, and other parties will be advised of any significant modifications and will be afforded an opportunity to comment further.

_____

Jeremy J. Chapman

Colonel, U. S. Army

District Commander

10.0 References

Able, K.W., M.P. Fahay, K.L. Heck, C.T. Roman, M.A. Lazzari, S.C. Kaiser, 2002. *Seasonal Distribution and Abundance of Fishes and Decapod Crustaceans in a Cape Cod Industry.* Northeastern Naturalist 9(3):285-302 https://www.jstor.org/stable/3858472)

Animalia 2024, *Mammals of Mississippi*. https://animalia.bio/lists/region/mammals-of-mississippi

Atwell, 1973. Mississippi Sound Remote Sensing Study, NASA ERL Report #48. https://safe.menlosecurity.com/doc/docview/viewer/docNBFF7D1565703548b0d756b8498e8ad8f41a93ba9d0716141334d4ddc267978af8dcd2e053bdc

Banse, K. 1995, Zooplankton: Pivotal role in the control of ocean production. *ICES Journal Marine Sciences* 52:265-277 https://safe.menlosecurity.com/doc/docview/viewer/docNBA7522A21647fcc4a132ad3e18242fb261f09dfeb8487af7d387a9707ae2240a41b5b23c4274

Barros, N.B., and R.S Well, 1998. *Prey and Feeding Patterns of Resident Bottlenose Dolphins in Sarasota Bay, Florida.* Journal of Mammalogy Vol 79, No 3. https://safe.menlosecurity.com/doc/docview/viewer/docN5507B587009B5df0c4566585e536ca25a1d6fe889196a601f230df543ed0a431f5395727c01e

Bergstrom, P.W., R.F. Murphy, M.D. Naylor, R.C. Davis, and J.T. Reel, 2006. *Underwater Grasses in Chesapeake Bay & Mid Atlantic Coastal Waters: Guide to Identifying Submerged Aquatic Vegetation*, Maryland Sea Grant College. https://www.mdsg.umd.edu

BMI Environmental Services LLC *EA Ten-Year Beach Maintenance Project, Harrison County, MS*. Prepared by, for Harrison County Sand Beach Authority, 2022. https://dmr.ms.gov/wp-content/uploads/2022/03/Public-Notice-of-Application-by-Harrison-Co-Sand-Beach-Authority-Application-20220308

Bolton, Toby F. and Graham, William M., 2004. *Morphological variation among populations of an invasive jellyfish.*, Marine Ecology Progress Series 278: 125-13)

Boyajian, N. *Mississippi Coast Audubon Society.* 2018. https://safe.menlosecurity.com/doc/docview/viewer/docNE5DE4FA06EA593e3988bde417196d0851bdafc8ca5fe94aa8af48998682343a6cd971a3d8d15

Brooks R.A., and K.J. Sulak. 2005. *Quantitative assessment of benthic food resources for juvenile Gulf Sturgeon, Acipenser oxyrinchus desotoi, in the Suwannee River estuary, Florida, USA*. Estuaries 28, 767−775

Brooks, R.A, C.N. Purdy, S.B. Bell, K.J. Sulak, 2006. *The benthic community of the eastern US Continental shelf: A literature synopsis of benthic faunal resources. Continental Shelf Research 26:804-83-18.* https://safe.menlosecurity.com/doc/docview/viewer/docN9A5BFB2B33A632205fdba6c857a68e9273d0438c4c3a6083b322108b4808c1afacc0bb4a5b45

Burger, J. (2017). *Avian Resources of the Northern Gulf of Mexico. Habitats and Biota of the Gulf of Mexico: Before the Deepwater Horizon Oil Spill*. Springer, New York, NY. https://doi.org/10.1007/978-1-4939-3456-0_4

Byrnes, M.R., J.D. Rosati, S.F. Griffee, and J.L. Berlingoff, 2012. *Littoral Sediment Budget for the Mississippi Barrier Islands.* MSCIP USACE ERDC/CHL TR-12-9. https://safe.menlosecurity.com/doc/docview/viewer/docNE0F1190843C77180892f7dabaf26f9b63dfe8feec52402d602c2f293b553868f5b39c60505bf

Chenier, K.A. Jr, 2022.*Targeting grazing in coast uplands can remove invasive species*. Mississippi State University Extension, http://extension.msstate.edu/news/extension-outdoors/2022/targeted-grazing-coastal-uplands-can-remove-invasive-species#:~:text=Common%20invasives%20found%20in%20coastal,chemical%20treatment%20and%20mechanical%20removal

Climate Data, 2024. https://en.climate-data.org/north-america/united-states-of-america/mississippi/gulfport-1600/#water

ClimaTemps.com (*https://www.usclimatedata.com/climate/gulfport/mississippi/united-states/usms0145*) (2015)

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe, 1979. *Classification of wetlands and deepwater habitats of the United States.* USFWS/OBS 79/31/

Crain, C.M., B.R. Stillman, S.L. Bertness, and M.D. Bertness, 2004. *Physical and Biotic Drivers of Plant Distribution Across Estuarine Salinity Gradients.* Ecology, 85(9) 2539 – 2549, Ecological Society of America. https://safe.menlosecurity.com/doc/docview/viewer/docN7F0FB10A845D499378c72172eb164af5b3dbcf3ae04e48217fb76924d584553ecd0e5f6bb92b

Cuevas, J., *Discovering Cat Island, Photos and History,* 2018. University Press of Mississippi, 9781496816078 (hardcopy) https://www.upress.state.ms.us/Books/D/Discovering-Cat-Island#:~:text=Originally%20owned%20by%20the%20Cuevas,treasure%20somewhere%20on%20the%20island%3B

Cushing, E.M., E.H, Boswell, and R.L. Hosman, 1968. *General Geology of the MS Embayment, Water Resources of the Mississippi Embayment*, Geological Survey Professional Paper 448-B, US DOI USGS

Dawes, C.J., *Marine Botany,* 2nd edition,1998. John Wiley & Sons, Inc

Dzwonkowski, B., S. Fournier, J.T. Reager, S. Milloy, K. Park, A.M.Shiller, A.T. Greer, I. Soto, S.L. Dykstra, and V. Sanial, 2018. *Tracking Sea Surface Salinity and Dissolved Oxygen on a river-influenced, seasonally stratified shelf, Mississippi Bight, Northern Gulf of Mexico*. Continental Shelf Research, Vol 169: 25 – 33.

Edwards, R.A., F.M. Parsuka, K.J. Sulak, 2007. *New Insights into Marine Migration and Winder Habitat of Gulf Sturgeon* USGS Published Research, 1044. https://digitalcommons.unl.edu/usgsstaffpub/1044

Eleuterius, C.K. *Mississippi Sound: Salinity Distribution and Indicated Flow Patterns*, 1976. Sea Grant Publication MASG-76-023. https://repository.library.noaa.gov/view/noaa/13145

Eleuterius, C.K., *Classification of Mississippi Sound as to Estuary Hydrological Type*. 1978 Physical Oceanography Section, Gulf Coast Research Laboratory, Gulf Research Reports Vol 6 No.2Ocean Springs, MS. https://safe.menlosecurity.com/doc/docview/viewer/docN2309798F11D2b9b3e67578bb2e4616bc264c716a8fa8db13a3f1cf3fe31555efd2380261394c

Erftemeijer, P. L. A., and R. R. Lewis III, 2006. *Environmental impacts of dredging on seagrasses: A review*. Marine Pollution Bulletin 52:1553–157.

Felder, D.L. and D.K. Camp, 2009. Gulf of Mexico origin, waters, and biota. Volume 1, Biodiversity. USA: Texas A&M University Press. 1393 p.

Fisk, H.R., R.J. LeBlanc, P.R. Mabrey, and E.L. Krinitzsky, 1949, rev 1968. *Geological Investigations of Gravel Deposits in the Lower Mississippi Valley and Adjacent Uplands. Mississippi River Commission*. USACE, IS Water ways Experiment Station Technical Memoir.

Forqurean J.W., C.M.Duarte, H. Kennedy, N. Marba, M. Holmer, M.A. Mateo, E.T. Apostolaki, G.A. Kendrick, D.Krause-Jensen, K.J. McGlathery, O. Serrano, 2012. *Seagrass ecosystems as a globally significant carbon stock*. Nature Geoscience DOI: 10.1038/NGE01477). 5(7): 505-509. https://www.nature.com/articles/ngeo1477

Florida Natural Areas Inventory (FNAI) *Natural Community Classification Guide*, 2010. https://www.fnai.org/

Global Environment Facility-United Nations Development Program-International Marine Organization, 2017. https://www.imo.org/en/ourwork/partnershipsprojects/pages/globallast-programme.aspx

Graham, W.M and T.F Bolton, 2004. *Molecular and morphological comparisons of native and non-native populations of a jellyfish invader*. American Society of Limnology and Oceanography, Summer Meeting, Abstract https://www.galvbayinvasives.org/invasive/A-025

Graham and Bayha 2007; USGS Nonindigenous Aquatic Species Program, *Biological Invasions*, 193 Springer, Berlin

Graham, Wiliam M.; Martin, Daniel L.; Felder, Darryl L.; Asper, Vernon L. (2003) *Ecological and economic implications of a tropical jellyfish invader in the Gulf of Mexico*. Biological Invasions, 5: 53-69

Grand Bay and Weeks Bay NERR, 2008. *Selected Plants of Coastal Mississippi and Alabama*, NOAA, MDMR, ADCNR, and University of Southern Mississippi.

Gulfport, City of, 2024. Code of Ordinances (Noise), Ch 14 Sec 14.35. https://library.municode.com/fl/gulfport/codes/code_of_ordinances?nodeId=COOR_CH14OF_S14-35NO

Hall, L.M., L.J. Morris, R.H. Chamberlain, M.D.Hanisak, R.W. Virnstein, R.Paperno, B. Riegl, L.R. Ellis, A. Simpson, & C.A. Jacoby. 2022. *Spatio-temporal Patterns in the Biomass of Drift Macroalgae in the Indian River Lagoon, Florida, United States.* Frontiers in Marine Science, DOI: 10.3389/FMARS.2002.767440. https://www.researchgate.net/publication/358326902_Spatiotemporal_Patterns_in_the_Biomass_of_Drift_Macroalgae_in_the_Indian_River_Lagoon_Florida_United_States

Handley, L.R, K.A. Spear, A. Leggett, C. Thatcher, 2012. USGS National Wetlands Research Center, https://www.usgs.gov/publications/mississippi-sound#:~:text=The%20Mississippi%20Sound%20is%20the,the%20south%20(Figure%201

Harris, H.E., A. Q. Fogg, M.S. Allen, R.N.M. Ahrens, and W.F. Patterson III, 2020. *Precipitous Declines in Northen Gulf of Mexico Invasive Lionfish Populations Following the emergence of an Ulcerative Skin Disease*. Scientific Reports 10 Article No: 1934. https://www.nature.com/articles/s41598-020-58886-8

Harris, P.T., 2020. Seafloor Geomorphology as Benthic Habitat,– Anthropogenic threats to benthic habitats.3 Geo-Hab Atlas of Seafloor Geomorphic Features and Benthic Habitats (2nd ed,)Hemminga M. & C. Duarte, 2000*Seagrass Ecology*. Cambridge University Press.

Harrison Co. Fire Rescue, 2022. https://harrisoncountyms.gov/departments/fire_services/index.php

Harrison Co. Sheriff's Dept. 2024. https://www.harrisoncountysheriff.com/citizen-services/

Hemminga M. & C. Duarte, 2000Seagrass Ecology. Cambridge University Press.

Hillman, E. R., K.E. DeMarco, M. LaPeyre, *Establishing a Baseline of Estuarine Submerged Aquatic Vegetation Resources Across Salinity Zones Within Coastal Areas of the Northern Gulf of Mexico.* 2016. Journal of the Southeastern Association of Fish and Wildlife Agencies 3:25-32

Hograth, P. J., 2007. *The Biology of Mangroves and Seagrasses,* 2nd ed. Oxford University Press.

Holt, J., R. Godbout and C.R. Arnold, 1981. E*ffects of Temperature and salinity on egg Matching and Larval Survival of Red Drum*, Sciaenops ocellata. Fish. Bull. 79(3): 569-573

Howey, T.W., 1976. *Zooplankton of the Gulf of Mexico*. LSU Dissertation. https://efaidnbmnnnibpcajpcglclefindmkaj/https://repository.lsu.edu/cgi/viewcontent.cgi?article=3967&context=gradschool_disstheses)

Invasive Plant Atlas, 2018.UGA, NPS, USDAFS and others, https://www.invasiveplantatlas.org/

Johnson, L.C., 1891, The Nita Crevasse (LA) Geological Society of America Bulletin, v.2, 9. 20-25

Johnson, W.S., and Allen, D. 2012. Zooplankton of the Atlantic and Gulf Coasts: Guide to their identification and ecology: Second edition

La Peyre, M.K., L.S. Miller, S. Miller, and E. Melancon, 2017. *Comparison of Oyster populations, shoreline protection serve, and site characteristics at seven created fringing reefs in Louisiana: Key Parameters and Responses to Consider.* Living Shorelines, Chapter 18:363-379. https://www.researchgate.net/publication/31700390

Laurent, A., K. Fennel, W.-J. Cai, W.-J. Huang, L. Barbero, and R. Wanninkhof. 2017. *Eutrophication-induced acidification of coastal waters in the northern Gulf of Mexico: Insights into origin and processes from a coupled physicalbiogeochemical model.* Geophysical Research Letters, 44(2):946-956. https://coastalscience.noaa.gov/data_reports/eutrophication-induced-acidification-of-coastal-waters-in-the-northern-gulf-of-mexico-insights-into-origin-and-processes-from-a-coupled-physicalbiogeochemical-model/

Ley M., T. Baldvins, D. Jones 1, H. Pilkington, and K. Anderson, 2023. *Vegetation Classification and Mapping, Gulf Islands National Seashore* Natural Resource Report, National Park Service, Natural Resource Stewardship and Science. NPS/GUIS/NRR- 2023/2519.

Little, S., P.J. Wood, and M. Eliott. 2017. Quantifying salinity-induced changes on estuarine benthic fauna: The potential implications of climate change. Estuarine, Coastal and Shelf Science 198: 610-625.Lippson, R.L and A.J.

Littler, D.S., M.M. Littler, K.E. Bucher, and J.N. Norris. 1989. *Marine Plants of the Carribbean, A Field Guide from Florida to Brazil.* Smithsonian Institution Press.

Lippson, 2009. *Life Along the Inner Coast,* University of North Carolina Press). Weis, J.D. and C. A. Butler, 2009. *Salt Marshes, A Natural and Unnatural History,* Rutgers University Press.

Louda J.W., J.W. Loitz, A. Melisiotis, and W.H. Orem, 2004. *Potential sources of hydrogel stabilization of Florida Bay line mud sediments and implications for organic matter preservation,* Journal of Coastal Research, 20(2):448-463. https://doi.org/10.2112/1551-5036(2004)020[0448:PSOHSO]2.0.CO;2

Love, G., S. Baker, and E. Camp, 2021. *Oyster-Predator Dynamics and Climate Change*, University of Florida/IFAS Publication #FA228. https://edis.ifas.ufl.edu/publication/FA228

Lowe, E.N., 1915. *Mississippi, Its Geology, Geography, Spoils, and Mineral Resources Survey*.Bulletin 12.

Marba, N., Arias-Ortiz, P. Masque, G.A. Kendrick, I. Mazarrassa, G.R. Bastyan, J.Garcia-Orellana, C.M. Duarte, 2015. *Impact of seagrass loss and subsequent revegetation of carbon sequestration and stocks.* Journal of Ecology 103, 296 – 302; DOI: 10.1111/1365-2745.12370

Marine Fish Conservation Network, 2016. *Gulf States Fisheries Fail Speckled Trout*. https://conservefish.org/2016/09/12/gulf-states-fisheries-managers-fail-speckled-trout/

McCormick, Brooks Jr. 2024. *Lawsuit Launched Over Federal Failure to Protect Manatees in Florida, Puerto Rico*. Animal Law and Policy Program Media Release, Harvard Law School. https://animal.law.harvard.edu/news-article/manatee-lawsuit-launched/#:~:text=The%20Fish%20and%20Wildlife%20Service%20announced%20its%20final%20rule%20downlisting,habitat%20loss%20and%20other%20causes

McGovern, T. M., 2009. *Growth and Reproduction of* Ruppia maritima *in the Northern Gulf of Mexico,* Gulf of Mexico Science 2:91-101. https://aquila.usm.edu/goms/vol27/iss2/2/

Mendelssohn, I.A, M.R. Byrnes, B.A. Vittor, 2017. *Coastal Habitats of the Gulf Of Mexico,* Springer, NY Publishing

MDEQ, 2012. *MS Gulf Coast Water Assessment*, in cooperation with USEPA, USHUD, Land Trust for the Mississippi Coastal Plain, and Gulf Restoration Network. https://safe.menlosecurity.com/doc/docview/viewer/docN9129DC3EF8DB7b15239d5c1ce5c12fff32467cbab74c5c70899f1316ac8952b07b2dc8664fc9

MDEQ, 2017 Mississippi Department of Environmental Quality (MDEQ) (2017). Wetlands protection. http://www.deq.state.ms.us/mdeq.nsf/page/WQCB_Steam_Wetland_Alteration03

MDEQ, 2023. https://www.mdeq.ms.gov/water/surface-water/watershed-management/basin-management-approach/basin-listing/coastal-streams/

MDMR, Artificial Reef Program 2024 https://dmr.ms.gov/artificial-reef/

MDMR, Coastal Preserves Program 1999. *Mississippi's Coastal Wetlands*., Biloxi, MS

MDMR, 2024. Mississippi Gulfcoast Blueways, National Heritage Area, Cat Island. https://msgulfcoastheritage.ms.gov/natural/blueways/cat-island/#:~:text=Cat%20Island's%20unique%20T%2Dshape,local%20raccoons%20as%20feral%20cats

MDMR, MS Oyster Stewardship Program, Office of Marine Fisheries. 2011. https://safe.menlosecurity.com/doc/docview/viewer/docN19B300BE05C5335d2b79c529c8ab933ac7b2bee03ddd791fd19353f8bd4008ab49cf41f1aaa5

MDMR 2015. MS State Wetland Program Summary. https://safe.menlosecurity.com/doc/docview/viewer/docN775AEFD86D22ef1ff5509fe3621ada2d367a813283f560d2d10bcf5f6dbf0c572d20f30e8b4a

MDMR, 2021. *Shrimping the Sound*. Shrimp and Crab Bureau. https://safe.menlosecurity.com/doc/docview/viewer/docN1C3B3003A1B48eaf6459907f12af9c7d4ceb883c1e2b9e9c3ffe11207fe4a04f5a9490ff780f

MDMR, 2023. 2019 Mississippi Bonnet Carré Fisheries Disaster Recovery Programs Projects Factsheet. https://dmr.ms.gov/wp-content/uploads/2023/08/2019-BC-Recovery-Summary-rev.pdf

MDWFP, 2023. https://www.mdwfp.com/media/news/museum/a-sound-like-no-other/

MDWFP, 2024 https://www.mdwfp.com/media/news/museum/species-portrait-striped-mullet/

MDWFP 2024. MMNS Herpetology Collection. https://www.mdwfp.com/museum/seek-study/biological-collections/amphibians-reptiles/

MDWFP MS Amphibians and Reptiles checklist (rev 2012), https://safe.menlosecurity.com/doc/docview/viewer/docN7BB631EA177934c9a17934bdf6b33e213d87656466026062bd8d4c5861f24bcaa645ce5175e0

MDWFP 2024. *A Sound like no other*. https://www.mdwfp.com/media/news/museum/a-sound-like-no-other/

Miller, L.J., M. Solangi, and S.A. Kuczaj II, 2010. *Seasonal and Diurnal Patterns of Behavior Exhibited by Atlantic Bottlenose Dolphins (Tursiops truncates) in the Mississippi Sound.* Ethology: International Journal of Behavioural Biology Vol 116, Is 12 https://doi.org/10.1111/j.1439-0310.2010.01824.x

Mississippi Forestry Commission 2024. Invasive Species List, https://www.mfc.ms.gov/forest-health/invasive-plants/

Mississippi Herps, 2024 Reptiles and Amphibians of Mississippi https://msherps.com/frogs/greenhouse-frog/

Mississippi State University (MSU) Extension, 2024. Publication no. P3011. http://extension.msstate.edu/publications/water-availability-and-use

MSU Extension, 2016. *Gulf Shrimp have value beyond market prices.* http://extension.msstate.edu/news/feature-story/2016/gulf-shrimp-have-value-beyond-market-prices

MSU Extension 2024. http://extension.msstate.edu/natural-resources/marine-resources/seafood-harvesting-and-processing

Mohammadmehdi A., A.C. Linhoss, R.A. Camacho, 2021. Hydrodynamic Modeling of the Western Mississippi Sound using a linked model System. Regional Studies in Marine Science, Vol 44, 101685. https://www.sciencedirect.com/science/article/pii/S2352485521000773#d1e2530

Moncreiff, C.A., 2006. *Seagrass Status and Trends in the Northern Gulf of Mexico: 1940-2002 – Mississippi Sound and the Gulf Islands.* DOI USGS Scientific Investigation Report 2006-5287 & USEPA 855-R-04-003. https://pubs.usgs.gov/publication/sir20065287

Morgan, L.M., and C.F. Rakocinski, *Predominant factors limiting the recovery of the Eastern Oyster (Crassostrea virginica) in western Mississippi Sound, USA,* 2022. Division of Coastal Science, School of Ocean Science and Engineering, University of Southern MS, Gulf Coast Research Library, Ocean Springs, MS. Estuarine, Coastal and Shelf Science, 264 107652

Morton, Robert A., 2008. *Historical Changes in the Mississippi-Alabama Barrier-Island Chain and the Roles of Extreme Storms, Sea Level and Human Activities*., USGS Journal of Coastal Research, vol 24-6 1587-1600)

Mrozinska, N., K. Ginska-Lewczuk, K. Obolewski, 2021. *Salinity as a Key Factor on the Benthic Fauna Diversity in the Coastal Lakes.* Animals (Basel) PMC8614431. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8614431/

National Audubon Society, 2024. https://www.audubon.org/important-bird-areas

National Invasive Species Awareness Week, 2012. *The Economic Impacts of Invasive Species in the United States – Regional Case Studies*. https://safe.menlosecurity.com/doc/docview/viewer/docN29B249CEC6DFa7a27ff87b777df33f49dd86d3777b15b566aad48a248a7b33102d3decc15d96

National Research Council's 1987 report *Responding to Changes in Sea Level: Engineering Implications.* Committee on Engineering Implication of Changes in Relative Means Sea Level. Commission on Engineering and Technical Systems National Research Council. https://nap.nationalacademies.org/read/1006/chapter/1

Neal, W., D. Riecke, G. Turnage, 2023. *Planktonic Algae*. Mississippi State University Extension Service Publication 3735-3 (POD-11-23) http://extension.msstate.edu/publications/planktonic-algae

NOAA, Booklet Chart *Mississippi Sound and Approaches – Dauphin Island to Cat Island,* 2015. NOAA chart 11373, Office of Coast Survey

NOAA NCEI, 2021.*U.S. Billion-Dollar Weather and Climate Disasters*, Consumer Price Index [CPI]-adjusted, 2020, https://www.ncdc.noaa.gov/billions/summary-stats

NOAA, Office for Coastal Management. Coastal Change Analysis Program (C-CAP) Regional Land Cover. Charleston, SC. 2016 dataset https://coast.noaa.gov/digitalcoast/data/ccapregional.html

NOAA, 2017. https://oceanservice.noaa.gov/facts/barrier-islands.html#:~:text=These%20islands%20are%20critical%20to,less%20flooding%20on%20the%20coast.

NOAA 2022. https://www.fisheries.noaa.gov/species/

NOAA, 2023. What is an Estuary? Factsheet https://oceanservice.noaa.gov/facts/estuary.html#:~:text=Estuaries%3A%20Where%20the%20River%20Meets%20the%20Sea.,to%20love%20in%20an%20estuary

NOAA National Centers for Environmental Information - *Gulf of Mexico Data Atlas*, 2023; https://www.ncei.noaa.gov/maps/gulf-data-atlas/atlas.htm?plate=Prevailing%20Winds

NOAA 2022. Pacific Marine Environmental Laboratory. *Understanding Ocean Acoustics.* https://oceanexplorer.noaa.gov/explorations/sound01/background/acoustics/acoustics.html

NOAA Flower Garden NMS, 2024 https://flowergarden.noaa.gov/education/invasivelionfish.html#:~:text=By%202009%2C%20lionfish%20were%20pretty,the%20sanctuary%2C%20at%20Stetson%20Bank

NOAA Southeast Region (SERO) – Habitat Conservation Division (HCD), 2024. Essential Fish Habitat Consultations in the Southeast | NOAA Fisheries Essential Fish Habitat - Data Inventory (noaa.gov)

NOAA Fisheries 2024, Shrimp data. https://www.fisheries.noaa.gov/species/brown-shrimp

NOAA, 2024. Factsheet. https://oceanservice.noaa.gov/facts/phyto.html#:~:text=Phytoplankton%20are%20microscopic%20marine%20algae.&text=Phytoplankton%2C%20also%20known%20as%20microalgae,where%20sunlight%20penetrates%20the%20water

NOAA 2024. Invasive and Exotic Marine Species. https://www.fisheries.noaa.gov/insight/invasive-and-exotic-marine-species#how-are-invasive-species-introduced-into-a-new-environment

NOAA NOS Sta 8747437 *Waveland Yacht Club, MS 2004. https://tidesandcurrents.noaa.gov/noaatidepredictions.html?id=8747437&units=standard&bdate=20240201&edate=20240229&timezone=LST/LDT&clock=12hour&datum=MLLW&interval=hilo&action=data

NOAA, 2024. Tides and Currents Gulfport Station 8745557, https://tidesandcurrents.noaa.gov/stationhome.html?id=8745557

NPS, 2010. EA, *West Ship Island North Shore Restoration, MSCIP, MS Sound, Harrison County,* MS, Oct USACE-SAM

NPS, 2023. Gulf Islands National Seashore, https://www.nps.gov/guis/learn/nature/barrierislands.htm#:~:text=Along%20the%20Gulf%20of%20Mexico,sand%20from%20east%20to%20west

NRCS, US Dept of Agriculture. Web Soil Survey https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm

NRDA, 2018. Mississippi Artificial Reef Habitat Early Restoration Phase I Early Restoration. https://www.mdeq.ms.gov/wp-content/uploads/2017/09/EARLY.RESTORATION.PHASE-1-ARTIFICIAL-REEF-ENHANCEMENT-1.pdf

NFWF, 2016. *The Mississippi Gulf Coast Restoration Plan: A Path Toward Sustainable Ecosystem Restoration*, 2015; *The Mississippi Gulf Coast Restoration Plan: A Path Toward Sustainable Ecosystem Restoration 2016 Addendum*

Nunnally, C.C., G.T. Rowe, D.C.O. Thornton, and A.S. Quigg, 2013. Sedimentary Oxygen Consumption and Nutrient Regeneration in the Northern Gulf of Mexico Hypoxic Zone. *Journal of Coastal Research,* Special Issue, No. 63. https://safe.menlosecurity.com/doc/docview/viewer/docNCF5B6B8B442D5b715946e12657ab7e4ed058d6844817c0147bb2a33bb0b3df712230c0dd2eb7

O'Connor, Rick, 2018. *Exploring the Gulf of Mexico: Phytoplankton Part 1*. Coasts and Marine Natural Resources, UF IAS Extension. https://nwdistrict.ifas.ufl.edu/nat/2018/01/05/exploring-the-gulf-of-mexico-phytoplankton-part-i/#:~:text=Much%20of%20the%20nutrients%20are,where%20rivers%20meet%20the%20sea

Omernik, J.M., and G. E. Griffith 2014. *Ecoregions of the conterminous United States: evolution of a hierarchical spatial framework*. Environmental Management 54(6):1249-1266. http://dx.doi.org/10.1007/s00267-014-0364-1

One Ocean, 2024. https://www.oceanprotect.org/resources/issue-briefs/invasive-species/

Otvos, E.G., 2001. *Mississippi Coast: Stratigraphy and Quaternary Evolution in the Northern Gulf Coastal Plain Framework*. Stratigraphic and Paleontologic Studies of the Neogene and Quaternary Sediments in Southern Jackson County, MS. USGS Open File Report 01-415-H.

Otvos, E.G. and W.E. Howat, 1992. *Late Quaternary Coastal Units and Marine Cycles: Correlations between Northern Gulf Sectors*. Government, Environmental Science AAGP Bulletin vol 42. https://api.semanticscholar.org/CorpusID:128444753

Parra, S.M., V. Sanial, A.D. Boyette, M.K. Cambazoglu, I.M. Soto, A. T. Greer, L. M. Chiaverano, A. Hoover, M.S. Dinniman, 2020. *Bonnet Carré Spillway freshwater transport and corresponding biochemical properties in the Mississippi Bight,* 2020. Continental Shelf Research 199 104114

Pattillo, M.E., D.M. Nelson T.E., Czapla, and M.E. Monoco, 1997. *Distribution and Abundance of Fishes and Invertebrates in Gulf of Mexico Estuaries Vol II: Species Life History Summaries,* 1997. NOAA National Ocean Service. https://www.biodiversitylibrary.org/item/127176#page/1/mode/1up

Perdido Key Chamber of Commerce, 2023. *Invasive Lionfish in the Gulf*. https://visitperdido.com/invasive-lionfish-in-the-gulf

Pham, Linh Thuy, 2017. *Historical Change of Seagrasses in the Mississippi and Chandeleur Sounds*. Dissertations. The Aquila Digital Community, University of Southern Mississippi. https://aquila.usm.edu/dissertations/1470.

Pickens and Taylor 2020. Pickens, B.A., and J.C. Taylor, editors. 2020. R*egional Essential Fish Habitat geospatial assessment and framework for offshore sand features*. Sterling (VA): US Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2020-002 and NOAA NCCOS Technical Memorandum 270. https://doi.org/10.25923/akzd-8556

Posadas, B.C. 2017. *Commercial Striped Mullet Fishing in the GOM*. Mississippi Market Maker Newsletter, Vol 7, no 5. MSU Ext

Rabalais N. N., D. E. Harper, R. E. Turner, 2001. Responses of nekton and demersal and benthic fauna to decreasing oxygen concentration. *Coastal Hypoxia: Consequences for living Resources and Ecosystems,* Coastal and Estuarine Studies 58, American Geophysical Union, https://www.researchgate.net/publication/279423077)

Schafer, D., C. Maglio, K. McConnell, T. Beck, and C. Pollock, 2016. *Characterizing Seagrass Exposure to Light Attenuation and Turbidity Associated with Dredging Activity in the Gulf Intracoastal Waterway, Sarasota Bay, Florida,*. USACE ERDC TN-DOER-E39

Schmalz R.A, 1983, *The Development of a Numerical Solution to the Transport Equation*, Report 1, Coastal Engineering Research Center, U.S> Army Engineer Waterways Experiment Station, Vicksburg, MS, CERC-83-2.

Simberloff, Daniel, I.M. Parker, P.N. Windle. 2005), Introduced Species Policy, Management, and Future Research Needs. Ecol Environ 2005, 3(1): 12-20. DOI:10.1890/1540-9295(2005)003[0012:ISPMAF]2.0.CO;2

Soniat, T.M., C.P. Conzelmann, J.D. Byrd, D.P. Roszell, J.L. Bridevaux, K.J. Suir, S.B. Colley, 2013. *Predicting the Effects of Proposed Mississippi River Diversions on Oyster Habitat Quality; Application of an Oyster Habitat Suitability Index Model.* Journal of Shellfish Research, 32(3):629-638. https://doi.org/10.2983/035.032.0302

State Data Center of Mississippi. (n.d.). Population Projections for Mississippi, 2020-2050. Retrieved July 11, 2024 from https:// https://sdc.olemiss.edu.

Stedman and Dahl, 2008. Stedman, S.M., and T.E. Dahl. (2008). *Status and trends of wetlands in the coastal watersheds of the eastern United States, 1998 to 2004*. NOAA-NMFS. https://www.fws.gov/wetlands/Documents/Status-and-Trends-of-Wetlands-in-the-Coastal-Watersheds-of-the-Eastern-United-States-1998-to-2004.pdf

Stewart, L., and J.F. Everett, 2002, A monitoring well network for the Mississippi Gulf coast Oligocene-Miocene-Pliocene aquifer system: MDEQ, Office of Land and Water Resources, Open-File Report 02-101

Sun Herald, 2015. Article on Coyote sighting in City of Gulfport. https://www.gulflive.com/news/2015/10/coyotes_on_hunt_for_pets_on_mi.html

Tampa Bay Water Atlas, Ch 4. 2001 – 2024. Tampa Bay Estuary Program. https://safe.menlosecurity.com/doc/docview/viewer/docN6FC55BA4D01E2f99323ae0489815f3d92f59894d7d0d93272ce2d1394580a194418256de1f1c

Texas A&M University at Galveston, 2024 https://www.tamug.edu/phytoplankton/projects/Gulf-Of-Mexico.html

Tiner, 2005. *In Search of Swampland: A Wetland Sourcebook and Field Guide*. 2nd ed. Rutgers University Press

United Nations (UN) Development Program - International Marine Organization Global Environment Facility, 2017. https://www.imo.org/en/ourwork/partnershipsprojects/pages/globallast-programme.aspx

University of Southern Mississippi, 2024. Center for Fisheries Research and Development. https://www.usm.edu/fisheries-research-development/red-drum-tag-release.php

U.S. Climate Data, version 3, 2024. https://www.usclimatedata.com/climate/gulfport/mississippi/united-states/usms0145

USACE, 2009. *Mississippi Coastal Improvements Program (MsCIP), Hancock, Harrison, and Jackson Counties, Mississippi, Comprehensive Plan and Integrated Programmatic Environmental Impact Statement.* Main report and appendices.

USACE, 2006. *Sediment Quality Characterization of the Gulfport Harbor Federal Navigation Channel, Gulfport, Mississippi Final Repor*t. Prepared by EA Engineering, Science, and Technology.

USACE, ERDC, 2010. *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region* (Version 2.0), ed. J. S. Wakeley, R. W. Lichvar, and C. V. Noble. ERDC/EL TR-10-20. Vicksburg, MS: U.S. Army Engineer Research and Development Center

USACE, 2010. *Environmental Assessment*, *West Ship Island North Shore Restoration, MSCIP, MS Sound, Harrison County,* MS, USACE-SAM

USACE ERDC, 2012. MSCIP CHL Letter Report ERDC Coastal and Hydraulics Laboratory and Environmental DA 10 Report.

USACE, 2013. *Evaluation of Proposed Dredged Material Gulfport Bar Channel, Gulfport, Mississippi.* Prepared by EA Engineering, Science, and Technology.

USACE, 2022. South Atlantic Coastal Study (SACS) Environmental Technical Report. https://www.sad.usace.army.mil/Portals/60/siteimages/SACS/SACS_Environmental%20Tech%20Report_Final_220819_508.pdf?ver=TTl4LyVcg9Wzbc2jeSYR3A%3d%3d

USACE, 2022. Storyboard SACS Environmental Analysis, 2022. https://sacs.maps.arcgis.com/apps/MapSeries/index.html?appid=f0aa02dd2aa54b4aab34b4bccea3c3d5

ERDC DA 10 Report, 2012.MSCIP CHL Letter Report ERDC Coastal and Hydraulics Laboratory and Environmental).

USACE ERDC Wilber, D.A., P.O. Grammer, E.M. Greenheck, M.J. Andres, W. T. Slack, M.S. Peterson, 2023. *Benthic Macrofauna Distributions and Gulf Sturgeon Occupancy Patterns at Year 1 post-restoration of Ship Island, MS.*, Prepared for MSCIP, USACE Mobile District World Wildlife Fund (WWF) 2023. https://www.wwf.org.uk/what-we-do/planting-hope-how-seagrass-can-tackle-climate-change

US Census Bureau. (n.d.). Selected Economic Characteristics. American Community Survey, ACS 1-Year Estimates Data Profiles, Table DP03, 2022. Retrieved July 3, 2024 from https://data.census.gov.

US Census Bureau. (n.d.). Selected Social Characteristics in the United States. American Community Survey, ACS 1-Year Estimates Data Profiles, Table DP02, 2022. Retrieved July 3, 2024 from https://data.census.gov.

US Census Bureau. (n.d.). TOTAL POPULATION [1]. Decennial Census, DEC Summary File 3, Table P001, 2000. Retrieved July 3, 2024 from https://data.census.gov.

US Census Bureau. (n.d.). TOTAL POPULATION. Decennial Census, DEC Summary File 1, Table P1, 2010. Retrieved July 3, 2024 from https://data.census.gov.

US Department of Human Health and Services (HHS), 2019. National Institute of Health (NIH) National Institute on Deafness and Other Communication Disorders. https://www.noisyplanet.nidcd.nih.gov/have-you-heard/how-is-sound-measured

USDOI, BLM/USFWS, 1982.*The Ecology of the Seagrasses of South Florida: A Community Profile*. FWS/OBS-82/25.

USEPA, 2000. *Principles for the Ecological Restoration of Aquatic Resources*. EPA841-F-00-003. Office of Water (4501F), USEPA, Washington, DC

USEPA, 2013 *Hypoxia Task Force Reassessment 2013: Assessing Progress Made Since 2008* National Science and Technology Council, Committee on Environment and Natural Resources.

USEPA and MDEQ, 2005. *Water Quality Study of Bays in Coastal Mississippi Water Quality Report.* Project #05-0926. https://safe.menlosecurity.com/doc/docview/viewer/docN2309798F11D2b087499af2d690ea2a21e09e25d4e73ad43dd28c79cac4ae282f5d0cb1037978

USEPA, 2021. Office of Water NCCA, *National Coastal Condition Assessment: A Collaborative Survey of the Nation's Estuaries and Great Lakes Nearshore Waters*. Washington, DC. August 2021. Last modified on 04/21/2023 10:26:28. https://www.epa.gov/national-aquatic-resource-surveys/ncca

USEPA 2023. Summary of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) 1980 42 USC §9601 *et seq.* *https://www.epa.gov/laws-regulations/summary-comprehensive-environmental-response-compensation-and-liability-act#:~:text=The%20Comprehensive%20Environmental%20Response%2C%20Compensation%2C%20and%20Liability%20Act%20%2D%2D%20otherwise,and%20contaminants%20into%20the%20environment*

USEPA rev 04/2024. https://www.epa.gov/epcra

USEPA rev. 05/2024).Resource Conservation and Recovery Act (RCRA)Laws and Regulations. https://www.epa.gov/rcra/history-resource-conservation-and-recovery-act-rcra

USEPA, 2023. NEPAssist. https://www.epa.gov/nepa/nepassist

USEPA, 2023. *Wetland Functions and Values.*. http://www.epa.gov/watertrain

USFWS, 2011 rev. 2017. *Greenhouse Frog Ecological Risk Screening Summary*. https://safe.menlosecurity.com/doc/docview/viewer/docN7BB631EA1779dc88d81b2670a31e2da6b9147233577a647fbafdbfd33fb0de9ef4ea75d1c2a9

USFWS, 2017. Flyway Information. Natural Resource Program Center. Administrative Waterfowl Flyway Boundaries. https://www.fws.gov/media/migratory-bird-flyways-north-america

USFWS ECOS 2022. Factsheet, https://ecos.fws.gov/ecp/species/4469

USFWS IPAC 2023. IPaC: Home (fws.gov)

USFWS 2024 Breton NWR website, https://www.fws.gov/refuge/breton/species

USFWS 2024 MS Sandhill Crane NWR website, https://www.fws.gov/refuge/mississippi-sandhill-crane/about-us

USGS, 1951. *Water Levels and Artesian Pressure in Observation Wells in the United States in 1947, Part 2 Southeastern States*. Geological Survey Water-Supply Paper 1097. US Government Printing Office. https://safe.menlosecurity.com/doc/docview/viewer/docN42311847F648ee1d9baee5475827913671deb87ace5740bd3dec7f305f25521ea472e8ce0a03

USGS, 2009. *Cat Island Geomorphology and Depositional Subenvironments of GINS,* MS Open File Report 2009-1250

USGS, 2009. Cat Island Open File Report 2009-1250. Geomorphology and Depositional Subenvironments of GINS, MS https://pubs.usgs.gov/of/2009/1250/

USGS, 2023. Jones, W.R., and Enwright, N.M., 2023, Potential Sea Turtle Nesting Areas for Cat and Ship Island, Mississippi for various years from 1998 to 2016: U.S. Geological Survey data release, https://doi.org/10.5066/P945DYIZ

USGS, 2021. Megan K. La Peyre, Danielle A. Marshall, and Shaye E. *Oyster Model Inventory: Identifying Critical Data and Modeling Approaches to Support Restoration of Oyster Reefs in Coastal U.S. Gulf of Mexico Waters.* Open-File Report 2021-1063

Walker, N.D., W.J. Wiseman, L.J. Rouse, & A. Babin, 2005. Effects of River Discharge, Wind Stress, and Slope Eddies on Circulation and the Satellite-Observed Structure of the Mississippi River Plume. *Journal of Coastal Research* 21-6. https://www.jstor.org/stable/4299530

Waring, G. T., E. Josephson, K. Maze-Foley, and P. E. Rosel, Editors. 2013. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments – 2012. Volume 1. March 2013

Weis, J.D. and C. A. Butler, 2009. *Salt Marshes, A Natural and Unnatural History*, Rutgers University Press

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

State Data Center of Mississippi. (n.d.). Population Projections for Mississippi, 2020-2050. Retrieved July 11, 2024 from https:// https://sdc.olemiss.edu.