FINAL

Master Plan for the Beneficial Use of Dredged Material for Coastal Mississippi

Prepared by CH2M HILL for the
Gulf of Mexico Alliance/Habitat Conservation and Restoration Team
in cooperation with
Mississippi Department of Marine Resources
Submitted to the
Gulf of Mexico Foundation
in accordance with
National Oceanic Atmospheric Administration
Cooperative award # NOAA GOMA 2003

Prepared by:

CH2MHILL®

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Executive Summary

The Mississippi Department of Marine Resources (DMR) has been working with federal, state and private partners for nearly a decade to promote the use of dredged material and concrete rubble for coastal land and habitat restoration. An important part of this effort was the development of the 2002 "Long-Term Comprehensive Master Plan for Beneficial Uses of Dredged Material Along Coastal Mississippi" (Master Plan) which was contracted by the U.S. Army Corps of Engineers Mobile District (USACE). The 2002 Master Plan helped steer the early development of a beneficial use (BU) program at DMR.

Following hurricane Katrina, the BU concept attracted additional public and agency attention which is now being enacted through a new Beneficial Users Group (BUG) that formed in 2008. Now meeting monthly at DMR, the BUG is co-chaired by USACE and includes representatives of the U.S. Fish and Wildlife Service (USFWS), Environmental Protection Agency (EPA), the National Oceanographic Atmospheric Administration (NOAA)/National Marine Fisheries Services (NMFS), Mississippi Department of Environmental Quality (DEQ), the Mississippi Secretary of State office, as well as staff from Senate and Congressional representatives. Local Ports and other private stakeholders are also encouraged to attend.

"One can never have enough information for making the "best" decision. However, in most cases, adequate information exists to make sound decisions"

One of the key actions of the BUG in 2010 was to write and have enacted new legislation that requires the BU of dredge material when BU sites are available and the material is suitable. To help meet the intent of the law, the BUG and DMR have developed two BU sites: Deer Island in Harrison County and Greenwood Island in Jackson County.

Reviewing historic maps, it is estimated that as many as 10,000 acres of Mississippi's coastal wetlands and islands have been lost since 1950. The Mississippi BU Program, in conjunction with the BUG, will continue working to ensure that our state's valuable dredged materials are used to help restore and protect these critically important resources. This master plan is a "living document" as the BU program evolves and matures.

This updated 2011 Master Plan is broken into sections to provide an overview of the existing sediment transport system in Mississippi, the laws and regulations that provide the permitting structure to be followed to establish beneficial use sites, options for dredging technologies, potential BU projects, and stakeholders. The goal of this updated Master Plan is to develop a comprehensive plan to identify areas within each coastal county where dredged material can be placed to help restore, nourish, and enhance the coastal marshes and wetlands of Mississippi.

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Acronyms

BU	beneficial use
BUG	Beneficial Users Group
CIAP	Coastal Impact Assistance Program
CDF	confined disposal facility
CVI	Coastal Vulnerability Index
CWPPRA	Coastal Wetlands Protection, Planning and Restoration Act
CZM	Coastal Zone Management
DEQ	Department of Environmental Quality
DMR	Department of Marine Resources (State of Mississippi)
EPA	Environmental Protection Agency
ESA	Endangered Species Act
GIC	Gulf Islands Conservancy
GIWW	Gulf Intercoastal Water Way
GPS	Global Positioning System
HDS	high-density solids
hp	horse power
IPCC	Intergovernmental Panel Climate Change
LERRD	lands, easements, rights-of-way, relocations, and dredged material disposal areas
m	meter
m^3	cubic meters
mm	millimeter
MPRSA	Marine Protection, Research, and Sanctuaries Act
MsCIP	Mississippi Coastal Improvement Program
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanographic and Atmospheric Administration
NPS	National Park Service
NRHP	National Register of Historic Places
OCS	Outer Continental Shelf
O&M	Operations & Maintenance
OMRR&R	Operations Maintenance, Repair, Replacement & Rehabilitation
QOCSR	Quality Outer Continental Shelf Revenue
NRC	National Research Council
PET	polyethylene terephthalate
PAS	public assistance to states
PL	public law
PMP	Project Management Plan
POC	point of contact
SHPO	State Historic Preservation Officer
SOPs	standard operating procedures
THPO	Tribal Historic Preservation Officer
USACE	U.S. Army Corps of Engineers

USC	U.S. Code
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Service
WRDA	Water Resources Development Act
yd^3	cubic yards

1. Introduction

Beneficial use of dredged material (BU) efforts in Mississippi has primarily focused on conventional projects with containment structures that are filled with dredged material. This approach is limited by Gulf Sturgeon critical habitat which typically confines restoration of eroded shorelines to recent historical footprints. This has limited the number and distribution of suitable BU project sites as well as the total capacity available for the state to retain its dredged materials.

Based on current dredging activities, it is clear Mississippi needs more options in order to handle the volume of dredged material being generated without placing undue burdens on normal dredging activity. A programmatic approach would ensure more efficient and ecologically beneficial use of dredged material from both small and large dredging projects. Typically smaller dredging projects have been conducted utilizing a bucket dredge like track hoe which is poorly suited for placing material in large contained BU sites. The scope of potential BU projects can also be severely affected by the long hauling distances required to reach conventional BU sites.

Large non-federal dredging projects in Mississippi, which are on track to produce over 2 million yards of material in 2011, will rapidly fill all available "historic footprint" restoration projects within a few years. A better method of managing material from small dredge projects as well as large projects need to be developed to provide more overall, long-term capacity for dredge material.

One method to handle dredged materials is utilizing pumped distribution, which is becoming increasingly accepted in many states. Although, the cost of pumping can be prohibitive for smaller projects this can be addressed by providing a system of staging areas that are accessible by barge and by truck. Dredgers could then move material from small projects to a local staging area over a distance not unlike what they currently work with. A tipping fee would be charged for use of the facility. The DMR BU program would then transport the material to new BU sites as needed. This process would allow better coordination of resources with needs and would provide operations on a scale that would make pumped distribution of the material more economically feasible.

To address the need for on-going capacity for large dredging projects, pumped distribution could open up thousands of acres of degraded coastal marshes via thin-layer deposition and other techniques. These techniques allow placement in a much wider range of settings including where containment structures are neither practical nor desirable. Pumped distribution is also much more suitable for periodic applications that can help maintain existing elevations to offset erosion and increased inundation due to sea level rise.

This report updates a plan that was prepared in partnership with the Mississippi Department of Marine Resources (DMR) in 2002. Titled "The Long-term Comprehensive Master Plan for Beneficial Uses of Dredged Material Along Coastal Mississippi," it was the first report of its kind for Mississippi. Prepared for the U.S. Army Corps of Engineers, Mobile District (USACE), it was approved by DMR and adopted as the plan the state would

follow to use dredged material beneficially instead of disposing of it in an upland disposal facility.

This plan updates and improves on the 2002 master plan. Since 2002, the methods of using dredged material beneficially and projects to use it for have matured. Currently, the Gulf of Mexico Foundation is funding this report, with a cooperative award from the National Atmospheric Administration (NOAA), as part of a comprehensive effort to develop sediment management plans for the entire Gulf of Mexico. This effort will provide a better understanding of how sediment moves across the Gulf, what areas in the Gulf are sediment deprived, and what areas, if any, are sediment rich.

Since 2002, the philosophy on beneficial use has evolved in Mississippi. The state legislature passed and DMR has instituted a beneficial use of dredged material law that establishes a breakpoint when beneficial use is required. Also, additional information and studies have been completed that provide information on the transport of sediment along the coast. Currently, DMR is permitting two new beneficial-use sites in Harrison County. These sites will be available to dredging projects over 2,500 cubic yards (yd^3) that have a beneficial use plan. Similar sites will be identified for Hancock and Jackson Counties, and additional sites and capacity will be developed for Harrison.

1.1 Goal and Approach

The goal of this updated master plan is to develop a comprehensive programmatic approach to identify areas within each coastal county where dredged material can be placed to help restore, nourish, and enhance the coastal marshes and wetlands of Mississippi. The areas identified should also be easily accessible to multiple user types to encourage beneficial use of dredged material.

The approach to reaching this goal has been to meet with local, state, and county officials as well as federal agencies to gather information on areas that would be appropriate places for disposal, areas that are regularly dredged, and issues that would prevent or limit disposal in certain areas.

1.2 Organization of the Plan

The master plan is broken into sections to provide an overview of the existing sediment transport system in Mississippi, the laws and regulations that provide the permitting structure to be followed to establish beneficial use sites, options for dredging technologies, current dredging projects and schedules, previous beneficial use projects, and finally the areas along the coast of Mississippi that would benefit from dredged material.

1.3 Summary of the Issues

Beneficial use for coastal Mississippi means keeping the sediments "in the system." Historically, dredged material has been disposed of in open water disposal sites or in upland facilities. The philosophy now is to ensure that dredged material that comes out of the Mississippi Sound is reused within the system, as close to the dredged area as possible.

To facilitate keeping the sediments in the system, Mississippi passed §49-27-61, Charges for Materials Removed under Permit; Alternative for Dredge Material Disposal (Appendix A).

To summarize, the law requires dredging projects of over 2,500 yd^3 to be used beneficially if there is a designated beneficial use (BU) site. Therefore, to ensure material is used beneficially, DMR needs to get new BU sites permitted. The challenge is to find sites within each county that can permitted as BU sites. One issue that adds complexity to the BU permitting process is the designation in 2003 of the Mississippi Sound as critical habitat for the Gulf sturgeon. The Gulf sturgeon was designated an endangered species in 1991. It is found in the waters of the Gulf of Mexico from Louisiana to Florida and is known to spawn in Mississippi within waters of the Pearl and Pascagoula Rivers. With the designation of the Sound as critical habitat, permitting new BU sites must be closely coordinated with the National Marine Fisheries Service (NMFS) to ensure the new sites do not negatively impact habitat areas for the Gulf sturgeon.

Another factor that should be considered when creating BU sites is sea level rise. The design, desired footprint, and elevation must take into account the projections for sea level rise along the coast of Mississippi. The issue of sea level rise is discussed more thoroughly in Section 2.

1.4 Stakeholder Meetings

The original master plan process began with stakeholder meetings, one in each coastal county, to introduce the project and solicit ideas for projects. The original meetings were valuable because county local agencies, nonprofits, and commissioners provided information on dredging projects and potential BU projects. The meetings also provided them an opportunity to verbalize any concerns with the concept of beneficial use. Based on the success of the meetings in 2002, this update repeated the process. Meetings were held in Hancock, Harrison, and Jackson Counties December 15-16, 2010. The Hancock County meeting was well attended, and the discussion of the master plan, goals, and potential projects was useful. Meetings in Harrison County and Jackson County were not as well attended. The meeting summaries with attendance rosters are included in Appendix B. Information gathered at the meetings has been used to develop BU projects along the coast.

2. Mississippi Sound Sediment System

The Mississippi Sound is a naturally shallow coastal lagoon that extends from Mobile Bay, Alabama, to Lake Borgne, Louisiana. The average nondredged depth is approximately 13 feet. The average tidal exchange is modest, averaging 1–2 feet. To define the existing sediment transport system, a review of existing documents has been conducted to collect reports or research related to the sediment system of the Mississippi Sound. Reports from the USACE, U.S. Geological Survey (USGS), and Mississippi Department of Environmental Quality (DEQ), as well as general Web sites, were reviewed for information and documents related to the Mississippi Sound sediment system. Based on a review of existing documents, general littoral drift has been documented. The USACE Mississippi Coastal Improvement Program (MsCIP) has documented sediment transport along both the barrier islands and the nearshore areas of the Sound. Additional information and studies that focused on the mouths of each of the constructed river basins and sediment loads from each river would be extremely helpful to understanding the complete sediment transport system along coastal Mississippi.

2.1 Background Information

Hurricane Katrina changed how Mississippi manages its coastline and how dredged material is used. The storm decimated the barrier island system, particularly Ship Island. As a result, USACE developed a master plan to provide systems-based solutions to address the destruction from the storm (MsCIP, 2009). Appendix H (MsCIP, 2009) specifically addresses the barrier islands and discusses sediment transport along the islands, within the Mississippi Sound and along the nearshore areas. This information as it relates to the coastal areas of Mississippi has been summarized in this master plan update. This information is an extremely valuable tool in updating the master plan and identifying areas for beneficial use.

A sediment transport model and sediment budget was prepared by USACE in an effort to understand the sediment transport system for long-term restoration of the barrier islands of Mississippi. Using historical, calculated, and conceptual sediment budgets and studies, the USACE developed a conceptual sediment budget (Rosati et al., 2007).

The Mississippi Sound is relatively shallow, with depths ranging from 1 to 18 feet. Tides in the Mississippi Sound are diurnal, with ranges of 1.5 to 1.8 feet (Foxworth et al., 1962). The MsCIP (2009) report states that net longshore sediment transport for the barrier islands is from east to west; however, at the tidal passes, there are local reversals (MsCIP, 2009, Appendix H, p. 23).

Along the coast of the mainland, beach change is the result of beach replenishment and restoration and of harbor construction projects (Pascagoula Bar Channel and Gulfport Bar Channel). Hancock County generally has net longshore transport from northeast to southwest (Christmas, 1973). Harrison County sediment transport has been affected by harbor construction, beach restoration, and renourishment (Byrnes et al., 1993a, 1993b, as cited in MsCIP, 2009, p. 23).

The report also states that dredging in the navigation channels in the Sound does not modify the sediment budget for the mainland or the barrier islands (MsCIP, 2009, p. 26). The existing information on dredging activities and shoaling rates was used with historical data analysis to prepare a present-day sediment budget. Based on a review of historical data, including bathymetric change data, the report concluded that as the barrier islands have eroded, "portions of the barrier islands have rolled over towards the Sound. For example, East Ship Island and western Dauphin Island have eroded on the Gulf side and reformed in a more northerly location further into the Sound" (MsCIP, 2009, p. 27).

A hypothetical sediment budget was developed using both the historical sediment budget and the calculated sediment budget. The hypothetical sediment budget was prepared for the barrier islands as well as the coast line. The figures from the MsCIP report pertaining to the shoreline have been included.

FIGURE 2-1
Hypothetical Present-Day Sediment Budget for the Mississippi Sound and the Barriers Islands
In thousands of cubic yards per year (MsCIP, Appendix H, 2009).

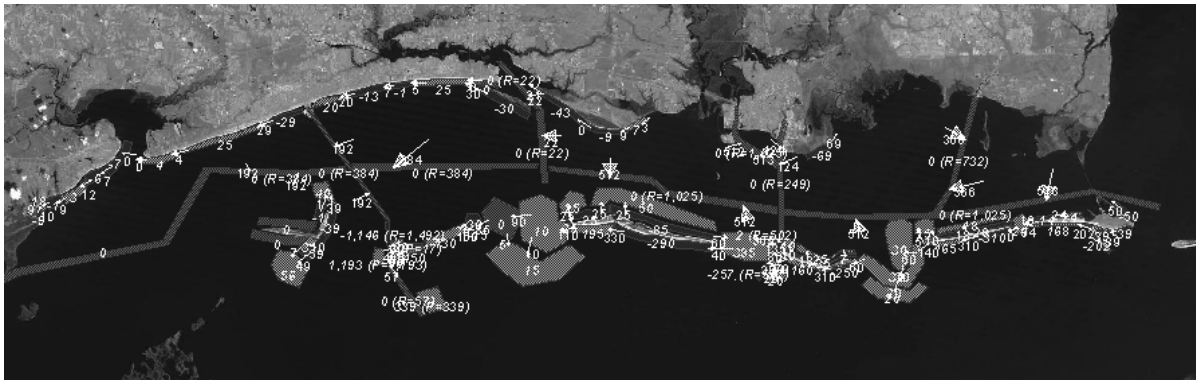


FIGURE 2-2
Hypothetical Present-Day Sediment Budget for Western Hancock County, Gulfport Harbor Channel, and a Portion of the Gulf Intercoastal Waterway
In thousands of cubic yards per year (MsCIP, Appendix H, 2009).

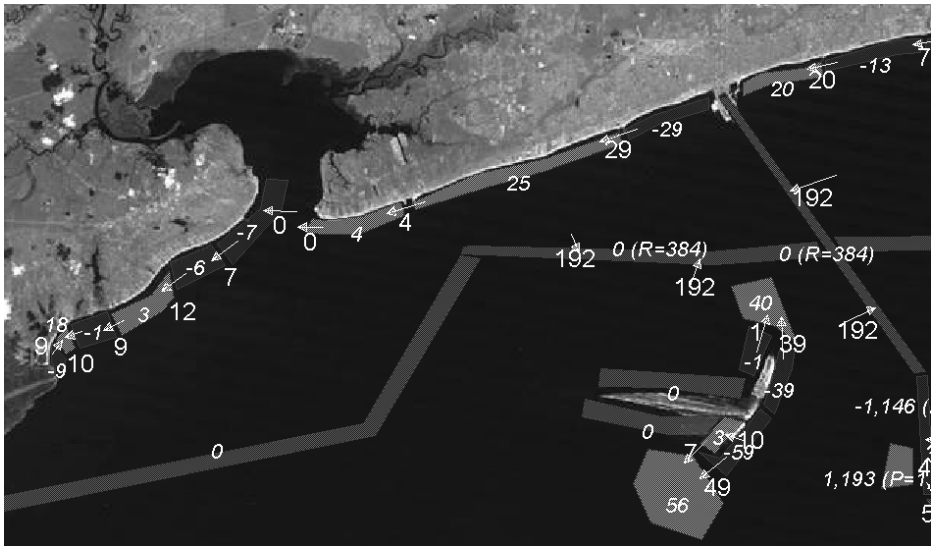


FIGURE 2-3
Hypothetical Present-Day Sediment Budget for Eastern Harrison County, Pascagoula Harbor Channel, and a Portion of the Gulf Intercoastal Waterway
In thousands of cubic yards per year (MsCIP, Appendix H, 2009).

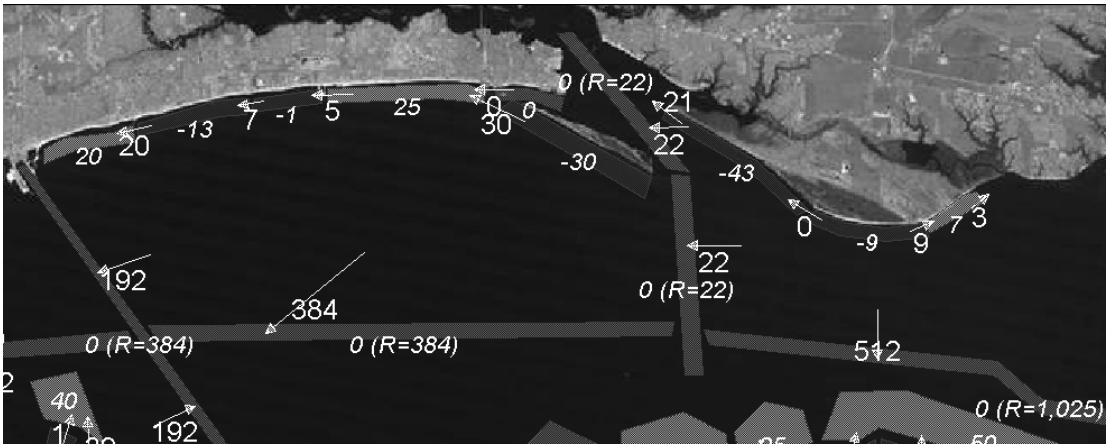
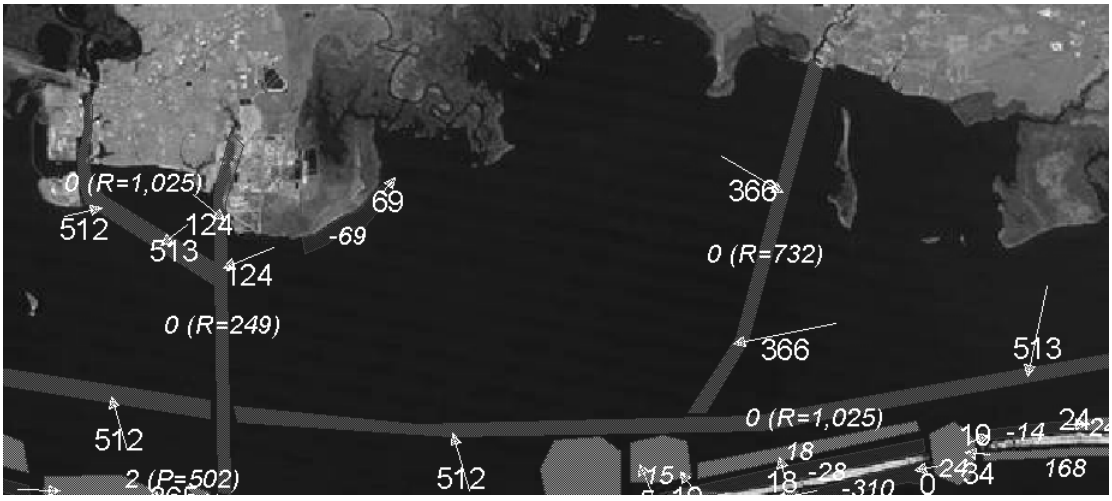


FIGURE 2-4
Hypothetical Present-Day Sediment Budget for Eastern Jackson County, Bayou La Batre, and a Portion of the Gulf Intercoastal Waterway
In thousands of cubic yards per year (MsCIP, Appendix H, 2009).



The findings of the study, based on wave modeling as it relates to the shoreline, are that the mainland coast has a greatly reduced wave climate due to the barrier islands, the Chandeleur Islands, and the Mississippi River's Bird's Foot delta. The study concluded that restoration of the barrier islands, including lengthening the islands to their historical footprint, would provide additional protection to the shoreline (MsCIP, 2009, p. 34).

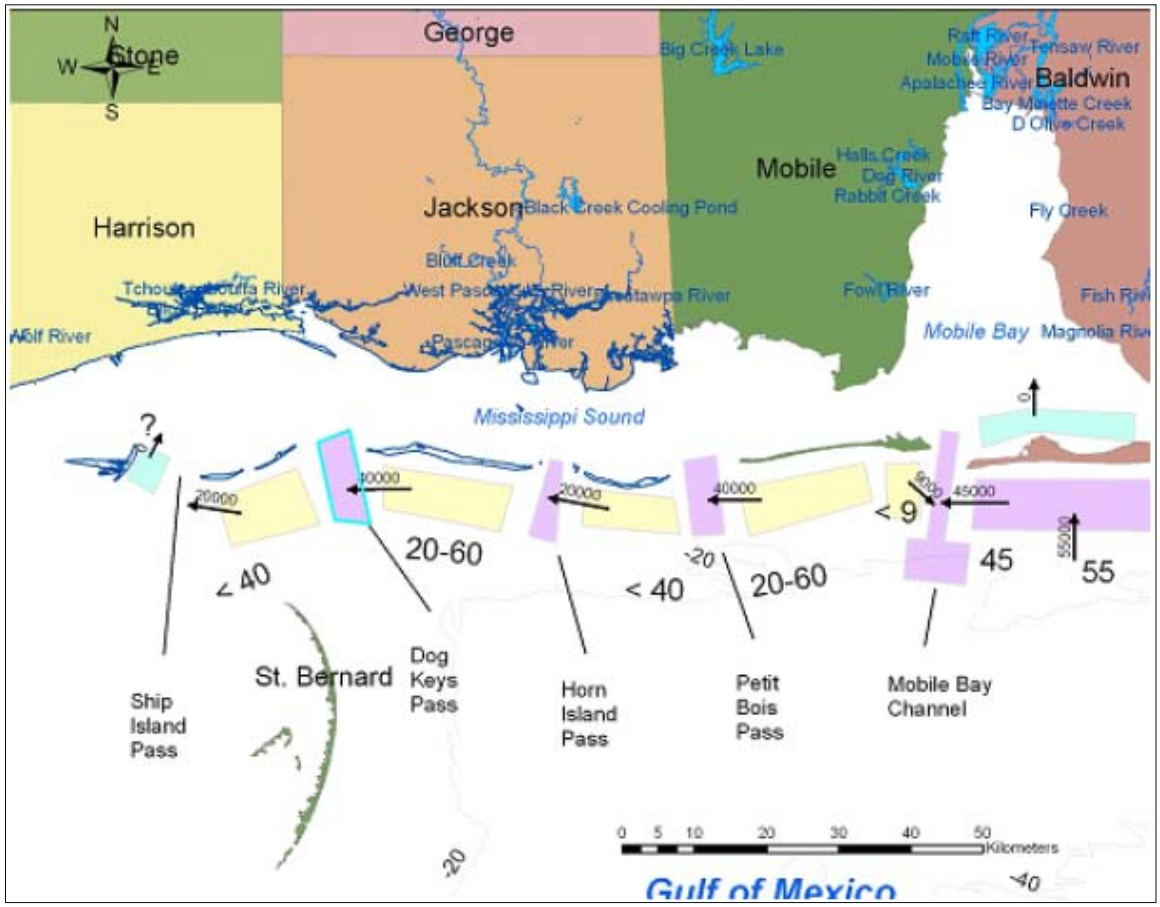
2.2 Regional Littoral Drift Influences

The majority of the shoreline along coastal Mississippi consists of manmade beaches beyond concrete seawalls. A few remaining areas along the shoreline consist of more natural areas,

such as expanses of marsh along the western and eastern borders of the state that are protected by four barrier islands. The barrier islands are located 11 to 13 miles offshore and are situated along a littoral drift zone that moves sediment westward (Figure 2-5). Drift created the three most eastern elongated islands of Ship, Horn, and Petit Bois. At the westward most, Cat Island, littoral currents are not as well defined (MsCIP, 2009, section 1.2.1.1).

Reports have calculated the annual net westward transport ranges from 20,000 to 60,000 cubic meters ($m^{3)}$ on Dauphin and Horn Islands, and from zero to 40,000 m^3 on Petit Bois and Ship Islands (Cipriana and Stone, 2001). Because the tidal range in the northern Gulf of Mexico is low (less than 0.5 meters [m]), wind-driven waves and associated currents are the primary mechanisms for entraining and transporting nearshore sediments (Morton, 2007). Within the Mississippi Sound region, the winds are predominantly from the east, which drives alongshore currents to the west.

FIGURE 2-5
Longshore Sediment Movement, Alabama and Mississippi
In thousands of cubic meters per year (HCRT Gulf Regional Sediment Management Master Plan Technical Framework).



2.3 Watershed Influences

Three of Mississippi's major drainage basins (Pascagoula, Pearl, and Coastal Streams) discharge into the Mississippi Sound. Combined, they account for approximately 1,800

square miles of drainage area and over 11,000 million gallons per day of discharge into the Mississippi Sound (Strom, 1998). Some of the stations where flow is measured in this report are farther upstream. Actual flow may be higher or lower depending on demands downstream. The Pascagoula and Pearl Rivers account for most of the freshwater discharge into the Mississippi Sound; however, many smaller creeks and streams also discharge into the Sound or discharge into Biloxi Bay, which ultimately discharges into the Sound.

The Pascagoula River is the last unregulated major river system in the continental states. Although there are no dams or levees along the river to restrict its flow, changes the river's banks and bathymetry have ultimately affected sediment transport in the Sound. For example, historically, the Escatawpa River flowed directly into the Mississippi Sound, with its mouth located near the eastern state line between Mississippi and Alabama. Aerial photographs of the area show evidence of an existing river bed that at one time flowed into the Sound at Grand Bay Savannah near Grande Batture Islands (Figure 2-6). Aerial photographs also show many canals throughout the wetlands of the coast, which have altered the flow through the system.

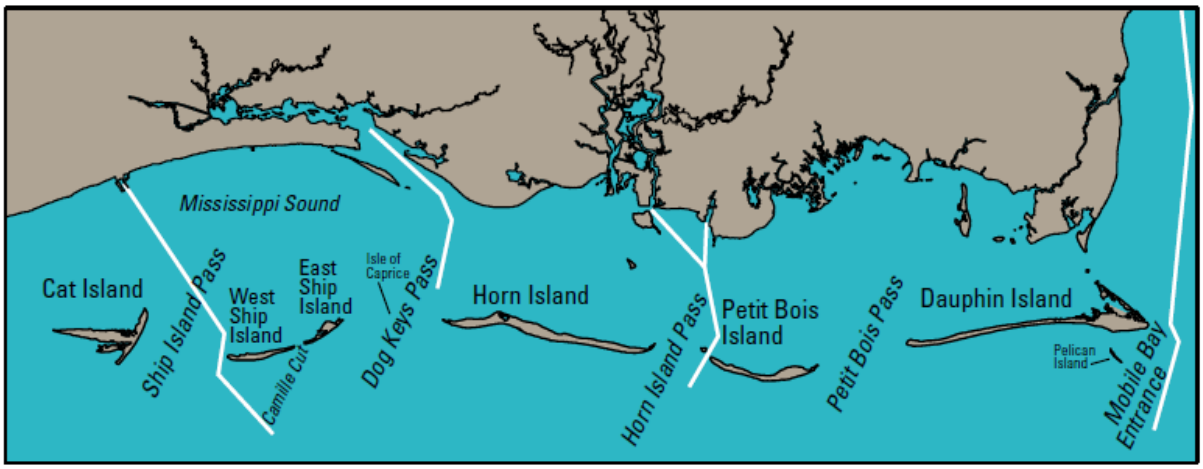
FIGURE 2-6
Aerial Evidence of a Dried-out River Bed That Once Flowed from the Escatawpa River to the Sound *(Google Earth).*

2.4 Navigation Influences

Dredging activities have been carried out in the Mississippi Sound and the Pearl and Pascagoula Rivers since at least 1908 (Nautical Chart 190-1-1908). Navigation channels as well as turning basins for the ports of Gulfport, Biloxi, and Pascagoula have been regularly dredged for decades. Since then, the frequency of port traffic has increased, as haves the sizes of vessels using the ports. These factors have required deeper and wider channels.

Historically, dredging activities have included the Pascagoula River, Pascagoula Upper Sound, Pascagoula Lower Sound, Escatawpa River, Beardslee Lake, Biloxi Bay, Davis Bayou, Biloxi West Approach, Biloxi East Approach, Cadet Bayou (a.k.a. Bayou Caddy), Wolf and Jourdan Rivers, Pass Christian, Gulf Intracoastal Waterway (GIWW), Bayou Caden, and Gulfport Sound Channel (USACE base maps).

FIGURE 2-7
Locations of the Mississippi-Alabama Barrier Islands and Associated Tidal Inlets
Navigation channels maintained by USACE O&M dredging activities are shown as white lines (From Morton, 2007).



Currently, four major federal navigation channels are maintained in the Mississippi Sound: Gulfport Harbor, in Harrison County; Biloxi Bay, in Harrison County; Pascagoula Harbor, in Jackson County; and the GIWW (Figure 2-7). Each of these federal channels serves an international port. Each is maintained by the USACE with an approved dredging plan for operations and maintenance (O&M).

In addition to the federally designated channels, numerous smaller private navigation projects and boat harbors are located along the coastal Mississippi shoreline (MsCIP, 2009). These projects generate additional dredged material. Examples of these private projects include the Southern Company, in Biloxi, and a commercial fish factory in Jackson County. The Southern Company operates a coal power plant at the mouth of the Biloxi River, which feeds the Bay of Biloxi. Large intake canals were constructed to allow the power plant to use water for cooling. A channel that spans the entire bay is routinely maintained to allow vessel access to the power plant. A fish factory located on the shore of the Escatawpa River in Jackson County, off of Highway 619, has dredged channels for fishing vessel access. These canals are dredged as needed to maintain access.

These types of dredging activities affect the regional sediment budget. They act as sediment sinks and impede the natural drift of sediment throughout the system. If the material collected from regular maintenance dredging of these channels is not properly placed, sediment deficiencies are created, and erosion as well as wetland loss is observed. The goal of this master plan update is to identify the sources of dredged material and work with those entities that dredge regularly to help use the material beneficially to keep it in the system.

2.5 Hurricanes and Sea Level Rise

2.5.1 Hurricanes

In addition to littoral drift that have resulted in erosion of the islands, hurricanes throughout the decades, most notably Camille and Katrina, have significantly eroded the barrier islands. Hurricane Camille created a cut, aptly named "Camille Cut" that divides Ship Island into two separate islands. Hurricane Katrina expanded the cut even more. The USACE MsCIP program plans to fill this cut to help restore Ship Island to its pre-Camille footprint.

2.5.2 Historic Sea Level Rise

In addition to dredging activities and hurricanes, studies have confirmed that sea level rise will also affect the long-term viability of coastal marshes. The Intergovernmental Panel on Climate Change (IPCC) is a "scientific body that reviews and assesses the most recent scientific, technical and socio-economic information produced worldwide relevant to the understanding of climate change." The IPCC regularly releases assessment reports that include information on sea-level rise. The IPCC's most recent assessment report provides measured rates for historical sea level rise from multiple papers (IPCC, 2007):

- For the twentieth century: average rate of 1.7±0.5 millimeters (mm) per year (0.56±0.16 foot per century)
- For 1961 to 2003: 1.8±0.5 mm per year (0.59±0.16 foot per century)
- For 1993 to 2003: 3.1±0.7 mm per year (1.00±0.23 foot per century)

The Mississippi regional rate could be different based on local influences such as land movement (subsidence) and water temperature increase.

2.5.3 USACE Sea Level Change Policy

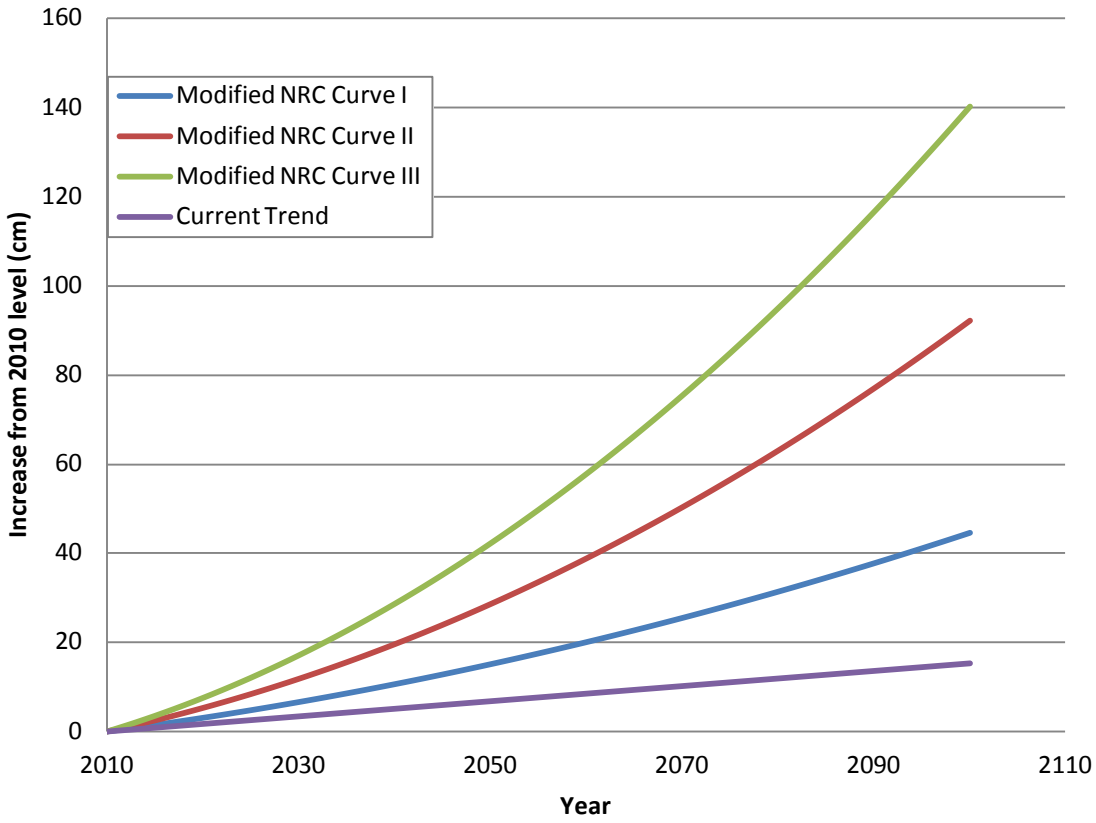
The USACE released guidance for incorporating the direct and indirect physical effects of projected future sea level change in managing, planning, engineering, designing, constructing, operating, and maintaining USACE projects and systems of projects (USACE, 2009). The guidance states that all USACE-related projects affected by sea level rise should use multiple scenarios recommended by the National Research Council's (NRC) report *Responding to Changes in Sea Level* (NRC, 1987). The report states that planning alternatives should be evaluated using "low," "intermediate," and "high" rates of sea level rise:

- Low: current historic rate of sea level rise of 1.7 mm per year
- Intermediate: modified NRC Curve I, which estimates a sea level rise of 500 mm between 1986 and 2100 (1.45 feet between 2011 and 2100)

- High: modified NRC Curve III, which assumes 1,500 mm rise between 1986 and 2100 (4.6 feet between 2011 and 2100)

While the IPCC scenarios are projections of sea level rise, the scenarios developed by the NRC are curves used for analysis. The IPCC (2007) assessment report does not consider the potential for rapid ice loss in Antarctica due to massive failures of the west Antarctic ice sheet. The USACE (2009) guidance suggests using the NRC scenarios of low, intermediate, and high because their scenarios are more conservative, providing planners and engineers with a small amount of flexibility in case sea level changes are greater than initially projected.

FIGURE 2-8
Summary of Projections for Sea Level Rise
From MsCIP (2009).



2.5.4 Summary of Projections

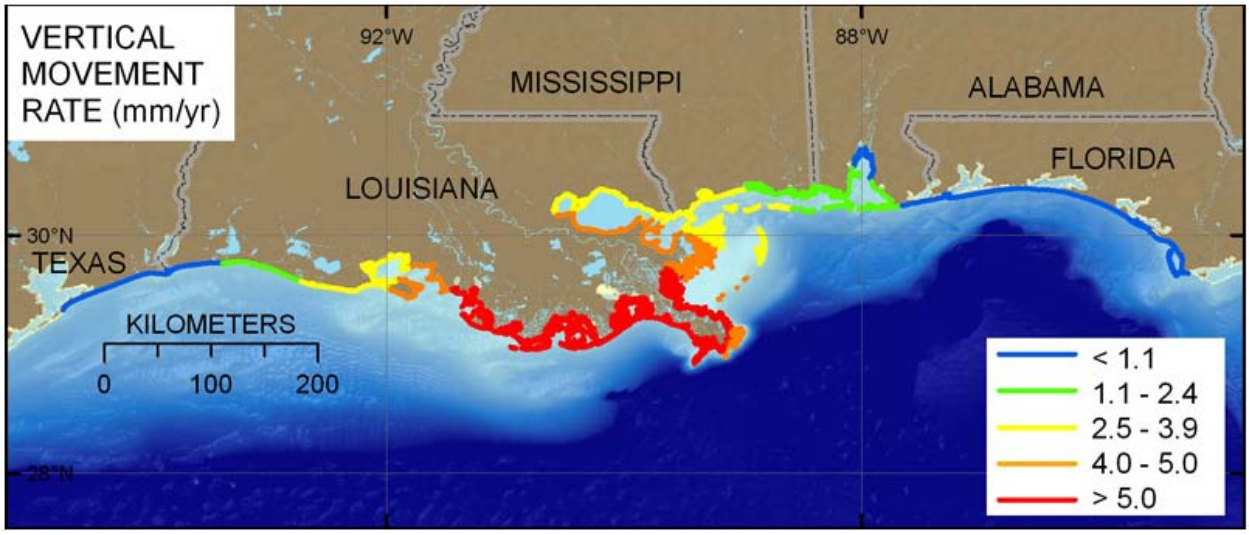
As a result, sea level rise should be considered when planning beneficial use projects and sites. Restoration projects conducted along the coast of the Gulf of Mexico in past decades are now experiencing land loss, requiring additional restoration projects. A long-term view of what is needed to offset projected sea level rise must be accounted for in a project's BU plan.

Sea level rise and climate change can also change the eco-services which can change BU.

2.5.5 Subsidence

Subsidence can also affect regional sea level rise trends. USGS released a report that used a coastal vulnerability index (CVI) to map the region's relative vulnerability to future sea level rise along the Northern Gulf of Mexico (USGS, 2010). The CVI was calculated based on the coast's ranked value for specific data variables (geomorphology, shoreline erosion/accretion rate, coastal slope, relative sea level rise/vertical movement rate, mean significant wave height, tidal range). Vertical movement rates were determined along the Northern Gulf of Mexico using methods including global positioning system (GPS) measurements, Holocene sediment thickness, and a viscoelastic Earth model (USGS, 2010). Figure 2-9 displays subsidence from Galveston, Texas, to Apalachicola, Florida. Existing data on subsidence shows that Louisiana has experienced significant subsidence, while areas near Pensacola show subsidence to be low or nonexistent.

FIGURE 2-9
Subsidence along the Northern Gulf of Mexico
From Coastal Vulnerability Assessment of the Northern Gulf of Mexico to Sea-Level Rise and Coastal Change.



Based on Figure 2-9, the trend is for subsidence to increase from east to west in the Mississippi coastal area. Research for specific data on coastal Mississippi and subsidence was not found. Additional research is needed to understand issues of subsidence in Mississippi and how that will compound issues of sea level rise and Mississippi's coastal marshes. The Mississippi coast could be experiencing critical land loss due to vertical movement without global sea level rise.

3. Regulatory Authorities, Agencies, and Stakeholders

In order to designate a BU site, coordination with federal, state, and local agencies will be necessary to obtain the required permits and approvals. There are numerous federal laws involved in permitting a new BU site. The laws address issues of clean water, endangered species, dredging, construction of containment dikes, restoration of wetlands involving placement of materials—grasses, hay bales, etc.—and activities in the coastal zone.

3.1 Federal Laws

Section 204, Water Resources Development Act of 1992 (Public Law [PL] 102-580), as amended, Beneficial Uses of Dredged Material. Under this authority, USACE is authorized to execute projects that protect, restore, and create aquatic ecologically related habitats, including wetlands, in connection with dredging for construction or O&M of a federally authorized navigation project. Project costs consist of the incremental costs of beneficial use as compared to a disposal plan that would have otherwise been used. A nonfederal sponsor is responsible for paying 25 percent of these costs, including lands, easements, rights-of-way, relocations, and dredged material disposal areas (LERRD). Under this authority, there is no process to allow the nonfederal sponsor to receive credit for in-kind work. The total federal costs associated with a beneficial use of sediments project shall not exceed $5 million. This cost limit refers to the incremental cost over the Base Plan.

Section 2037, Water Resources Development Act of 2007 (WRDA), as amended, Regional Sediment Management. Under this authority, USACE authorizes flood control, navigation, and environmental projects and studies. Section 2037 replaces provisions under the WRDA of 1992 regarding beneficial uses of dredged material with provisions requiring the Secretary of the Army to develop, at federal expense, regional sediment management plans; including federally funded regional sediment management plans, beneficial use projects for property protection (flood and storm damage) and habitat. Also, it directs the Secretary to give priority to regional sediment management projects in areas of specified states. The total federal costs associated with construction of a project under this section may not exceed $5 million.

Section 528, Water Resources Development Act of 2000 (PL 106-541), Coastal Mississippi Wetlands Restoration Projects. Under this authority, USACE can participate in restoration projects for critical coastal wetlands and coastal barrier islands in Mississippi that will produce immediate and substantial restoration, preservation, and ecosystem protection benefits. A nonfederal sponsor for projects implemented under this authority must provide LERRD and pay 35 percent of project construction costs.

Section 22, Water Resources Development Act of 1974 (PL 93-251), as amended, Planning Assistance to States (PAS). Under this authority, USACE may provide technical assistance to support state preparation of comprehensive water and related land resources

development plans. Activities conducted under this authority are cost-shared with a nonfederal sponsor on a 50/50 basis.

Section 404, Clean Water Act of 1972 (33 US Code [U.S.C.] Chapter 26) requires approval prior to discharging dredged or fill material into the waters of the United States. Typical activities requiring Section 404 permits include the following:

- Depositing of fill or dredged material in waters of the U.S. or adjacent wetlands
- Site development fill for residential, commercial, or recreational developments
- Construction of revetments, groins, breakwaters, levees, dams, dikes, and weirs
- Placement of riprap and road fills

Section 10, Rivers and Harbors Act of 1899 (U.S.C. 403) requires approval prior to accomplishing any work in or over navigable waters of the United States or that affects the course, location, condition, or capacity of such waters. Typical activities requiring Section 10 permits include construction of piers, wharves, bulkheads, dolphins, marinas, ramps, floats intake structures, and cable or pipeline crossings.

Endangered Species Act of 1973, [16 U.S.C. 1531-1584, 87 Stat. 8840 as amended] (ESA) Public Law 93-205, approved December 28, 1973, repealed the Endangered Species Conservation Act of December 5, 1969 (P.L. 91-135, 83 Stat. 275). Through federal action and by encouraging the establishment of state programs, the ESA[1] provides for the conservation of ecosystems upon which threatened and endangered species of fish, wildlife, and plants depend. ESA…

- Authorizes the determination and listing of species as endangered and threatened;
- Prohibits unauthorized taking, possession, sale, and transport of endangered species;
- Provides authority to acquire land for the conservation of listed species, using land and water conservation funds;
- Authorizes establishment of cooperative agreements and grants-in-aid to states that establish and maintain active and adequate programs for endangered and threatened wildlife and plants;
- Authorizes the assessment of civil and criminal penalties for violating the Act or regulations; and
- Authorizes the payment of rewards to anyone furnishing information leading to arrest and conviction for any violation of the Act or any regulation issued there under.

Magnuson-Stevens Act (P.L. 94-265, as amended by the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act [P.L. 109-479]) is the primary law governing marine fisheries management in federal waters. The Act was enacted in 1976 and amended in 1996. Most notably, the Magnuson-Stevens Act aided in the development of the

[1] The Endangered Species Act of 1973 (16 U.S.C. 1531-1584, 87 Stat. 8840 as amended) (ESA), Public Law 93-205, approved December 28, 1973, repealed the Endangered Species Conservation Act of December 5, 1969 (P.L. 91-135, 83 Stat. 275). The 1969 Act had amended the Endangered Species Preservation Act of October 15, 1966 (P.L. 89-669, 80 Stat. 926). The ESA implemented the Convention on International Trade in Endangered Species of Wild Fauna and Flora (T.I.A.S. 8249), signed into law on March 3, 1973, and the Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere (50 Stat. 1354), signed by the United States on October 12, 1940 (http://www.fws.gov/laws/lawsdigest/esact.html).

domestic fishing industry by phasing out foreign fishing. To manage the fisheries and promote conservation, the Act created eight regional fishery management councils. The 1996 amendments focused on rebuilding overfished fisheries, protecting essential fish habitat, and reducing bycatch. On January 12, 2007, President George W. Bush signed the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006. The new law mandates the use of annual catch limits and accountability measures to end overfishing provides for widespread market-based fishery management through limited access privilege programs, and calls for increased international cooperation. The goal of the Act is to end overfishing, increase the use of market-based management tools, create a national saltwater angler registry, and emphasize ecosystem approaches to management.

National Historic Preservation Act (16 U.S.C. §§ 470a to 470w-6) (NHPA) is the primary federal law governing the preservation of cultural and historic resources in the United States. The law establishes a national preservation program and a system of procedural protections that encourage the identification and protection of cultural and historic resources of national, state, tribal, and local significance. Primary components of the Act include the following:

- Articulation of a national policy governing the protection of historic and cultural resources
- Establishment of a comprehensive program for identifying historic and cultural resources for listing in the National Register of Historic Places (NRHP) implemented and managed by the National Park Service (NPS)
- Creation of a federal-state/tribal-local partnership for implementing programs established by NHPA through State and Tribal Historic Preservation Offices (SHPOs and THPOs)
- Requirement that federal agencies take into consideration actions that could adversely affect historic properties listed or eligible for listing on the NRHP
- Establishment of the Advisory Council on Historic Preservation, which oversees federal agency responsibilities governing the NHPA
- Placement of specific stewardship responsibilities on federal agencies for historic properties owned or within their control (Section 110 of the NHPA)

3.2 State Authorities

In July 2010 the Mississippi state legislature amended the existing law to encourage and require the beneficial use of dredged material.

Mississippi Code of 1972, as amended in 2010, Title 49—Conservation and Ecology, Chapter 27—Coastal Wetlands Protection Act, Section 61. The amendment revised the charges for materials removed under an approved permit. The amended law requires a charge for the disposal of dredged material; the DMR commission will charge \$0.50/yd^3 for any sand or gravel removed from wetlands and \$0.25/yd^3 for any other materials removed from coastal wetlands by a permittee or his agent under the terms of any permit issued. There will be no charge levied by the DMR commission for the removal of 100 yd^3 or less of any material removed from wetlands by a permittee or his agent under the terms of any

permit issued. The DMR commission may waive these charges on any project of a governmental agency or any project when expenditures are made as the result of a governmental grant or governmental bond proceeds. Any party participating in the beneficial use of dredge materials programs will be exempt from the charges. With the amended law, DMR requires any party permitted to conduct dredging activities of over 2,500 yd^3 to participate in the DRM program involving beneficial use of dredge materials, provided the material is suitable and a beneficial use site is available. If approved by DMR, a party may deposit acceptable dredge materials in a designated location for a fee not to exceed 50 percent of the fair market cost to transport and dispose of the material in an approved upland site. DMR will consider in-kind services for offsetting depositional charges.

The Public Tidelands Trust Fund. This is a special fund created in the state treasury and administered by the secretary of state as trustee. Any funds derived from lease rentals of tidelands and submerged lands, shall be transferred to the special fund, except those funds derived from mineral leases, or funds heretofore specifically designated to be applied to other agencies. However, funds derived from lease rentals may be used to cover the administrative cost incurred by the secretary of state. Any remaining funds derived from lease rentals shall be disbursed pro rata to the local taxing authorities for the replacement of any lost ad valorem taxes. Any remaining funds shall be disbursed to the commission for new and extra programs of tidelands management, such as conservation, reclamation, preservation, acquisition, and education, or the enhancement of public access to the public trust tidelands or public improvement projects as they relate to such lands.

Coastal Impact Assistance Program (CIAP). This is offered through the U.S. Department of the Interior's Bureau of Ocean Energy Management, Regulation and Enforcement (formally Minerals Management Service) as a one-time appropriation from Congress. The program was designed to authorize funds to be distributed to Outer Continental Shelf (OCS) oil- and gas-producing states for the conservation, protection, and preservation of coastal areas, including wetlands. Six states, including Mississippi, share in this source of funding. Each eligible state is allocated its share based on the State's Qualified Outer Continental Shelf Revenue (QOCSR) generated off of its coast in proportion to the total QOCSR generated off the coasts of all eligible states. CIAP authorized the secretary of the interior to distribute to producing states and coastal political subdivisions $250 million for each of the fiscal years 2007 through 2010.

Activities that can be supported by this program include projects and activities for the conservation, protection, or restoration of coastal areas, including wetland, mitigation of damage to fish, wildlife, or natural resources, planning assistance and the administrative costs of complying with this section, implementation of a federally approved marine, coastal, or comprehensive conservation management plan, and mitigation of the impact of OCS activities through funding of onshore infrastructure projects and public service needs. Projects in Mississippi will include building a new Marine Education Center in Ocean Springs, Mississippi, acquiring 1.72 waterfront acres in Jackson County for the protection and conservation of this marshland area to prevent future redevelopment and to provide for the conservation and protection of local fish and wildlife habitats. This funding will also assist with erosion control and water quality protection in this flood prone area. Also, Mississippi was granted CIAP money for land management and education in the Mississippi coastal area. These efforts include measures to control invasive species,

controlled burns in areas to reduce fuel sources that feed wildfires, and sponsoring a series of meetings for land management partners to strengthen collaboration on coastal restoration efforts.

3.3 Potential Funding Sources

Primary funding sources for BU projects, construction of containment areas, transport of dredged materials, and placement will be borne by dredging entities, as required by the MS BU law. Other sources of funding such as the ones listed below could help enhance the BU program, if appropriate.

Section 14, Flood Control Act of 1946, as amended—Streambank and Shoreline Erosion Protection of Public Works and Non-Profit Public Services. This program is designed to implement projects to protect public facilities and facilities owned by non-profit organizations that are used to provide public services that are open to all on equal terms. These facilities must have been properly maintained but be in imminent threat of damage or failure by natural erosion processes on stream banks and shorelines, and are essential and important enough to merit federal participation in their protection. Eligible facilities are: highways, highway bridge approaches, public works, churches, public and private non-profit hospitals, schools, and other public or non-profit facilities offering public services open to all on equal terms; and known historic properties whose significance has been demonstrated by a determination of eligibility for listing on, or actual listing on, the NRHP. The historic property(ies) must be open to all on equal terms. A nonfederal sponsor for projects implemented under this authority must provide LERRD and pay 35 percent of project construction costs. Operation and maintenance, repair, replacement and rehabilitation (OMRR&R) is a 100 percent nonfederal responsibility.

Section 103, River and Harbor Act of 1962, as amended—Beach Erosion and Hurricane and Storm Damage Reduction. This authority may be used for protecting multiple public and private properties and facilities and single nonfederal public properties and facilities against damages caused by storm-driven waves and currents. All projects must be formulated for hurricane and storm damage reduction, in accordance with current policies and procedures governing projects of the same type specifically authorized by Congress. Any policies and procedures applicable to federal participation in projects involving beach nourishment must apply to Section 103 projects involving beach nourishment. Projects implemented under this authority have the same project cost-sharing requirements as hurricane and storm damage reduction projects implemented under specific congressional authorization. The nonfederal sponsor is responsible for 35 percent of total project costs assigned to hurricane and storm damage reduction, plus 50 percent of total project costs assigned to recreation plus 100 percent of total project costs assigned to privately owned shores (where use of such shores is limited to private interests) during the design and implementation phase. Any costs assigned to protection of federally owned shores are 100 percent federal. In accordance with the terms of the cost share agreement, the nonfederal sponsor must provide all LERRD required for the project, participate in the project coordination team, perform necessary nonfederal audits, and perform investigations necessary to identify the existence and extent of hazardous substances on lands, easements, and rights-of-way required for the project. OMRR&R is a 100 percent nonfederal responsibility.

Section 107, River and Harbor Act of 1960, as amended—Navigation Improvements. Section 107 projects are to be formulated for commercial navigation purposes in accordance with current policies and procedures governing projects of the same type which are specifically authorized by Congress. As modified by Section 201 of WRDA 1996, Public Law 104-303, Section 101 of WRDA 1986, PL 99-662, requires that the term "general navigation features" include dredged material disposal facilities required for construction or operation and maintenance of the other general navigation features. Accordingly, for Section 107 projects, both the federal costs of initial construction and the federal costs of construction for subsequent dredged material disposal facilities count toward the per project limit. Projects implemented under this authority have the same project cost-sharing requirements as commercial navigation projects implemented under specific congressional authorization.

Section 204, Water Resources Development Act of 1992, as amended—Beneficial Uses of Dredged Material. Under this authority, USACE is authorized to execute projects that protect, restore, and create aquatic ecologically related habitats, including wetlands, in connection with dredging for construction or O&M of a federally authorized navigation project. Project costs consist of the incremental costs of the beneficial use as compared to the disposal plan that would have otherwise been used. A nonfederal sponsor is responsible for paying 25 percent of these costs, including LERRD. Under this authority, there is no process to allow the nonfederal sponsor to receive credit for in-kind work. The total federal costs associated with a beneficial use of sediments project shall not exceed $5 million. This cost limit refers to the incremental cost over the Base Plan. There is authorized to be appropriated not to exceed $15 million annually to carry out this section. Such sums remain available until expended.

Section 206, WRDA of 1996 (PL 104-303), Aquatic Ecosystem Restoration. Under this authority, USACE can participate in environmental restoration projects to restore degraded ecosystems. A nonfederal sponsor for projects implemented under this authority must provide LERRD and pay 35 percent of project construction costs. The sponsor's share may be satisfied through work-in-kind. Note that LERRD is included in the 35 percent.

Section 208, Flood Control Act of 1954, as amended—Snagging and Clearing for Flood Damage Reduction. This authority provides for minimal measures to reduce nuisance flood damages caused by debris and minor shoaling of rivers. This authority is treated as a flood damage reduction project for policy eligibility and cost sharing purposes. Work under this authority is limited to clearing and snagging or channel excavation and improvement with limited embankment construction by use of materials from the channel excavation. If investigation indicates that placement of revetment is needed to provide a complete and fully effective project, this work will be accomplished at the expense of the nonfederal sponsor. A nonfederal sponsor for projects implemented under this authority must provide LERRD and pay 35 percent of project construction costs. OMRR&R is a 100 percent nonfederal responsibility.

Section 1135, WRDA of 1986 (PL 104-303), Project Modification for Improvements to the Environment. Under this authority, if the construction or operation of a USACE project has contributed to the degradation of the quality of the environment, measures for restoration through modification of the structure or operation of the structure may be undertaken at the project site if such measures do not conflict with the authorized project purposes. A

nonfederal sponsor for projects implemented under this authority must pay 25 percent of project construction costs, including LERRD.

Section 104(b)(3), Clean Water Act (PL 92-500), Five Star Restoration Program. Under this authority, the U.S. Environmental Protection Agency (EPA) provides funds to four intermediary organizations: the National Association of Counties, the National Association of Service and Conservation Corps, the National Fish and Wildlife Foundation, and the Wildlife Habitat Council, which then make subgrants to support community-based wetland and riparian restoration projects. Preference is given to projects that are part of a larger watershed or community stewardship effort and include a description of long-term management activities. Projects must involve contributions from multiple and diverse partners, including citizen volunteer organizations, corporations, private landowners, local conservation organizations, youth groups, charitable foundations, and other federal, state, and tribal agencies and local governments. Each project would ideally involve at least five partners who are expected to contribute funding, land, technical assistance, workforce support, or other in-kind services that are equivalent to the federal contribution.

Section 104(b)(3), Clean Water Act (PL 92-500, 33 U.S.C. 1254), Wetlands Program Development Grants. Under this authority, EPA provides financial assistance to states, federally recognized Indian tribes, and local governments to support development of new wetland programs or augment and enhance existing ones. Projects must clearly demonstrate a direct link to an increase in the state's, tribe's, or local government's ability to protect its wetland resources. Recipients must provide a 25 percent match of total project cost.

Section 305, Coastal Wetlands, Planning, Protection and Restoration Act (CWPPRA) (PL 101- 646, 16 U.S.C. 3954), National Coastal Wetlands Conservation Grants. Under this authority, the U.S. Fish and Wildlife Service (USFWS) provide funds to assist states in pursuing coastal wetland conservation projects. Funds can be used for acquisition of easements in coastal lands or waters and for restoration, enhancement, or management of coastal wetland ecosystems. Federal share of costs will not exceed 50 percent, except it may be increased to 75 percent if a coastal state has established a fund (1) for the acquisition of coastal wetlands, other natural areas, or open spaces, or (2) that is derived from a dedicated recurring source of monies.

North American Wetlands Conservation Act of 1989 (PL 101-233), North American Wetlands Conservation Act Grants. Under this authority, USFWS provides matching grants to carry out wetlands conservation projects in the United States, Canada, and Mexico. Both the standard and small-grants programs help deliver funding to on-the-ground projects through the protection, restoration, or enhancement of an array of wetland habitats. Partners must match grant funds with nonfederal dollars.

Coastal Zone Protection Act of 1996 (PL 104-150), Coastal Zone Management Administration/Implementation Awards. Under this authority, NOAA assists states in implementing and enhancing Coastal Zone Management (CZM) programs that have been approved by the secretary of commerce. Funds are available for projects in areas such as coastal wetlands management and protection, natural hazards management, public access improvements, marine debris reduction, assessment of impacts of coastal growth and development, special area management planning, regional management issues, and demonstration projects with the potential to improve coastal zone management. Formula grants require a match of nonfederal funds. Program enhancement grants do not require a

match. CZM Protection Implementation awards are given to the designated state agency; in this case, DMR would receive these funds. Formula grants are program administration grants, and enhancement grants are awarded to improve the state's CZM program. These grants could be used for restoration projects if the project were a priority for the state. Typically, the funding for these grants is limited.

Fish and Wildlife Act of 1956 (16 U.S.C. 742(a)-754), Coastal Program. Under this authority, USFWS forms cooperative partnerships designed to (1) protect coastal habitats through conservation easements and acquisitions; (2) restore coastal wetlands, uplands, and riparian areas; and (3) remove barriers to fish passage in coastal watersheds and estuaries. Projects require a nonfederal match of funds of at least 25 percent.

The Land and Water Conservation Fund Act of 1965 (PL 88-578), Land and Water Conservation Fund Grants to States. Under this authority, NPS provides funds to be used for state planning and for the acquisition and development of state and local facilities that provide active and/or passive recreation opportunities. Recreation enhancement may be accomplished through the preservation of open space, estuaries, forests, wildlife, and natural resource area. Projects require a nonfederal match of funds of 50 percent.

3.4 Stakeholders

Stakeholders that will be part of implementing the master plan include federal, state and local agencies, nonprofit organizations, and private citizens. Primary federal agencies include the EPA, NMFS, USFWS, and USACE. Primary state agencies include DMR, DEQ, and the secretary of state's office. Within the secretary of state's office, the Public Lands Division has the constitutional and statutory authority for enforcement of the Sixteenth Section Public School Trust Lands and Lieu Lands laws, development and implementation of the Public Trust Tidelands Management Programs, sale of lands forfeited to the state for nonpayment of ad valorem taxes, inventory of state agency lands and services to the public and governmental subdivisions relating to sales, acquisitions, leasing, and title of the state's real property assets.

Local agencies include departments within each of the three coastal counties and cities. The responsibilities for each are outlined in Table 3-1.

TABLE 3-1
Coastal County Responsibilities

	Hancock Co.	Harrison Co.	Jackson Co.
Beaches, parks, etc.	Maintains beaches and parks in unincorporated areas of Hancock County and regulates development in unincorporated areas of the County	Maintains beaches, fairgrounds, parks, and community centers. Regulates development, zoning, and engineering in unincorporated areas of the County	Maintains beaches, fairgrounds, parks and recreation, community centers, and shelters. Regulates county harbor and engineering and development in unincorporated areas of the County
City	City of Diamondhead—Manages park lands and access to Mississippi Sound within city limits	City of Gulfport—Provides standards for managing property development fronting the Mississippi Sound in conjunction with city zoning standards.	City of Pascagoula—Manages park lands and access to the Mississippi Sound associated bays and bayous within city limits.
Port	—	Port of Gulfport—The port is governed by the Mississippi State Port Authority Board of Commissioners. The Port Authority is the legal entity responsible for the management and operations of the Port of Gulfport public cargo facilities	Port of Pascagoula—The Jackson County Port Authority is an agency of Jackson County Mississippi. The Port Authority is the legal entity responsible for the management and operations of the Port of Pascagoula public cargo facilities. The Jackson County Port Authority Board of Commissioners governs the Port Authority and the Port of Pascagoula.

Nongovernmental organizations can often serve as a project partner, providing small grants or in-kind services that can help ensure successful project implementation. Nonprofit organizations and entities include the following:

- Audubon Society
- Ducks Unlimited
- Mississippi Power Company
- Gulf Restoration Network
- Diamondhead Marina
- Waveland Yacht Club
- Pass Christian Yacht Club
- Nature Conservancy
- Sierra Club
- Mississippi Land Trust
- Mississippi Gulf Fishing Banks
- Mississippi Museum of Natural Science
- Restore America's Estuaries
- Land Trust for MS Coastal Plain

The Nature Conservancy is a nonprofit organization with the mission to locate, protect, and maintain the best examples of natural communities, ecosystems, and endangered species habitat. The Mississippi chapter supports community-based conservation projects through their Mississippi Gulf Coast Program, providing in-kind matching resources for federal grants supporting coastal and estuarine restoration projects.

The Audubon Society also has an interest in proposed BU projects along coastal Mississippi. This group's interest in creating and maintaining bird habitats complements the proposed marsh creation and restoration projects. The Audubon Society is a nonprofit organization with the mission to conserve and restore natural ecosystems, focusing on birds and other

wildlife. Through its state chapters, the society provides in-kind matching resources and limited funding matches for federal conservation grants.

Ducks Unlimited is a non-profit organization with the mission to conserve, restore, and manage wetlands and associated habitats for North America's waterfowl. In support of this mission, Ducks Unlimited is a source of both monetary and in-kind matching resources for federal grants, such as those allocated under the North American Wetlands Conservation Act.

The Gulf Restoration Network is a diverse network of local, regional, and national groups dedicated to protecting and restoring the valuable resources of the Gulf of Mexico. Member organizations in Mississippi include Delta Land Trust; Earthshores Foundation; Environmental Coalition of MS; Environmental Justice Project; Gulf Islands Conservancy, Inc.; Mississippi River Basin Alliance, Mississippi Chapter; Mississippi Wildlife Federation; Sierra Club, Mississippi Chapter; and Wetlands Watch. These organizations may also help provide sources of funding, cost-sharing, or in-kind services.

Delta Land Trust accepts conservation easement donations on forest and farm land throughout the Arkansas-Louisiana-Mississippi region. Delta Land Trust provides wetlands mitigation credits for Clean Water Act Section 404 permit applicants in the Little Rock, Memphis, and Vicksburg Districts of USACE. Delta Land Trust researches and promotes alternative economic development in the Delta based on reforestation of marginal farmland. Primary focus of Delta Land Trust includes nutrient reduction, sediment reduction, agricultural landscape change, wetlands restoration, water quality improvement, policy development, education/information sharing, and monitoring. Delta Land Trust sources of funding include foundations, individual donors, contract services, etc.

Earth Shores Foundation is an endangered species coalition located in Bay St. Louis, MS. The foundation headquarters was devastated by Hurricane Katrina, and after 5 years they are beginning to reappear, with their focus and efforts toward solving the oil problems in the Mississippi bayous, which are also the nurseries for many species throughout the food chain locally and continue working to improve the fish habitat protections.

Gulf Islands Conservancy, Inc. (GIC) is dedicated to the preservation and protection of the barrier islands and coastal wetlands of Mississippi. The GIC is a non-profit, all-volunteer organization that encourages public use of marine resources balanced with the need to protect the Gulf Coast's fragile estuarine system. The diverse membership provides a service as a friends group to the Gulf Islands National Seashore through volunteer programs, public education projects, and environmental advocacy efforts.

Mississippi River Basin Alliance is a coalition of over 150 environmental, outdoor, farm, commercial fishing, and civil rights groups from the headwaters of northern Minnesota to the Gulf of Mexico, working on bringing people together to save the Mississippi River. To that end, it distributes daily dispatches on river pollution, USACE projects, and conservation activities. In a typical month, it may host meetings where Louisiana fishermen and Corn Belt farmers talk about diminishing farm runoff; where conservation groups coordinate their strategy to improve USACE projects; or where Memphis environmentalists learn how their community's issues connect with others up and down the Mississippi. Its mission is to bring people and organizations together to protect and restore communities and the environments of the Mississippi River Basin. The alliance plans to continue

coordinating opposition to expansion of the Upper Mississippi's locks, to develop policies to reduce runoff polluting the Gulf, and to encourage more riverside greenways.

Land Trust for Coastal Mississippi is a statewide organization was organized in 2000. The mission of the Land Trust is to "conserve, promote and protect open spaces and green places of ecological, cultural or scenic significance in the counties of the Mississippi Coastal Plain."The Land Trust focuses on the six coastal counties of Hancock, Harrison, Jackson, Stone, Pearl River, George. The organization has numerous programs including conservation lands, easements, teaching resources, watershed partnerships, and a membership who volunteers for numerous programs during the year.

4. Permitting and Beneficial Use

4.1 Dredging and Dredge Disposal Permitting in Mississippi

DMR is the point of contact in Mississippi for wetland permits in the Mississippi Coastal Zone, which include the counties of Hancock, Harrison, and Jackson. Under a memorandum of agreement with the Mobile and Vicksburg districts of the USACE, applications for wetland activities in the coastal zone are to be submitted to DMR, which has regulatory authority in the Mississippi coastal zone in accordance with the Coastal Wetlands Protection Law (Sections 49-27-1 through 69), enabling legislation in Section 57-15-6 for the Mississippi Coastal Program and the guidelines of the Mississippi Coastal Program.

Applications for wetland activities in the Mississippi Coastal Zone are submitted to the DMR on the joint application and notification form. DMR then evaluates the permit application for completeness and forwards copies to the appropriate agencies for review and comment. As part of the permit application, the applicant is required to submit a BU plan for any dredging activities over 2,500 yd^3. The DMR permitting office will forward the application to the DMR Beneficial Use Program for review.

For minor activities within the jurisdiction of the DMR, at or below the watermark of ordinary high tide, DMR will issue the joint USACE permit. For major activities, those not covered by the general permit guidelines, separate permits will be issued by DMR and by USACE. In all cases, all applications should be submitted to DMR on the joint application form.

In accordance with Section 401 of the Clean Water Act (33 U.S.C. 1341), DEQ Office of Pollution Control issues water quality certification for permits which may result in any discharge into waters of the U.S.

In 2007, the State of Mississippi and USACE issued general permits for minor structures and activities in the coastal zone. These general permits were established to minimize the unnecessary duplication of efforts between agencies and to facilitate the permitting process for routine projects with limited or minimal impacts on the coastal zone. Table 4-1 summarizes existing state coastal use permits that could be used to create beneficial use projects.

TABLE 4-1
General Permits for Construction in Mississippi Coastal Zone Applicable to Beneficial Use Projects

	Description
SAM-2006-2029-ALF, MS-GP-07—Maintenance Dredging	
Area to be dredged	Dredging is limited to the previously dredged and previously authorized dimensions. For proposals in the Mississippi Sound, project specific authorization must be obtained through the Mobile District, versus the DMR, so as to allow for completion of consultation with the NMFS regarding Gulf sturgeon critical habitat.
Cubic yards of material to be removed	Maintenance dredging of up to 2,500 yd^3 of material is authorized by this permit; however, maintenance dredging of previously authorized residential boat slips or open-water berths shall be limited to 500 yd^3 of material.
Best management practices	Best management practices should be used at all times during construction to minimize turbidity at both the dredged and spoil sites. Methods should include the use of staked hay bales; staked filter cloth; sodding, seeding, and mulching; staged construction; and the installation of turbidity screens around the immediate project site. Any effluent from the disposal area should be routed through a return swale system and filtered through a series of hay bales and silt fences so as to reduce the turbidity of the effluent.
Disposal area	All dredged material must be properly confined in an upland area unless otherwise authorized. Hydraulic dredging will require an upland bermed disposal area (or other suitable methods of retention). Additional best management practices as required by the DEQ will apply regarding the return water from the bermed disposal area. Dredged material disposal areas shall be immediately seeded and stabilized to prevent the movement of sediment offsite and into adjacent drainage areas.
Hydrographic survey	Before and after hydrographic surveys may be required based on local knowledge of the waterway and likelihood that important aquatic resources or special aquatic sites could be present.
Special aquatic sites	No dredging of wetlands, submerged grass beds, or shellfish beds is authorized (exceptions maybe made for noxious vegetation in man-made water bodies).
SAM-2006-2030-ALF, MS-GP-08—New Work Channel Dredging	
Cubic yards of material to be removed	Dredging of up to 1,000 yd^3 of material is authorized by this permit. Authorization under this permit is limited to open-water channels for navigation access, and must be a single and complete project. For proposals in the Mississippi Sound, project specific authorization must be obtained through the Mobile District, versus the DMR, so as to allow for completion of consultation with the NMFS regarding Gulf sturgeon critical habitat.
Maximum depth of dredging	Dredging depth must be no greater than that of the controlling navigational depth of the adjacent waters, but cannot exceed a depth greater than 6 feet below mean low tide or ordinary low water unless specifically authorized.
Best management practices	Best management practices should be used at all times during construction to minimize turbidity at both the dredged and spoil sites. Methods should include the use of staked hay bales; staked filter cloth; sodding, seeding, and mulching; staged construction; and the installation of turbidity screens around the immediate project site. Any effluent from the disposal area should be routed through a return swale system and filtered through a series of hay bales and silt fences so as to reduce the turbidity of the effluent.

TABLE 4-1
General Permits for Construction in Mississippi Coastal Zone Applicable to Beneficial Use Projects

	Description
Disposal area	All dredged material must be properly confined in an upland area unless otherwise authorized. Hydraulic dredging will require an upland bermed disposal area (or other suitable methods of retention). Additional best management practices, as required by DEQ, will apply regarding the return water from the bermed disposal area. Dredged material disposal areas will need to be immediately seeded and stabilized to prevent the movement of sediment offsite and into adjacent drainage areas.
Hydrographic survey	Before and after hydrographic surveys may be required based on local knowledge of the waterway and likelihood that an important aquatic resource or special aquatic site could be present.
Fill material	Dredging for fill material is not authorized under this permit; however, navigation projects may use the dredged material for fill.
Special aquatic sites	Grass bed survey: A submerged aquatic vegetation (grass beds) survey may he required based on local knowledge of the waterway and the likelihood that grass beds may be present. In water bodies without shoreline protection (bulkheads, riprap, etc.), a minimum 10-foot buffer must be maintained between the proposed work area and wetlands and a 3:1 (horizontal: vertical) or flatter side slope must be maintained. No dredging of wetlands, submerged grass beds, or shellfish beds is authorized (exceptions may be made for noxious vegetation in man-made water bodies).
SAM-2006-2031-ALF, MS-GP-09—Fill in Previously Dredged Areas[a]	
Previously dredged wetlands or natural channels	If the area to be filled had previously been a wetland or natural channel, the fill may not exceed the original elevations or dimensions.
Fill material	Only clean material free of waste, metal and organic trash, unsightly debris, etc., may be used as fill.
Areas excluded	No wetlands, submerged grass beds, natural streams, shellfish beds, or natural channels may be filled. No area providing mitigation, enhancement, or flushing of an aquatic system may be filled.

[a]Authorizes the filling of previously dredged areas such as boat slips, artificial canals, etc.

4.2 Gulf Sturgeon

One issue that will affect permitting is the Gulf sturgeon. Gulf sturgeon were listed as threatened in 1991 after their stocks were greatly reduced or extirpated throughout much of their historical range by overfishing and habitat degradation. Protection of the Gulf sturgeon is jointly managed by USFWS and NMFS of the NOAA Fisheries. On April 18, 2003, the Mississippi Sound was designated critical habitat for the Gulf sturgeon (Figure 4-1). "Critical habitat" is a term used in the ESA to refer to specific geographic areas that are essential for the conservation of a threatened or endangered species and that may require special management and protection. An area designated as critical habitat is not a refuge or a sanctuary for the species. Only activities that involve a federal permit, license, or funding that may affect critical habitat will require consultation with USFWS and NMFS on actions they carry out, fund, or authorize to ensure that their actions will not destroy or adversely modify the Gulf Sturgeon's critical habitat.

FIGURE 4-1
Gulf Sturgeon Critical Habitat Boundaries
From http://sero.nmfs.noaa.gov/pr/sturgeon.htm

As stated in 68 FR 13380,

> actions that may destroy or adversely modify Gulf sturgeon critical habitat may include, but are not limited to, dredging; dredge material disposal; channelization; in-stream mining; land uses that cause excessive turbidity or sedimentation; water impoundment; hard-bottom removal for navigation channel deepening; water diversion; dam operations; release of chemicals, biological pollutants, or heated effluents into surface water or connected groundwater via point sources or dispersed non-point sources; release of chemical or biological pollutants that accumulate in sediments; and other physical or chemical alterations of channels and passes. Note, however, that these same activities may be carried out in a way that does not destroy or adversely modify critical habitat.

Assessments are highly site and fact specific and the information about the species and its habitat is continually expanding. For example, Gulf sturgeon migration and feeding may occur within the Mississippi Sound. USFWS and NMFS will work closely with DMR and USACE to identify appropriate measures to reduce dredging impacts to Gulf sturgeon critical habitat while allowing dredging and the implementation of beneficial use projects in the Mississippi Sound.

4.3 Beneficial Use Permitting

The BU permitting process applies to any project requiring a state coastal use permit that involves dredging 2,500 yd^3 or more to facilitate the movement or mooring of vessels. The permitting process for beneficial use adopted by the DMR Office of Coastal Ecology includes three options for permit applicants involved in coastal projects that include dredging:

1. Implementing a project that makes beneficial use of the dredged material
2. Providing for the use of the dredged material on an approved coastal restoration project
3. Using dredged material at another location that creates the same amount of beneficial use

One of the BU permitting processes is allowing in-lieu contributions instead of direct use of the dredged material for projects where direct use of the soil on beneficial coastal projects is not feasible due to quality of soil or the expense of transportation.

The process to establish a beneficial use project is:

1. A joint application, which should include a BU plan for any project dredging over 2,500 yd^3, is submitted to the DMR permitting office.
2. The BU plan is forwarded for review by BU Program.
3. The BU Program administrator will review plan and determine if appropriate site for disposal has been chosen. If the site is a pre-designated site, DMR will determine if the site has capacity for the proposed project.
4. If the site has capacity, the BU Program administrator will send approval to the permitting office.
5. If the plan does not include a specific BU site, the BU Program administrator will review existing priority areas, determine capacity for new material, and determine if existing permits are sufficient. Based on these determinations, DMR will implement needed approvals for the application to ensure the proposed dredged material is used beneficially.

This master plan identifies proposed coastal restoration sites for consideration in development of BU plans. The goal is to provide coordination through the BU Program administrator to ensure that existing or prioritized project sites receive dredged material for coastal restoration and enhancement.

4.3.1 Beneficial Use Site Identification and Development

State agencies, including the secretary of state's office, actively participate in the BU site designation. Other offices within DMR also participate in the process to coordinate goals for new BU sites with goals to expand and establish new oyster and fishing reefs. The Office of Coastal Preserves participates in designating new BU sites within or adjacent to state coastal preserves. The Coastal Preserves Program would like to enhance and restore the coastal

marshes of the preserves. Since the coastal preserves are owned by the state, designating BU sites within the preserves is an easier process than designating a site on private lands.

4.3.2 Testing of Material

With the participation of state regulatory agencies, risk-based testing protocols can be used to evaluate the dredged material for each of its physical phases (sediment and as dry soil). As the dredged material is moved upland and changes to the physical characteristics occur (sediment to soil), there needs to be a clear division between regulatory programs evaluating aquatic and terrestrial end-points. For dredged material that is planned for placement in waters in or adjacent to the Mississippi Sound, testing is required by EPA and DEQ to ensure the material does not contain contaminants.

In order to encourage beneficial use of dredged material, make the process an attractive alternative to upland placement, and streamline the process, DMR has prepared interim testing protocols (see Table 4-2) for dredged material. They have been developed by DMR's BU Program in order to:

- Provide regulators and permit applicants with consistent guidance for evaluating, sampling, and testing sediments to be dredged from waters of the state for potential use in Mississippi's Beneficial Use of Dredge Material Program
- Minimize the burden on applicants and contractors as they seek compliance with Mississippi's Beneficial Use of Dredge Material Law (Section 49-27-61, Mississippi Code of 1972) effective July 1, 2010
- Establish nonanalytical evaluation as the baseline for non-commercial/industrial (low risk) dredging projects
- Delineate when bioassay screening is allowed and when chemical analysis will be required
- Develop standardized chemical testing/screening methods for projects with higher risk due to association with certain commercial or industrial environments (At this time, the NOAA Screening Quick Reference Tables protocols will be required unless more specific potential contaminant information is available and/or more focused or alternate testing methodologies are proposed by the applicant and accepted by the appropriate regulatory agencies.)

The disposal of dredged material into inland waters is governed by the Clean Water Act and the disposal of dredged material into ocean waters is governed by the Marine Protection, Research, and Sanctuaries Act (MPRSA) of 1972, Section 103 (PL 92-532). The procedures for evaluating sediments prior to disposal are provided in two manuals prepared by USACE and EPA: the "Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S.—Testing Manual,"[2] known as the Inland Testing Manual, and the "Evaluation of Dredged Material Proposed for Ocean Disposal-Testing Manual," commonly known as the Ocean Disposal-Testing Manual, or "Green Book." These DMR Interim Protocols have been established with regard to the Inland Testing Manual and the Green Book.

[2] Available at http://water.epa.gov/type/oceb/oceandumping/dredgedmaterial/testing.cfm.

TABLE 4-2
DMR Interim Protocols for Dredge Material Analysis for Beneficial Use

	Description
Evaluation	Any information provided by the applicant or their authorized agent regarding the potential for (or the absence of) chemical contamination at the project site or in the immediate vicinity or watershed could be considered to help reduce the need for additional analytical assessment. This could include: • Historical information regarding the use of the project site and/or adjacent or upstream sites • Commercially available environmental records searches *Note:* Applicants or authorized agents may want to approach an initial evaluation of this type as they would a typical Phase 1 Environmental Assessment albeit with a focus on submerged/ aquatic aspects. Where no specific information regarding the potential for contamination (or lack thereof) is provided by the applicant or authorized representative, or if public commentary or other information suggests a possibility of contamination for a noncommercial/nonindustrial project, a nominal bio-assay screening process will be used. If however, specific potential contaminants are identified, chemical analysis will be required.
Sampling	Unless an alternative strategy is approved, the minimum sample collection interval will be: • For dredging projects totaling between 2,500 yd^3 and 25,000 yd^3, a minimum of two grab samples (one pair) will be taken. • For typical channel dredging or similar "linear" projects, two samples will be from the centerline of the channel, one at the upstream limit and the other at the downstream limit. For projects exceeding the base volume of 25,000 yd^3, an additional pair of grab samples will be taken on the centerline for each additional 25,000 yd^3 or part thereof. Each pair of samples will be composited so that each 25,000-yd^3 segment will be individually analyzed. Sample locations for nonlinear projects will be determined on a case by case basis. This sampling methodology may also be adjusted as appropriate on projects greater than 100,000 yd^3. All sample locations will be preapproved by DMR. The specific type of analysis to be run will dictate the sample size, retrieval and handling methods. Please contact the lab that will be used for specific instructions.
Analysis	<u>Sediment Toxicity Tests</u> • Method for Assessing the Toxicity of Sediment-associated Contaminants with Estuarine and Marine Amphipods, Test Method 100.4. EPA/600/R-04/025, June 1994. • 10-day *Leptocheirus plumulosus* sediment toxicity test Includes initial weight data for representative test organisms and final weight data for each replicate of each treatment. <u>Analytical Analyses</u> • Percent organic matter, total organic carbon, and total volatile solids • Particle size distribution Sample and shipping containers (ice chests): 1-gallon bucket with lid (hydrogen chloride and deionized water rinsed) *Note:* For sites where some specific contaminate data is available or a commercial/ industrial site is involved, NOAA Screening Quick Reference Tables have been accepted by DMR and DEQ on a provisional basis. Additional or alternate chemical analysis may be required based upon site specifics (http://response.restoration.noaa.gov/book_shelf/122_NEW-SQuiRTs.pdf.

If, based on results of DMR's Interim Protocols for Beneficial Use, it is determined more testing is needed, the permittee will follow the established guidance of USACE and EPA for the testing of dredged material. If initial bioassay testing results in fatalities of the samples,

chemical testing of the material will be required before the material can be cleared for BU. The testing will ensure the potential BU material "will not cause significant harmful effects to human health or the marine environment."

4.3.3 Inland Testing Manual

The Inland Testing Manual describes the procedures for implementing requirements of Section 404 of the Clean Water Act for evaluating dredged material destined for discharge in fresh, estuarine, and saline (near-coastal) waters. This manual, written by USACE and EPA, addresses the contaminant-related impacts associated with the discharge of material resulting from dredging, and contaminant-related impacts associated with dredged material runoff from confined disposal areas.

This manual and the Ocean Disposal-Testing Manual provide the framework for testing as part of the overall decision making process on whether dredged material can be disposed in U.S. waters. This manual provides the national guidelines for testing and evaluation, while site-specific issues can be resolved at the regional levels of EPA and the USACE district offices.

There is a tiered approach to testing and evaluation:

- Tier I Evaluation of Existing Information
- Tier II Sediment and Water Chemistry Assessment
- Tier III Generic Bioassays—Toxicity and Bioaccumulation Testing
- Tier IV Specific Bioassays—Toxicity and Bioaccumulation and Other Testing

The Inland Testing Manual provides national guidance for dredged material testing, while the USACE district offices and EPA regional offices assist with regional implementation.

4.3.4 Ocean Disposal-Testing Manual

The Ocean Disposal-Testing Manual, or "Green Book," outlines the procedures for testing and evaluating dredged material. The evaluation of dredged material increases in intensity with the risk of contaminants and/or the absence of existing information. If an evaluation in Tier I is not adequate to determine the material's suitability for ocean disposal, the evaluation proceeds to the next tier(s), Tiers II, III and IV, and the protocols of the next tier(s) must be followed.

EPA and USACE must approve dredged material testing procedures. No permit can be issued unless the agencies have enough information to determine that ocean disposal will not cause significant harmful effects. As with inland testing, there are four tiers for testing dredged material for ocean disposal:

- Tier I Evaluation of Existing Information
- Tier II Conservative Screening Tools
- Tier III Laboratory Bioassays
- Tier IV Advanced Biological Evaluations

The Ocean Disposal-Testing Manual provides national guidance for dredged material testing, while USACE district offices and EPA regional offices assist with regional implementation.

5. Priority Areas and BU Projects

With the passage of the new BU law for Mississippi, the need to identify potential BU sites within each coastal county is of the utmost importance. The concept behind identifying BU sites within each county is to provide commercial dredging companies and agencies, such as USACE, with sites, both large and small, within coastal areas and back bays. The desire is to have BU sites close to potential dredging sources so that the requirement to dispose of dredged material would not be cumbersome to private and agency dredging projects.

The projects listed below have been suggested by federal, state, and local authorities as possible projects to use dredged material beneficially along coastal Mississippi. As time passes, technologies improve, and the master plan matures, new projects could and probably will be proposed.

In addition to specific projects, "priority areas" have been identified within watershed areas and coastal preserves where erosion has dramatically changed the historic shoreline. Data gathered from NOAA has been used to determine areas that have experienced significant land loss. This information has been used to select areas along that coast that could be restored. As an example, Figure 5-1, Heron Bay, illustrates the 1953, 1969 and current shorelines. Areas such as this are priority areas for beneficial use. Maps in Appendix C include specific projects and priority areas for beneficial use.

Dredged material can be used beneficially to support the implementation of ecosystem restoration projects. Dredged material consists of a range of sediment types that includes silt, sand, and coarse gravel. The master plan will aid in matching the material needed for a project to the dredged material available for use.

5.1 Project Types

Beach drift retention projects are used to help retain sand in the littoral draft zone and on the shoreline. Materials that may be used for this type of project include rock or rubble, gravel, sand, and consolidated clay. These materials may be used to construct dikes, riprap shore protection, jetties, and breakwaters to help hold the sand in place.

Beach restoration or beach nourishment projects can enhance the profile of the beach and moderate the wave climate at the shoreline. Beach restoration has benefits: it provides coastal protection; it enhances the recreational aspects of the beach; or it can create new beaches. Borrow material can supply the large amounts of sand that are needed to restore a beach. While this is an option for BU, it is not the first choice of DMR.

Marsh restoration projects can restore marshes by using dredged material through several different methods. Dredged material can be used to restore the viability of the marsh. After the material is dewatered, it can be used to construct erosion barriers and other structures that aid in restoring degraded or impacted marsh or it can also be used to construct wind and wave barriers that will allow natural vegetation to regrow and restore the viability of

the marsh. Dredged material can be used to stabilize eroding natural wetland shorelines or nourish subsiding marshes. Sediments that are appropriate for this type of project include consolidated clay, silt/soft clay, or a mixture of these.

Figure 5-1 Heron Bay Historic Shoreline

Marsh creation can be accomplished by providing the correct hydric soil conditions, appropriate hydrologic conditions, and marsh vegetation. The creation of a marsh will also include long-term planning, design, maintenance, and management. Dredged material has been used extensively to create marshes. Employing similar techniques used for marsh restoration, dredged material can be used to create marshes by raising the intertidal elevation of the substrate.

Small bird islands could be created using a combination of dredged material and containment. This type of project offers several benefits: it would create new habitat for migratory and resident bird populations; it would create new recreational areas for boaters and fishermen; and it could act as a new small barrier island. Locations for new bird islands would be coordinated with DMR, USACE, and other federal agencies.

Mosquito ditches were constructed along the coast of Mississippi in the 1950s and were designed to help combat mosquitoes. The intent was that the ditches would allow larger fish into the marsh and these fish would eat the mosquito larvae. The idea did not work. The existing ditches are about 6 to 30 feet wide, approximately 2 to 10 feet deep, and are located in all three coastal counties of Mississippi. The state would now like to fill in these ditches and restore these areas to their original elevation. Efforts to fill them will be evaluated on a project-by-project basis.

Below is a summary, by county, are the general characteristics, potential BU projects and DMR-identified Priority Areas.

5.2 Hancock County

5.2.1 General Characteristics

Hancock County is the western most of the three Mississippi coastal counties. It is bordered to the west by the Louisiana, to the south by the Gulf of Mexico, and to the east by Harrison County. Hancock County is primarily comprised of small cities and communities with rural and natural areas. The county population is growing and is projected to increase by over 80 percent by 2030. Incorporated areas include the cities of Bay St. Louis, Waveland and Shoreline Park. These three cities house over 40 percent of the county's population with the unincorporated Diamondhead community housing an additional 14 percent. Other unincorporated areas with significant populations include Pearlington, Ansley, Bayside Park, Clermont Harbor, and Kiln.

The Pearl River and the coast play a significant role in the county's economy. Commercial shrimp and oyster harvesting has historically been a notable contributor to the county's economy. However, a high percentage of the oyster reefs were destroyed during Hurricane Katrina. These reefs are in the process of recovering and are expected to return to favorable conditions for harvesting within the next few years. Other natural resource industries in the county include dirt mining, silviculture, and landfills. Many of the dirt mining activities are associated with rebuilding levees in Louisiana.

Over two-thirds, an estimated 219,454 acres, of Hancock County is undeveloped land. A significant portion remains undeveloped due to restrictions or easements associated with the buffer zone for the NASA Stennis Space Center. Farmland, forest and wetlands make up most of the undeveloped property in the county. The forests include pine, hardwood, and pine/hardwood with the poorly drained areas hosting black gum, swamp tupelo, and pond cypress. Timber, cattle, and horse farms are the primary uses for the agricultural land. Cultivated crops are limited due to the sandy soil conditions throughout most of the county. Approximately 88,575 acres of wetlands are located in Hancock County. The wetlands range from coastal/estuarine wetlands to upland/non-tidal wetlands.

5.2.2 Hancock County Coastal Preserves

The following Mississippi Coastal Preserves are located in Hancock County. The coastal preserves include priority areas for BU projects.

Hancock County Marsh Preserve

This preserve is comprised of 13,570 acres of marshland bordering the Mississippi Sound from the Pearl River to Point Clear. Lands are a combination of privately, locally, state, or federally-owned tidal wetlands, however much of the property is owned by the state. DMR activity monitors the preserve. The preserve is used by boaters and anglers for waterfowl hunting and fishing and by commercial operators to harvest shrimp and oysters. An identified threat to the preserve is residential open septic systems.

The habitat within the preserve includes several low ridges and small hammocks. Point Clear Island and Campbell Island have characteristics similar to barrier islands. The habitat includes: estuarine subtidal; large tidal creek/estuarine intertidal; sand shore; mesohaline marsh; and oligohaline marsh/other shell middens. This habitat supports a variety of wildlife and rare or endangered species including: Black-crowned Night Heron, White-faced Ibis, Merlin, Royal Tern, Barn Owl, Mississippi Diamondback Terrapin, American Alligator, Gulf Salt Marsh Snake, and the Tiny Leaved Buckthorn, which is one of the rarest shrubs in the nation.

USACE has recently completed a BU project at Bayou Caddy/Point Clear that is assisting in the restoration of the historic shoreline of the area. The BU site will soon be planted with marsh grasses; however, there are areas north and west of the new BU site that can also be filled with dredged material to enhance the coastal marshes of the Heron Bay marsh.

Bayou La Croix

The Bayou La Croix Preserve is comprised of 1,478 acres, which follows the edge of the non-forested marsh along Bayou La Croix. The preserve is managed and monitored by DMR. The lands adjacent to the preserve are privately, locally, state, and federally-owned. An identified threat to the preserve is residential open septic systems.

The habitat of the preserve is comprised of small tidal creek/estuarine intertidal and oligohaline marsh. The upper bayou is tidally influenced with bands of cypress/gum swamp, freshwater marsh, and floating leaved aquatic beds. The lower bayou is a combination of mid-level needle rush zones.

The area is used on a seasonal and occasional basis by boaters and anglers for waterfowl hunting and fishing.

Grand Bayou

The Grand Bayou Preserve is comprised of 565 acres along the edges of open brackish marsh. The preserve is bordered by a small levee and is primarily marine, receiving some freshwater runoff. The preserve is privately, locally, state, or federally-owned. The largest area of the preserve is state-owned tidal wetlands. The preserve is managed and monitored by DMR. The property is used by boaters and anglers for seasonal and occasional waterfowl hunting and fishing. An identified threat is residential open septic systems.

This preserve is a small estuarine marshland with habitat consisting of: muddy sand embayment/estuarine subtidal; mesohaline marsh; and oligohaline marsh. Rare and endangered species supported by this habitat include the Gulf Coast Toad, River Frog, and Carolina Lilaeopsis.

Jourdan River Preserve

The Jourdan River Preserve is comprised of 6,423 acres from the mouth of the Jourdan River to the forested area to the northwest. The preserve includes privately, locally, state and federally-owned tidal lands, most of which is owned by the state. The preserve is managed and monitored by DMR. The property is used by boaters and anglers on a seasonal and occasional basis to hunt waterfowl and fish. Threats to the preserve include residential open septic systems.

The habitat is estuarine intertidal comprised of large tidal creek, oligohaline marsh, and meohaline marsh. The upper Jourdan River is tidal freshwater lined with cypress/gum wetlands. Floating leaf cow lily occurs along the shoreline in this area. The middle and lower Jourdan River is oligohaline with the middle having a mix of saltgrass and needle rush while the lower dominated by needle rush with stands of cordgrass. The habitat provides a site for feeding, resting and wintering for migratory birds including the Brown Pelican, White Pelican, Osprey, and Cormorant.

5.2.3 Other Potential BU Sites

Sites other identified as potential beneficial use sites include the following.

Collin Point, Inside St. Louis Bay

This is an area that will be able to accept material. The material could be trucked in and therefore would not affect Gulf sturgeon. Historically, in the 1940s, the area was an oyster factory and there are lots of shells in the area.

Tennessee Gas Pipeline

Located in the southwest corner of the state, near the Pearl River, is a pipeline with an adjacent canal. The intent of this project is to help restore the marsh and the natural water flow by filling the canal, degrading the existing side-cast berms, and possibly burying the pipeline.

Jourdan River

The Jourdan River has marsh islands at the mouth of river. These islands could be enhanced and restored using a thin layer application of dredged material.

Jourdan River at I-10

Areas under the recently constructed bridge are open water. These areas could be filled, restoring marsh destroyed with construction of the bridge.

Biloxi Marsh (Louisiana)

The islands south of Pearlington are an area of Louisiana called the Biloxi Marsh Complex. Restoration of this marsh area will support fisheries in Louisiana and Mississippi. Initial informal discussions with Louisiana natural resources staff indicate this project would be supported by the state.

5.3 Harrison County

5.3.1 General Characteristics

Harrison County is the middle of Mississippi's three Gulf coast counties. It is bordered to the west by Hancock County, to the East by Jackson County, and to the south by the Gulf of Mexico. The county had a total population of 181,191 in 2009, which was over a 4 percent decrease since 2000; the decrease is due to Hurricane Katrina in 2005. The cities of Biloxi and Gulfport both serve as county seats. Other cities within the county include D'Iberville, Long Beach, and Pass Christian.

5.3.2 Harrison County Coastal Preserves

The following Mississippi Coastal Preserves in Harrison County. The coastal preserves include priority areas for BU projects.

Wolf River Marsh Preserve

The Wolf River Marsh Preserve is comprised of 2,426 areas of non-forested marsh along the Wolf River from Grassy Point to the end of the marsh. The preserve consists of privately, locally, state and federally-owned tidal wetlands; most of the preserve is state-owned. The preserve is managed and monitored by DMR. The property is used by boaters and anglers for seasonal and occasional waterfowl hunting and fishing. A threat to the preserve is encroaching development.

The habitat is comprised of: large tidal creek; muddy sand embayment/estuarine intertidal; mesohaline marsh; and oligohaline marsh. The preserve includes expansive tidal freshwater marsh which is dominated by sawgrass. The lower portion of the Wolf River is oligohaline dominated by needle rush with duck potato and big cordgrass in some areas. Smooth cordgrass is located along the edges of creeks. The preserve serves as a feeding, nesting and wintering location for a variety of migratory birds including the Brown Pelican, White Pelican, Osprey, and cormorants. Rare and endangered species that live in the marsh include Mottled Duck, Osprey, Yellow Rail, Black Rail, Coastal Shiner, Diamondback Terrapin, American Alligator, Gulf Salt Marsh Snake, and Southern Red Cedar.

Deer Island Preserve

The Deer Island Preserve is comprised of 400 acres and follows the beach on Deer Island. The southern border contains narrow natural beach/dune areas and the remaining property is high levee formed by excavation of channels. The levee has been breached in three locations to allow for hydrolic exchange between the Sound and the canals. The majority of the lands within the preserve are owned, managed and monitored by the DMR.

Habitat within the preserve is comprised of: Mississippi Sound sand bottoms; barrier island pond/lagoon complex; polyhaline marsh; mesohaline marsh; slash pine maritime forest; and relic dune scrub. This habitat provides a feeding, resting and wintering area for migratory birds, including the Brown Pelican and Cormorant. The preserve supports the Great Blue Heron Rookery and a number of rare and endangered species including Brown Pelican, Sharp-Shinned Hawk, American Kestrel, Merlin, Snowy Plover, American Oystercatcher, Least Tern, and Southern Red Cedar.

The USACE completed a restoration project on Deer Island in spring 2011. Deer Island was divided into two parts by Hurricane Camille in 1969 and the breach increased with additional storms. Hurricane Katrina greatly increased the size of the breach. The restoration project involved constructing two containment dikes on the north and south sides of the island. Sandy fill material from the breached area was stacked and covered in geotextile material, and ultimately covered with rock. Follow-up plans include planting the large sandy expanse with grasses and small trees.

Biloxi River Marsh Preserve

The Biloxi River Marsh Preserve is comprised of 4,020 acres following the edges of the marsh along the Biloxi and Tchoutacabouffa Rivers and Bernard Bayou. The preserve includes privately, locally, state, and federally-owned tidal wetlands. A large portion of the preserve is owned by the state. The preserve is managed and monitored by DMR. The land is used by boaters and anglers on a seasonal and occasional basis for waterfowl hunting and fishing. Residential open septic systems pose a threat to the preserve.

The marsh is dominated by needle rush with duck potato. Bands of smooth cordgrass align the creeks with salt-meadow grass along the upland borders. The habitat is estuarine subtidal and comprised of: muddy sand embayment; embayment widgeon grass bed; large tidal creek/estuarine intertidal; mesohaline marsh; oligohaline marsh; and tidal freshwater marsh. Some areas of the marsh are non-forested. The preserve provides habitat for resting, feeding and wintering for migratory birds including the Brown Pelican, White Pelican, Osprey, and Cormorant. Rare and endangered species on the preserve include the Mottled Dusk, Coastal Shiner, and Diamondback Terrapin Alligator.

Bayou Portage Preserve

The Bayou Portage Coastal Preserve is comprised of 1,137 acres of estuarine marsh along Bayou Portage. Property adjacent to the preserve is privately, locally, state or federally owned. The preserve is managed and monitored by DMR. Boaters and anglers use the preserve on a seasonal and occasional basis to hunt waterfowl and fish. A greatest threat to the preserve is nearby residential areas with open septic systems.

The habitat within the preserve is estuarine marsh comprised of: muddy sand embayment; small tidal creek/estuarine intertidal; mesohaline marsh; and oligohaline marsh. The marsh is primarily covered with needle rush with duck potato and big cordgrass. Smooth cordgrass is located along the edges of creeks.

5.3.3 Public Use/Access Lands

Harrison County is the most highly developed of the three Mississippi coastal counties. It is home to resorts and attractions to lure tourism. The coastline of Harrison County includes a developed, 26-mile man-made beach named Sand Beach. A Master Plan for the redevelopment of Sand Beach after Hurricane Katrina (Harrison County Sand Beach Master Plan, 2008)

5.3.4 Other Potential BU Sites

Biloxi River

In the Back Bay area of Harrison County, in the Biloxi River, there are numerous small islands, east and west of the bridge, and within the bay itself. There is also marsh loss within

areas on the north and south shores of the bay. Also within the bay are "spoil islands," islands creating by dredging. These islands now support wildlife and wetlands. It is proposed to restore the footprint of these islands. For these areas, thin layer application of dredged material would help restore the historic shoreline.

Deer Island Mosquito Ditches

The state would like to fill in these ditches and restore the area to its original elevation. For this project to succeed, appropriate dredged material would most likely have to be pumped into the area from a dredge site relatively close due to the narrowness of the ditches. The amount of material that will be needed will vary depending on the length and depth of each ditch.

Goat Island

There is a large canal that cuts across the island. DMR would like to fill the canal, restoring the marsh. This land is currently privately owned.

5.4 Jackson County

5.4.1 General Characteristics

Jackson County is Mississippi's eastern most Gulf coast county and is bordered to the east by the Alabama state line. Most development is concentrated in the coastal, southern region of the county. Over half of the land in the county is not suitable for development due to environmental or regulatory issues. This includes the areas within National Forest, Sandhill Crane Wildlife Refuge, wetland areas within the Pascagoula River watershed, and public areas.

Along with development, population is concentrated in the southern portion of the county. However, there is a trend for people to move north away from the coast to avoid hurricanes, and county planners anticipate this trend to continue as infrastructure and public services expand into more northern areas of the county. Population has increased over the past four decades with some periods of rapid growth. However, a 4.7 percent population decline was reported in 2006 due to residents being displaced after Hurricane Katrina. Overall, Jackson County ranks between Hancock and Harrison counties in total population.

Manufacturing, especially that driven by the defense and fuel industries, employs a higher percentage of workers, approximately 37 percent, than any other sector. The retail trade and construction industries also are important contributors to the county's economy. Although the county is located on the coast, with over 50 percent of the total land area undeveloped, employment within the fisheries and agricultural industries is negligible. The average annual wages reported by county residents are higher than the Mississippi state average but lower than the national average.

Along with rail, air, and surface transportation, the Port of Pascagoula ranks 2nd in the State, behind the Mississippi State Port at Gulfport, for total tons of goods transported. The Port of Pascagoula spans over approximately 214 acres and has two harbors, each with a depth of 38 feet. The Bayou Casotte Harbor is on the east side of Pascagoula with the West Harbor being on the other side of the city.

5.4.2 Jackson County Coastal Preserves

The following Mississippi Coastal Preserves Program Projects are located in Jackson County. The coastal preserves include priority areas for BU projects.

Round Island

Round Island is a 65 acre site south of Singing River Island. The lands are mostly privately and state-owned. It provides feeding, resting, and wintering habitat for a variety of migratory birds and is a breeding area for the Great Blue Heron. Rare and endangered species supported on the site include the Osprey, the American Alligator, and the Night-Flowering Ruellia. The site is used on a seasonal basis for limited waterfowl hunting and fishing.

Pascagoula River Marsh

The Pascagoula River Marsh Preserve is 11,150 acres of brackish coastal marshland at the mouth of the Pascagoula River. It supports over 300 species of plants with needle rush being the dominant species. It includes the tidal freshwater area of Paige Bayou, which supports bald cypress and saw grass. Forested islands, with live oaks and other species are located at the northern extremity of the property.

Rare and endangered species located on the site include American Swallow-Tailed Kite, Bald Eagle, Northern Harrier, Peregrine Falcon, Gull-Billed Tern, Gulf Sturgeon, Diamondback Terrapin, Redbelly Turtle, Gopher Tortoise, Spanish Amber snail, Florida Flatcoil, Tall Prarie-Gentain, White Arum, and Texas Spider Lily. Some areas of the preserve are nesting sites for the Mississippi Redbelly Turtle and the Gopher Tortoise. The preserve also provides feeding, nesting and migratory habitat for migratory birds, including the Brown Pelican, White Pelican, Osprey, and Cormorants. The tidal marsh areas serve as nursery areas for Gulf seafood fisheries, provide hurricane buffers, and aid in filtering pollutants from flows from rivers and streams prior to them entering the Gulf of Mexico.

Water fowl and a variety of shorebirds frequent the oligohaline area of the lower marsh area, which is dominated by mid-level needle-rush marsh. The oligohaline area of the West Pascagoula River supports a variety of fresh and brackish water species and is comprised of various types of marsh. There are three tidal freshwater areas. Poticaw Landing/bayou is bald cypress/blackgum wetlands which support arrow arum, duck-potato, pickerelweed and other species. Paige Bayou area is bald cypress and sawgrass wetlands. The tidal area of John's Bayou is also bald cypress/blackgum wetlands which supports a variety of freshwater species.

Most of the preserve is undisturbed with some areas south of the Escatawpa River impacted by development and pollution. Current threats to the preserve marshlands are industrial and residential development with associated dredging, fill, and byproduct pollution. Additionally potential future diversions of water from the Pascagoula River watershed could spur saltwater intrusion and expand the marsh area into areas that currently are forested.

Old Fort Bayou

The Old Fort Bayou site is comprised of 1,459 acres in Ocean Springs. The preserve is at the edge of the estuarine marsh from the mouth of Fort Bayou to the forested area of the marsh.

Lands within the preserve are privately, locally, state and federally owned with most of the title wetlands being owned by the state. The property is managed by DMR. The preserve supports a variety of rare or endangered species including Coastal Shiner, Salt marsh Topminnow, Diamond Back Terrapin, and the Southern Red Cedar. The lower oligohaline areas of the bayou are primarily comprised of hummock needle rush marsh. The substrate in the lower area is clay silt and not firm. The mid and upper areas of the bayou are dominated by mid-level needle rush marshes with bands of smooth cordgrass along creeks in the upper area.

The property is used on a limited seasonal basis for waterfowl hunting and fishing. An identified current threat to the property includes residential open septic systems.

Graveline Bay

The Graveline Bay Preserve is comprised of 2,339 acres of wetlands bounded by Graveline Bay and bayou. It is located along the coast between Ocean Springs and Gautier, Mississippi. Most of the preserve is owned by the state, and it is managed by the DMR. The area feeds salt and brackish marsh which supports several oyster beds. The bay, marshland, forested uplands, and undeveloped beach within the preserve are landing areas for neotropical birds.

The preserve is relatively undisturbed estuarine bays and title creeks. The estuarine system within the preserve is sustained by local freshwater runoff and consists of mid-level needle rush. Smooth cordgrass runs as narrow bands along creeks and bayous. Habitat includes estuarine subtitle, small tidal creek, mollusk reef/Estuarine intertidal, sand beach, mesohaline marsh, and oligohaline marsh. Rare and threatened species on the property are the Diamondback Terrapin and the Red Southern Cesar.

Lands within the preserve are used by boaters and anglers on a limited seasonal basis for waterfowl hunting and fishing. Commercial fishing and crabbing also takes place on the preserve. Current threats are septic tank contamination and sediment from potential additional residential development to the south. Septic tank contamination from existing development has caused oyster beds to be closed.

Escatawpa River Marsh

T he Escatawpa River Marsh is comprised of 2,826 acres along the edge of the estuarine marsh. Lands within the preserve are privately, locally, state or federally owned with much of the tidal wetlands being owned by the state. The site is managed and monitored by DMR. It is used by boaters and anglers on an occasional and seasonal basis for waterfowl hunting and fishing.

Much of the marsh is dominated by a tidally restricted sawgrass. There is bald cypress/blackgum wetlands and bog, which are in the mid-reaches of the Escatawpa River to the north. Much of the marsh cover has been impacted or lost. The preserve has been impacted by a variety of causes including saltwater intrusion resulting from the deepening of the Escatawpa River. An impoundment associated with a rail crossing and areas used by nearby industries are suspected as causes of some impacts. Despite the impacts, the marsh is recovering. A current threat is residential open septic systems.

Habitat in the preserve is comprised of muddy sand embayment, riverine estuary, cypress swamp, blackgum swamp, and pitcher plant big. These habitats support a variety of species. It serves as a feeding, resting, and wintering location for migratory birds including the Brown Pelican, the White Pelican, Osprey, and Cormorants, and it serves as a breeding ground and nursery for the Osprey Rookery. Boaters and anglers use this site on an occasional and seasonal basis for waterfowl hunting and fishing.

Davis Bayou

The Davis Bayou Preserve is comprised of 1,410 acres north of the Mississippi Sandhill Crane Refuge. The property is privately, locally, state or federally owned with the tidal wetlands, which is a large portion of the property being owned by the state. The property is managed and monitored by DMR. A current identified threat is residential open septic systems.

The upper and middle oligohaline areas are primarily mid-level needle rush with the lower mesohaline area being mid-level needle rush and cordgrass. The habitat is comprised of muddy sand embayment, small tidal creek, embayment widgeon grass bed/estuarine intertidal, mesohaline marsh, oligohaline marsh, and sand shore.

The preserve supports a variety of wildlife including the following threatened and endangered species; Brown Pelican, Coastal Shiner, Alligator Snapping Turtle, Diamondback Terrapin, Gulf Salt Marsh Snake, Brilliant Hibiscus, and Chalky Broomsedge. It is used by boaters and anglers on and occasional and seasonal basis for fishing.

Bellefontaine Marsh (Privately owned)

The Bellefontaine Marsh is comprised of 1,305 acres and is managed by DMR. The site is used for fishing, boating and birding. It is primarily a marine mesohaline marsh/dune system that does not receive any significant amount of freshwater.

The habitat is comprised of small tidal creek/estuarine intertidal, polyhaline marsh, mesohaline marsh, sand shore, mud shore, beach dune scrub, and oak pine maritime woodland. Rare and threatened species supported on the site are the American White Pelican, Gray Kingbird, Diamondback Terrapin, American Alligator, Sandhill Bean, and Southern Red Cedar.

An identified threat to this marsh is failing septic systems and encroachment by construction.

5.4.3 Public Use/Access Lands

There are three public beach areas in the county. These are Oceans Springs Front Beach, Ocean Springs East beach, and Pascagoula Beach. There also are eleven public areas such as boat launches at Moss Point on the Escatawpa River.

5.4.4 Other Potential BU Sites

Sites other identified as potential beneficial use sites are listed below.

Greenwood Island

The concept for this project is to restore the island to its historical size. The area has experienced a great deal of erosion. Previous fill projects have expanded the footprint of the

island. Current plans by Chevron would deposit an additional 200,000 yd^3, creating additional acreage.

Moss Point

The area north and west of Moss Point is a large estuarine area that has eroded over the past 50 years. These areas could be restored using a variety of disposal methods and placement to help restore these coastal marshes.

Lake Mars

The shoreline in the Lake Mars area has experienced extensive beach erosion, including areas around the boat ramp. Restoration of the shoreline and marsh will provide protection for the residential areas northeast of the shoreline.

6. Dredging Methods, Containment Options, and Sources of Material

To encourage the beneficial use of dredged material, options for dredging and containment will provide DMR and other agencies with the opportunity to create multiple sites along the coast. New sites, both large and small, can be permitted to accommodate the different types of dredges that are used in Mississippi. In some instances, the areas that need dredged material are in shallow areas. By utilizing different technologies, these areas can accept dredged material for beneficial use.

One method to handle dredged materials is utilizing pumped distribution, which is becoming increasingly accepted in many states. Although, the cost of pumping can be prohibitive for smaller projects this can be addressed by providing a system of staging areas that are accessible by barge and by truck. Dredgers could then move material from small projects to a local staging area over a distance not unlike what they currently work with. A tipping fee would be charged for use of the facility. The DMR BU program would then transport the material to new BU sites as needed. This process would allow better coordination of resources with needs and would provide operations on a scale that would make pumped distribution of the material more economically feasible.

To address the need for on-going capacity for large dredging projects, pumped distribution could open up thousands of acres of degraded coastal marshes via thin-layer deposition and other techniques. These techniques allow placement in a much wider range of settings including where containment structures are neither practical nor desirable. Pumped distribution is also much more suitable for periodic applications that can help maintain existing elevations to offset erosion and increased inundation due to sea level rise.

In addition to considering different dredging technologies, options for containment can enhance the benefits of beneficial use. Following are summaries on options for both dredging and containment.

6.1 Dredging Technologies and Methods for Placement

Several options are available for dredging. Choosing a method depends on the dredging location, material type, sea conditions, transport distance, and volume to be excavated. For larger cuts and larger volumes, a cutterhead with hydraulic piping is a method proven in the Gulf for projects with reasonable transport distances. For projects with large transport distances offshore or in heavy-sea conditions, a hopper dredge is often used. Hopper discharge is via bottom dump or pump-out through a discharge line. For smaller and more restricted areas, a clamshell dredge or bucket dredge can be used to excavate material and place onto a barge, into dump trucks, or into hoppers. Often a small cutterhead dredge can be used when volumes are small or the thickness of material is small, but this requires the use of discharge pipelines in most cases.

Discharge via hydraulic means does not have to be via a pipeline for long-distance placement. Cutterhead dredges have often pumped material through a short discharge line

through a "spider barge," which is configured to allow hydraulic placement into hopper barges moored to either side. The hopper barges can then transport the material to its final destination.

Dredging contractors have been highly creative in the use of proven technologies to suit project needs. Since the dredging process utilizes three distinct subprocesses: excavation, transport, and then placement, they often combine the best features of each subprocess to optimize the overall process. Hence variations of all the above technologies and methods are possible.

Typical wetland and marsh restoration projects often use small quantities of dredged materials for each project. As the volume of placed material decreases, the cost to place per square yard increases using conventional placement methods due to equipment mobilization and demobilization costs. Several methods are considered for the beneficial use placement.

Deciding which method for placing source material will be evident for certain potential beneficial sites, as only one option will be possible. However, other sites will require further analysis to decide the best method based on multiple factors. A scoring system, based on volume, location, proximity to source, environmental sensitivity, and material type could be developed to help choose which method is suitable for each site.

6.1.1 Hopper

Once the hopper fills with material, dredging stops and the vessel moves into position for material placement. Once in position, doors on the bottom side of the vessel open or the hull splits open and the material deposits. Hopper dredges can also employ pump-out capabilities as well as through-hull dumping. Hoppers are able to move more quickly and deliver the material faster over long distances than other methods, though they are restricted by shallower depths. Hopper dredges can also be used to beneficially place material moved from navigation channels via pipeline to replenish marsh areas.

6.1.2 Hydraulic Piping

From a cutterhead dredge or hopper dredge, the material slurry is pumped through a pipeline that deposits the material to the beneficial site. This method is considered more labor intensive than typical methods, but results are more immediate and vegetation recovers faster. Pipeline placement could disrupt marsh areas and may not be considered appropriate for environmentally sensitive areas. Material could be piped from dump trucks, hoppers, or barges. The cost for hydraulic piping is entirely dependent upon the amount of time that the dredge is pumping material. A hopper dredge thus has extra costs while sailing that does not produce more material.

Pipeline placement is *ideally* suited for marsh restoration. A BU project must take into account the shedding of the transport water, but the material can be accurately placed and can avoid sensitive areas. It has been proven that the material can be restrained by dikes, hay bales, etc.

6.1.3 Thin Layer Disposal

Thin layer disposal has been used previously by pumping the material through a nozzle mounted on a movable platform on shore or on a barge in open water. The platform or

barge is moved either constantly or periodically according to a layout pattern, thus spreading the slurry over an area to the desired thickness. Upland or sea bottom thin layer placement can be tailored for beneficial uses. This process has been used previously in Mississippi Sound for USACE maintenance dredging projects.

6.1.4 Water Injection Dredging

Water injection is a method of using large volumes of low-pressure water pumped to a wide manifold that is towed across the sea bottom to liquefy the bottom sediments and bulk up the material. This injected material is heavier than the surrounding seawater and thus will move along the bottom due to the difference in density of the materials. It is used for short transport distances and often for navigational purposes to reduce the height of a shoal. Since the material is not encapsulated in a bucket or pipeline, it is not normally used for beneficial uses but is used as a cheaper means to improve the bottom contours.

6.1.5 Small Dredge

The small "dredge" technology is a barge 9 feet wide by 24 feet long, drawing about a foot of water. It does not have a motor and so requires a tender boat to move it into place. The barge has a 15-horse power (hp) submersible pump suspended from a winch on an overhead track so that the pump can be moved forward and back when placing dredged material. Spuds located on the rear of the barge act as stabilizers and pivoting hold-fasts. The barge also has two winch-controlled front cables attached to anchors that allow the barge to move side to side. To begin dredging, the submersible pump is lowered to the substrate, where it agitates the sediment and pushes it up into the transport hose under pressure. The effluent under pressure can be flowed directly from the pipe into open water or sprayed to distribute the sediment more evenly through a fragmented marsh. Theoretically, the small dredge can pump up to 70 percent solids at a rate of 20 yd^3 per hour through a 4-inch hose, up to 1,000 feet away. Based on the size of the hose and pump, an acre can be filled to a 1-foot depth in 75 hours. The small dredge is a very efficient method to fill areas of shallow water; it has relatively low fuel requirements and can be handled by two people, resulting in a low per-acre cost. If needed, the dredge can be modified to allow it to be operated by one person once the dredge pipe is connected and it has been pushed into place by another boat.

6.1.6 Spray Method

Using a high-density solids (HDS) pump, material can be sprayed on BU sites. The material comes out in a high-solids toothpaste consistency and can easily be sprayed onto existing wetlands/marshes. Due to its consistency, there are fewer turbidity issues, and the results are instant. HDS pumps could be used in conjunction with a hopper, barge or dump truck to pump placement material to the BU site from a distance, eliminating the need for an access channel. This method could be used for distances up to 1,000 feet, and this distance can be much, much longer with the use of booster pumps.

While this is an attractive method to distribute dredged material, HDS pumps are not fully vetted and have not been accepted as a viable method of transport. They require clean material to work, so they are used mostly in a process environment, after trash and water have been removed from the material. It is not possible to effectively remove material from the bottom in a high-density state.

6.1.7 Punaise Dredge

The punaise ("thumbtack") is a dredge pump system that operates totally below the water surface. It's a compact, watertight unit, remotely controlled from a shore station, with an umbilical, with electrical power, signal and control cables. The punaise settles on the sea bed and removes non-cohesive materials for transport. The dredged material is pumped through a discharge line to the deposition area. (See http://www.theartofdredging.com/punaise.htm for more information.)

6.1.8 Rainbow Discharge

The rainbow discharge method is similar to the spray method except that it is used most often by hopper dredges. With this placement method, the hopper dredge sails to the shallow deposition area and pumps out the hopper contents via a bow-mounted nozzle, thus "rainbowing" the material 100 to 200 feet in front of the dredge. It can be used to place material in the nearshore zone for littoral drift transport or to build a base for other materials to be placed atop the rainbowed material. This process has been used on multiple projects on the East Coast and the Gulf Coast.

6.1.9 Spill Barge Placement

A spill barge is a barge with a long, overhanging pipe that can extend as much as 300 feet from the end of the barge. It is used in conjunction with a pipeline and allows the slurried material to be placed a large distance away, often in much shallower water. Theodore Island confined disposal facility (CDF) in Mobile Bay is an example of a spill barge–placed disposal area in which the CDF perimeter containment dikes were built up out of the water.

6.1.10 Bottom Dumping in the Littoral Zone

Split-hull hopper dredges have been used to place material in the nearshore zone in water depths of 10 feet or more by grounding the vessel and then splitting the hulls apart to deposit the material in clumps along a bottom contour. Littoral drift action will then transport the material along the shoreline, and wave action will transport the material both onshore and offshore.

6.1.11 Geotube Placement

Deposition of dredged material via pipeline can utilize woven fabric sewed into containers called "geotubes." These are often used when the material must be confined to small areas and needs to be dried out and permanently removed from the deposition site, as a structural barrier to wave energy or when the material may contain materials or components that are undesirable. They allow the water to pass through the fabric so the disposal site can be kept small.

6.2 Containment Options

Research was conducted to determine where successful restoration projects have used a variety of methods to contain dredged material, based on the location of the beneficial use site and the environmental conditions. Louisiana and its CWPPRA projects have utilized a variety of containment materials and methods. These different options could be utilized along the coast of Mississippi. Determination of what method would be best would be determined by DMR.

Table 6-1 lists several containment products; this list is not an endorsement of the products described, but instead illustrates the numerous options available for beneficial use. In identifying a containment option for a specific project, additional research should be conducted to determine previous successful projects and/or reasons why projects might have failed. The goal of DMR is to construct beneficial use projects that will be successful.

TABLE 6-1
Containment Options

Containment Option	Material	Benefit
Rapidly deployable precast sediment retention barrier	Precast concrete	Light weight; deployed by crane; removable and reusable
Sediment vegetation ribbons to enhance dredged sediment retention and reduce storm surge	Geobags	Allows sediment interchange; with woody plants creates a ridge
BayouBacker	Corn oil–based (biodegradable) plastic strips	Low cost; easy to transport; wave reducer
BioHaven Floating Island Environmental Solutions	Matrix of fibers derived from 100% recycled plastic	Manmade ecosystem that mimics natural occurring wetlands
Polders for marshland creation	Manmade berms	Enclose shallow, open-water area with dikes, lower water table within, succession of vegetation builds up organic rich sediments, increase water table and introduce fine sediments, and reinstate open connections with surroundings
The Wave Robber wave suppressor sediment collection system	Prefabricated light-weight patented material	The WSSC units are reusable and designed to be removed from one location and easily moved to another.
Bioengineering solutions using fascines and coir mattresses	Vegetation (live, dead, and dormant) in combination with natural structural components, such as fascines, mattresses, live staking and coir fabric, and “live lifts” for engineering purposes	This bioengineering solution does not require special skills or equipment to install, it is cost effective to acquire and install, and is aesthetic as it results in a natural, indigenous plant community
Habitat enhancements through vegetation planting using Gulf Saver bags	100% all natural, biodegradable; decompose and provide additional food for the marsh plants as they grow	A Gulf Saver bag is a USACE standard biodegradable “burlap (sand) bag” that is filled with an all-natural humus mix rather than sand (weight and size adapted for easy handling by volunteers)

TABLE 6-1
Containment Options

Containment Option	Material	Benefit
Autoclaved aerated concrete for the coastline	Autoclaved aerated concrete	As oysters accumulate on these structures, the effectiveness of the reef increases. Potential benefits include dissipation and absorption of wave energy, protecting existing shoreline, being lighter than other riprap structures, and creating the possibility for multiple applications of the product.
Deltalok	Highly adaptive soft material product that exhibits hard material capabilities	These serve two purposes: stop further erosion and provide a stable foundation for growth of vegetation
Alternative to manual planting	To install a hopper on the dredge pipe that would allow rhizomes or seeds to be carried to the dredge placement site with the dredge material	The preliminary project benefit would be to reduce the cost of planting and increase habitat value.
Erosion control blankets	Photodegradable and 100% biodegradable	Photodegradable, can last up to 12 months
Turf reinforcement mats	Mats are constructed around a permanent, nondegradable, three-dimensional matting structure and consist of either 100% synthetic components or a combination of synthetic and natural ingredients	Provide long-term erosion protection

6.3 Dredging Activities and Sources of Materials

6.3.1 Dredging Activities

In addition to developing beneficial use projects based on permit applications, there are dredging programs that regularly result in dredged material that can be used beneficially.

As part of the master plan, these sources of material have been identified and summarized in the tables in Appendix D. The goal of the master plan is to match dredging projects with potential BU areas. In order to serve as a useful tool, the tables of material sources should be updated periodically, as new sources of material are identified.

Federal, state, and local authorities and nongovernmental organizations have identified the sources listed in Appendix D as current or possible future activities that could yield material

that could be used beneficially. The viability of the businesses included in the list of material sources may change over time; that is, some businesses may cease to exist, relocate, or change business priorities. This list is a best effort to capture currently available information on dredging activities along coastal Mississippi. The description for each identified source includes a brief description of the source and its maintenance cycle, when the area was last dredged and when it will be dredged again, the quantities and types of material that are produced from dredging, and where the material is typically deposited.

6.3.2 Mining of Confined Disposal Sites

Additional sources of material that could be used beneficially are existing USACE-designated confined disposal sites. These sites could be "mined," if the material is suitable, for use in BU projects. For example, material from maintenance dredging for the Gulf Intercoastal Waterway (GIWW) is typically disposed of in one of two methods: thin layer or confined upland disposal. The upland disposal areas are typically on land immediately adjacent to the channel. Utilizing the material in the upland site for BU projects could be a cost effective option to handle and transport the material since it is dry and adjacent to an existing waterway. The material could be push onto a barge and transported to a BU project site. Typically the material is free, with the only cost being handling and transportation costs. This option is advantageous to the USACE because it provides additional capacity for the upland site. It benefits the coast because it returns needed material into the system.

Upland sites may also provide opportunities to truck dry material to a BU project site, if it is a cost effective method to enhance or restore a site. Trucking may be an appropriate solution for a small BU project in a specific location where barging is not an option.

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Appendix A
Beneficial Use Law

Mississippi Beneficial Use of Dredged Material, July 2010

§ 49-27-61. Charges for materials removed under permit; alternative for dredge material disposal.

(1) (a) The commission shall charge Fifty Cents (50¢) per cubic yard for any sand or gravel removed from wetlands and Twenty-five Cents (25¢) per cubic yard for any other materials removed from coastal wetlands by a permittee or his agent under the terms of any permit issued.

(b) There shall be no charge levied by the commission for the removal of one hundred (100) cubic yards or less of any material removed from wetlands by a permittee or his agent under the terms of any permit issued.

(c) The commission may waive these charges on any project of a governmental agency or any project wherein expenditures are made as the result of a governmental grant or governmental bond proceeds.

(d) Any party participating in the beneficial use of dredge materials programs under subsection (2) shall be exempt from these charges.

(2) The department shall require any party permitted to conduct dredging activities of over two thousand five hundred (2,500) cubic yards to participate in the department programs involving beneficial use of dredge materials, provided the material is suitable and a beneficial use site is available. If approved by the executive director, or his designee, a party may deposit acceptable dredge materials in a designated location for a fee not to exceed fifty percent (50%) of the fair market cost to transport and dispose of the material in an approved upland site. The department shall consider in-kind services for offsetting depositional charges.

Sources: Laws, 1973, ch. 385, § 11; Laws, 1988, ch. 408, § 3; Laws, 1994, ch. 578, § 46; Laws, 2005, ch. 371, § 2; Laws, 2010, ch. 412, § 1, eff from and after July 1, 2010.

Appendix B
Stakeholder Meetings

Hancock County Meeting—Update for the Master Plan for the Beneficial Use of Dredged Material

ATTENDEES:

Mississippi Dept. of Marine Resources	George Ramseur
USACE, Mobile District	Jenny Jacobson
	Larry Parson
Hancock Co. Dev. Comm., Port Director	Steve Landry
Hancock Co. Board of Supervisors	Jenell Tompkins
Matthews Brothers Inc.	Shaw Matthews
Compton Engineering	Mickey Lagasse
Congressman Gene Taylor's office	Chris Lagarde
Alabama Dept. of Cons. Nat. Res.	Carl Ferraro
EPA Region 4, Gulf of Mexico Program	John Bowie
CH2M HILL	Elizabeth Calvit
	Dawn Townsen

DATE: December 15, 2010

George Ramseur introduced the goals of the meeting and the objective of the project. The project to update the Master Plan prepared in 2002 is funded by the Gulf of Mexico Alliance (GMA). Carl Ferraro and Larry Parson are working on Gulf of Mexico Sediment Management Restoration Team. This group is looking at the entire sediment budget along the MS coast to understand sediment transport and where the opportunities are to beneficially use dredged material. Once the way sediment moves along the coast is understood, decisions can be made for the best possible use of dredged material—for example, using dredged material to rebuild marsh. Information from the county meetings will be used to update the "Master Plan for the Beneficial Use of Dredged Material Along Coastal Mississippi."

The project includes gathering ideas for beneficial use projects. Ideas include building a bird island in shallow mud flats in the Sound where no land has been before. The group was asked to help develop ideas for Hancock County. Chris Lagarde mentioned a project Dr. Walker, Director, DMR, is working on: cleaning out canals. As he understands it, $13 million of federal money will be used to clean out existing canals. Jenell Tompkins mentioned Seymour Engineering is conducting master engineering associated with the work to clean out the canals. Chris Lagarde also mentioned that Collin Point, inside the Bay, is an area that will be able to accept material. He said the material could be trucked in and therefore would not affect Gulf sturgeon. Historically, in the 1940s, the area was an oyster factory, and there are lots of shells in the area.

Mickey Lagasse mentioned the Washington Street boat launch and the project proposed to put approximately 1,800 cubic yards of material in the area.

Elizabeth Calvit asked about any known activities in the Diamondhead area. The group responded that Devil's Elbow could be a project. Mickey has a contact for that area.

Permit documents have been submitted to expand the Pass Christian Harbor Project but the current status is unknown. The project has not been approved by the city. The project would dredge almost 300,000 cubic yards of sand, but the plan, as it stands now, is for it all to be use for beach re-nourishment. Hurricane Gustav caused a loss of 100 feet of beach in Pass Christian. The sand from the harbor project will help restore this loss. Chet McDermott or Patrick Chub would be the contacts for this project. Willie Davis is the harbor master.

There may also be a Waveland lighthouse project. Mickey will have the information for the contact.

Jenell Thompkins mentioned a potential expansion to the marina at Bayou Caddy. More information is needed on this project.

There is also a proposed marina in Bay St. Louis. It is estimated that 300,000 cubic yards of material would be dredged. Brown and Mitchell is working on it. The city has not approved the project.

Larry Parson, USACE, provided an update on the Mississippi Coastal Improvement Program (MsCIP). Currently the Corps is implementing the comprehensive plan. The current focus is Ship Island and closing the Camille cut. The USACE estimates that there is 22 million cubic yards of suitable material just offshore from Ship Island (southwest side of the island). Other sites for suitable material for restoration have been reviewed but are not serious considerations. It is estimated that 13 million cubic yards of material are needed for Ship Island and 9 million cubic yards for littoral zone. The USACE expects to complete these projects within a year. The USACE is currently in the middle of preparing a Supplemental Environmental Impact Statement (SEIS).

A smaller project on the northwest end of West Ship Island entails placing dredged material to protect Fort Massachusetts. Much of the material will come from the widening of the Gulfport Channel and from the abandoned Gulfport Channel borrow site. It is estimated that 1.2 million cubic yards are there. Manson is doing the dredging.

Disposal sites along the Gulfport Navigation Channel could be mined for beneficial use. The disposal material would most likely be more coarse material (especially on the Gulf side). The USACE would welcome mining existing disposal sites since it would increase their capacity for disposal. The USACE has adopted a regional sediment beneficial use program. The USACE will collect samples of material within the Entrance channel and Ocean Dredged Material Disposal Site (ODMDS) to identify the type of material to determine if it is appropriate for restoration purposes.

Petit Bois might have suitable material for the USCE to use for the MsCIP program. Another area may be from disposal sites along the Black Water Tom Bigbee River in Alabama that have suitable material for beneficial use. There are tens of millions of cubic yards of material at a cost of approximately $10/yard to get to Gulfport. The material is coarse-grained material that is stained. Some may not want to use the material because of the stain. The USACE is doing a study to determine that if the material was placed on the beach, how long it would to bleach out the stain. The issue of stained sand is a concern to the U.S. Fish and

Wildlife Service (USFWS) because it is not clear if this will affect sea turtle nesting habits. The USACE may conduct a demonstration project at Dauphin Island, using the stained sand, to see what happens.

Steve Landry reported on Port Bienville. They would like to deepen the channel at Little Lake. One problem is the CSX bridge. On one side of the bridge, it would take quite a lot of dredging to deepen the channel; currently it is only at 6 feet and to be viable it would have to go to 16 feet. The bridge is the major issue. They would like to get the channel down to 16 feet at the Port, but currently the channel is maintained to 12 feet. With the current depths, barge companies are having trouble at low tide.

Port Bienville has lost tenants since Hurricane Katrina. Before the storm, the Port created 1,200 local jobs. Tenants included Wellman, Saybic (GE), PSL pipe company, coal for Dupont and Calgon, and Vulcan import rock. Now there are concerns with getting barges in and out of the Port. Currently the channel is 12 feet, but Steve would rather have 14 feet. Steve thinks the Pearl River is deep enough, but around the CSX bridge its about 6 feet, and parts of the Port need to be deepened as well. To deepen the channel around the Port, the Port will need to raise the necessary funds.

John Bowie, EPA, mentioned how the New Orleans USACE is moving clay material out of Hancock County to rebuild the levees in New Orleans. It is being trucked directly from the pits in Hancock County.

The discussion moved on to the types of material that could be found in some of the sources of material. Devil's Elbow will be a mixture of fine and coarse grained. At Devil's Elbow the Diamondhead Homeowners Association owns the bend and hopes to build breakwaters just below the waterline, below the piers. Of the material that will be dredged, 95 percent is going to have to be disposed of. The material would be good for beneficial use except that it has a lot of fertilizer in it due to runoff from the golf course. Although it is assumed there is a lot of fertilizer in the sediment, the material has not been tested. It was recently surveyed and will be tested. The survey will be completed by this week. By the end of January, Steve expects to have an application submitted to DMR and the USACE. The request would be to deepen the channel to about 8–10 feet and lengthen it to 40–50 feet.

There was a discussion on how to streamline the process to encourage the beneficial use of dredged material. Jenny Jacobson, USACE, outlined the four tiers of testing. Sandy material will be excluded in Tier 1. In order to help simplify the process and encourage beneficial use, Jenny stated that if it could be determined that the sediment to be dredged and used beneficially is far removed from a source of contamination then the USACE would not require testing. Noncommercial areas have used this train of thought in the past; if nothing is known, the minimum amount of testing would be required. Jenny thinks that testing can be specific to the type of commercial use and the history of the area. Minimum testing, such as a bioassay and grain size would cost about $1,000. George is working with DEQ to encourage them to accept bioassay or an abbreviated list of analysis for those sediments in which the history shows no potential for contamination.

Shaw Matthews, Matthews Brothers, provided information from a contractor's point of view. He supports beneficial use because typically he must pay $4 per cubic yard for material going to a disposal facility. His issue is getting access to Deer Island. There needs to

be easy access or have multiple sites at Deer Island or any beneficial use (BU) site to encourage contractors to use the site. He briefly discussed the type of equipment he would need to dispose of material. Typically, he uses a bucket and pipeline (suction dredging). Bucket technology has come a long way. Buckets can cut to 6 inches, and using GPS mapping it can be determined at what depth and location an area needs to be dredged. Because of these new technologies, there is very little overdredging. He did a project for the Port of Texas City where they pumped, targeting the mud and separating out the creosote, concrete, and steel and dumping the debris. They were able to pump up to 30 percent solids, but it doesn't dig real deep.

George discussed House Bill 1440, which became effective July 1, 2010. The bill addressed dredged material projects and for any project that dredges over 2,500 cubic yards, the material needs to be used beneficially, if possible. Placing the material in a BU site depends on if there are sites available to accept the material. DMR will work with the contractor to find sites and work out access.

Mickey Lagasse raised the issue that Hancock County has faced in meeting mitigation needs by buying credits in upland wetland mitigation banks. He wanted to understand why they had to do this instead of using the money spent toward the mitigation bank to go to DMR to help restore wetlands. The consensus of DMR and USACE staff was that wetland laws are extremely difficult to change. Mitigation is complicated and requires long-term monitoring and, in terms of habitat, DMR doesn't have the legal right or staff to do the follow up and monitoring that is required for mitigation for wetlands permits.

The question was raised to the group about the potential to create bird islands. The construction of a bird island would include some type of containment structure to hold the material in place. Options include constructing a levee around it and/or an erosion mat. Potential areas for bird islands could be in west Hancock County by Bayou Caddy. Any bird island should be located close to major dredging projects. The island would be no bigger than 12 acres. Any bird island would be in shallow water.

Carl mentioned Galliard Island in Alabama that was created from dredged material from the ship channel. Galliard Island is 200–300 acres in size and is armored. It is used as a disposal area. Because birds are now nesting on it, the island is regulated. The island has attracted birds and has become a nesting habitat for terns and pelicans. It has an elevation of +5 to +6. Steve Calver with the Savannah District is a good resource for information on birds. Creating a bird island can be controversial. To destroy one type of habitat to create another is frowned upon. The only viable location for one in Hancock County would be southwest of Bayou Caddy. Another issue that came up was building bird islands in aircraft flyways. Jenny mentioned an island that was created but has now created a hazard for aircraft.

It was agreed that there is local support for BU projects. Beneficial use was put on hold in 2003 when critical habitat in the Mississippi Sound was designated. Since then there is a better understanding of what is needed to protect the habitat while allowing BU projects to move forward. Critical habitat should not stop a project and should be easier to work through as compared to in the past. For BU projects, especially bird islands, expect that Gulf sturgeon monitoring will be conducted.

Harrison County Meeting—Update for the Master Plan for the Beneficial Use of Dredged Material

ATTENDEES:

Mississippi Dept. of Marine Resources	George Ramseur Jeff Clarke Ali Leggett
Senator Thad Cochron's office	Win Ellington
MSU, Research Coordinator Grand Bay NERR	Dr. Mark Woodrey
Compton Engineering	Jason Saucier
EPA Region 4, Gulf of Mexico Program	John Bowie
CH2M HILL	Elizabeth Calvit Dawn Townsen

DATE: December 15, 2010

George Ramseur introduced the goals of the meeting and the objective of the project. The project to update the master plan prepared in 2002 is funded by the Gulf of Mexico Alliance (GMA). The project includes gathering ideas for beneficial use projects and identifying sources of dredged material. George discussed House Bill 1440, which became effective July 1, 2010. The bill addressed dredged material projects and for any project that dredges over 2,500 cubic yards, the material needs to be used beneficially if possible.

The group was asked if they knew of any dredging projects in Harrison County. Jason Saucier, with Compton Engineering, said that Compton does not have any projects right now that will generate more than 2,500 cubic yards of material. He supports the concept of using material beneficially.

Jeff Clarke, DMR, mentioned that Deer Island and Greenwood Island are both places that could use dredged material. Deer Island is already permitted and ready to accept dredge material. George mentioned that Chevron has a project directly across from Greenwood Island that is being dredged, and the material will be pumped over to the island. This new large dredging project will fill up that entire beneficial use site at Greenwood Island.

The question was asked if anyone knew any potential dredging projects in Bayou Bernard/Back Bay. The general response was that it was believed the USACE was going to do some maintenance dredging in that area, possibly using bucket dredging and then side casting the material.

It was suggested that Mississippi Power be contacted to see what their plans are for dredging. Ron Herring would be the contact.

Jennifer Wittmann, DMR, should be contacted to see if there are any new large development projects planned, or any new permits that would include dredging.

Jeff Clarke said that Jackson County wanted to do some dredging around the mouth of Graveline Bayou. The boat ramp at Lake Mars may also need to be dredged.

John Bowie raised the question as to whether casinos still needed to dredge if part of their facility sat on a barge. The group could not think of any casino that was still on a barge. Most were destroyed by Hurricane Katrina. Beau Rivage may be the only one really left. They could be contacted to see if they still have a dredging program.

The Pass Christian project to double the size of the harbor and marina is in Harrison County. That material will be used to restore the beach destroyed by Hurricane Gustav.

The group was asked if anyone knew of any plans for dredging at Biloxi Harbor. The City of Biloxi? Harrison County? No one knew of any plans for any of these places to conduct dredging projects.

The discussion moved to the status of the Old President Casino—Broadwater. The site is owed by W.D. Fore and Roy Anderson, and currently no one knows of any plans for the site.

Jeff mentioned that there is talk of a new casino in Harrison County, just west of the I-110 in D'Iberville. He had heard someone was considering putting in a marina. The casino would be called the "CanCan" and he believed Thompson Engineering was working on it. There have been some articles in the newspaper (the *Sun Heral*d). There are marshes in that area.

Heron Bay in Hancock County is a potential deposition area since it is eroding. There is a canal, part of the Tennessee Gas Pipeline that could be filled in. George said he would work on that and call to see if they need any material to cover their pipeline. George thought that Tennessee Gas was required to have a minimum 3-foot cover over the pipeline per DOT regulations. There is no road access to the site. At the end of the pipeline is Heron Bay. If the canal were filled in with dredged material, the material would have to be barged in and dumped. As George understands it, the pipeline company dug the canal for the pipeline, but the canal has not been filled in and it cuts across sinuous bayous. DMR would like to block off the canal everywhere it crosses a bayou. John Bowie may know the contact person at Tennessee Pipeline.

In Hancock County, the Tennessee Gas Pipeline canal has resulted in oyster reefs closing closed because of runoff from homeowners and the RV park. This project would be good for dredging projects with smaller amounts of material. DMR owns all the land except for a small portion. The project would still have to get USACE permit, but the area does not include Gulf sturgeon habitat and there are no legal water access issues.

The question was raised about filling in the mosquito ditches at Marsh Point, but DMR said the ditches are located on private property so they cannot be used as beneficial use sites.

No one had any information on potential projects in Pascagoula associated with the ship yards or other tenants at the Port. It was suggested to contact Jenny Jacobson or Linda Brown at USACE, Mobile District.

At Long Beach there are flood problems in N. Long Beach. Bob Langford, a developer, was going to donate land to help with stormwater runoff, but there was a disagreement with the USACE about how the land would be used. This was about 5–6 months ago. A contact for

this project would be the mayor of Long Beach. Jennifer Wittmann may know if permit application has been submitted for this project.

Dr. Woodrey has a stewardship program at the Grand Bay National Estuary Program. The reserve does not have much loss of wetlands, and any beneficial use projects would be small. There is no need for large restoration projects.

The question was raised about Grand Batture and if it was going to be restored. He did not know about that. Grand Bay has some of the most expansive sea grass beds in Mississippi. The plan for the Reserve is to characterize the plant communities, densities, etc., at designated reference sites if trying to restore sites. The information from the reference sites can be used to help restore other areas.

Jackson County Meeting—Update for the Master Plan for the Beneficial Use of Dredged Material

ATTENDEES:

Mississippi Dept. of Marine Resources	George Ramseur
Jackson Co. Administrator	Alan Sudduth
Jackson Co. District Supervisor	Manly Barton
Thompson Engineering	John McFadyen
USACE Mobile	Mike Malsom
	Ken Foote
EPA Region 4, Gulf of Mexico Program	John Bowie
CH2M HILL	Elizabeth Calvit
	Dawn Townsen

DATE: December 16, 2010

George Ramseur introduced the goals of the meeting and the objective of the project. The project to update the Master Plan prepared in 2002 is funded by the Gulf of Mexico Alliance (GMA). The project includes gathering ideas for beneficial use projects and identifying sources of dredged material. George discussed House Bill 1440, which became effective July 1, 2010. The bill addressed dredged material projects, and for any project that dredges over 2,500 cubic yards, the material needs to be used beneficially if possible.

Manly Barton discussed his frustration getting waterways in Jackson County dredged. The County has lots of rivers and tributaries, and several years ago the County purchased dredging equipment and had a crew and a county dredging program. But the county is not dredging anymore because of difficulty getting permits and as a result the County sold the equipment.

Because there has been no dredging, small bayous have silted in. Prior to Hurricane Katrina, he met with the USACE, New Orleans District. They recommended dredging and then side casting on the adjoining banks. But the USACE Mobile District does not allow that type of dredge in Alabama. Jackson County is not dredging and therefore does not have any material to be used beneficially. If and when Jackson County starts dredging again, they want to be able to get rid of the dredge spoils cheaply; it doesn't matter to them where it goes. They don't want to pay to have it disposed and they don't want to pay to move the material. They have had a few successes in reusing the material, but very few, and they have had to find appropriate sites for beneficial use.

He is very frustrated that private property owner can get a permit to dredge and put the material back on their property, but the County is unable dredge and then side cast on to private property. He would like to have a maintenance dredging program in place but permitting has been very difficult. Alan Sudduth said that the county doesn't necessarily have a list of dredging projects, because of the permitting issues, but they have a list started and can provide it. Alan will work with Dawn to get information on the projects in Jackson County with estimated cubic yards. Jackson County beaches are maintained by staff located

in the Road Department. Alan will provide information for them. They will be managing the project at beach in Pascagoula.

The group was asked if they knew of any future projects that might require dredging. John McFadyen suggested contacting Dawn Harde (?) at Seymour Engineering. He recalled that there may be an interest in putting dredge material somewhere. George mentioned that he had worked with her on getting permitting recently but he could not remember the project.

It was stated that it is hard to get U.S. Fish and Wildlife Service and USACE to allow open water disposal.

In a discussion about the Pascagoula Navigation channel, Mike Malsom said that most of the dredged material that comes out of the channel is usually silty material. For maintenance dredging, he thinks they have about 4–5 million cubic yards.

The group was asked if they knew anything about the shipyards in Pascagoula and their dredging programs, or contacts to call about dredging programs. For Halter, the contact is Mark McAndrews, director for the Port of Pascagoula. Alan will provide the contact information for Northrop Grumman.

The group was asked about Krebs Lake, off the Pascagoula River, near Spanish Fort (just north of Hwy 90): Are there any plans for dredging? Alan said he may have that information.

The group was asked about the beach nourishment project in Pascagoula. Alan said that the Pascagoula beach was replenished by pumping sand from the Sound onto the beach. This method will not be used in Ocean Springs. Replenishing the beaches in Ocean Springs (two beaches) will require 100,000 cubic yards (the beaches are 1 mile long, 20 feet wide, and 3 feet deep). At Front beach they want to add an additional 20 feet to the beach due to losses from storms.

Upper Davis Bayou: there are small projects, but they can't get permitted.

Kensington Basin: needs to be dredged but they don't have a permit in hand. Alan will provide information on this.

Pine Street Basin: no information.

Pascagoula River: there was a dredging project on the East River last year (20 miles upriver). After Hurricane Katrina, little bayous were cut off. The county had great difficulty getting a permit to dredge out sand as a result of the storm. For example, at the public boat launch, after the hurricane, there was a new sand bar in front of the boat launch. It finally was dredged last year. It took four years to get a permit. Manly was very frustrated with the process to get a permit. This boat ramp is the only public boat launch south of the interstate and Hwy 614, and it only has access on the east side of the river.

Horn Island: the island has dredged material deposited for beneficial use.

Potential restoration and enhancement areas would include Upper Davis Bayou; this area has problems with erosion.

Bridge View in St. Martin Bayou: 11 or 12 property owners have bulk heads where they have backfilled with dirt that is now in the bayou. The bulkheads are in poor condition, allowing sediment to seep into the bayou. Some property owners have dredged the bayou and side cast the material back onto their property. However, when an owner has soil that has seeped into the bayou, they usually just get more topsoil to fill the holes in their yard. But they don't fix the bulkhead, so the material continues to fill in the bayou.

The difficulty the county has with getting permits to dredge is associated with the endangered species: river Sturgeon and red belly turtle. The Pascagoula River is a breeding and habitat area for the sturgeon. Dredging could potentially destroy this habitat.

The group was asked if they knew of any new development projects: no one knew of any.

Manly did mention a potential high-rise condo in Pascagoula, but he didn't know the status.

Alan thought the Jackson County Planning Department would have this information. Alan will provide list or contact info.

It was suggested to contact Damon Young, Regulatory, USACE, Mobile District to see if he knows of any future projects with permits in the area.

Manly asked why underwater aquatic surveys need to be done on areas that have been dredged in the past? The channels he was thinking of had not been dredged for 20–30 years.

Appendix C
Priority Area Maps

Legend

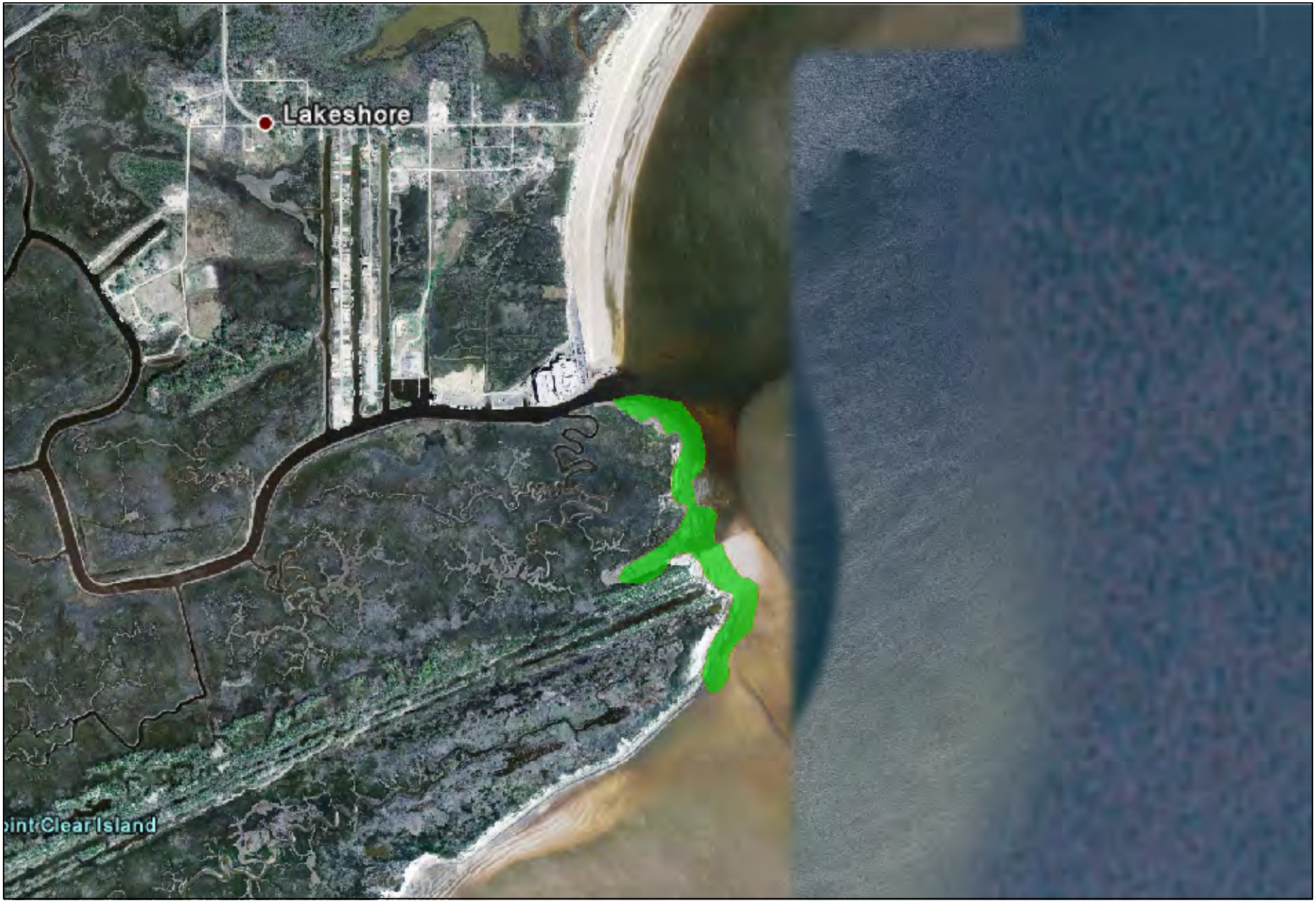
Potential Benifical Use Site

0 8

Approximate Scale in Miles

N

Site Location Map
Potential Beneficial Use Sites



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Potential Benifical Use Site

0 1500

Approximate Scale in Feet

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Bayou Caddy
Hancock County
Potential Beneficial Use Sites

CH2MHILL

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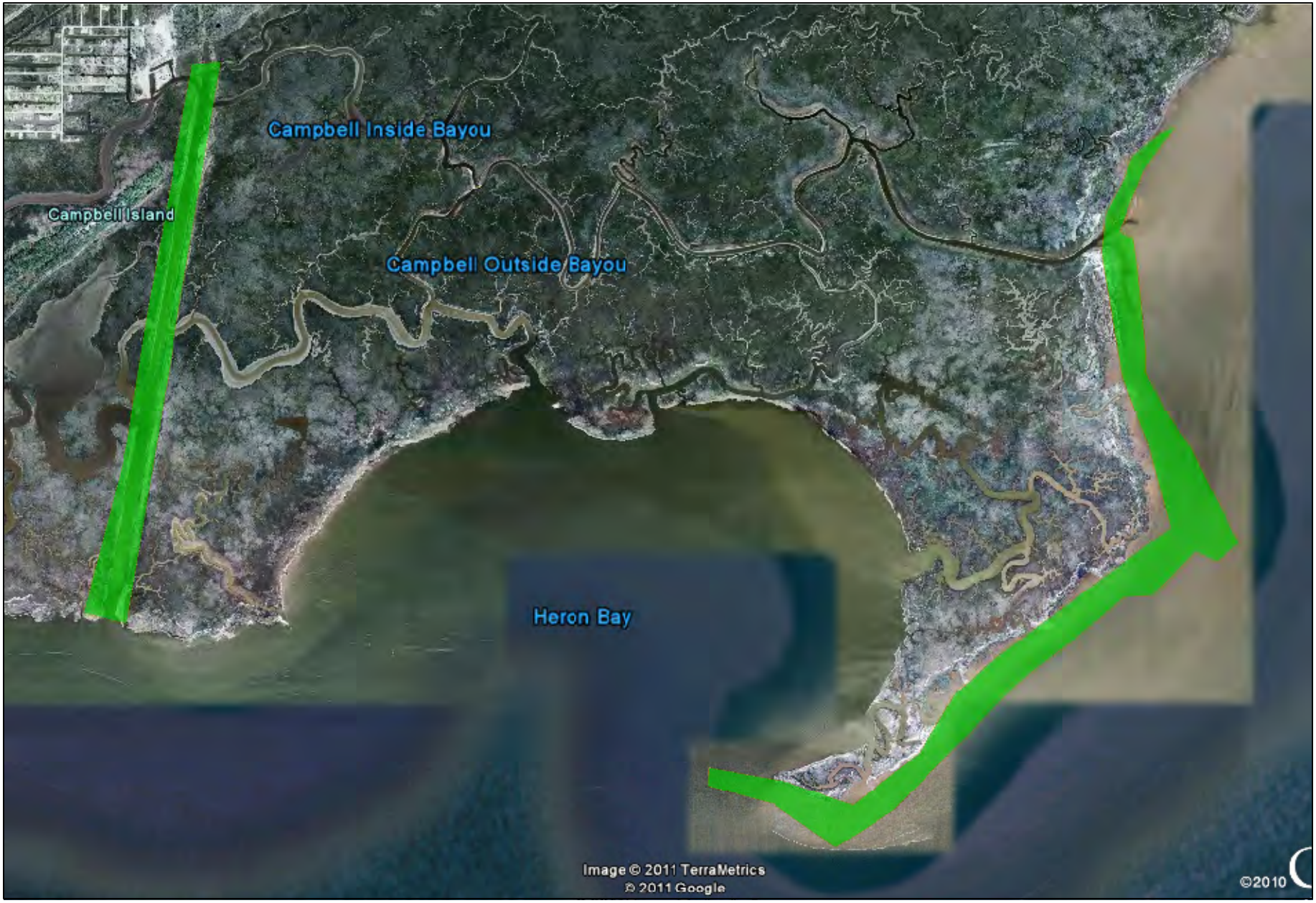

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Potential Benifical Use Site

0 2300

Approximate Scale in Feet

N

Tennessee Gas Pipeline
Hancock County
Potential Beneficial Use Sites

CH2MHILL

GNV C:\GIS\Mississippi Images\MXDs\Hancock Tennessee Gas Pipeline.MXD 06/02/2011

Legend

Potential Benifical Use Site

0 12500

Approximate Scale in Feet

N

Biloxi Marsh Complex
Hancock County
Potential Beneficial Use Sites

CH2MHILL

GNV C:\GIS\Mississippi Images\MXDs\Hancock Biloxi Marsh Complex.MXD 06/02/2011

Legend

Potential Benifical Use Site

0 1400

Approximate Scale in Feet

N

Collin Point
Hancock County
Potential Beneficial Use Sites

CH2MHILL

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Legend

Potential Benifical Use Site

0 1200

Approximate Scale in Feet

N

Jourdan River
Hancock County
Potential Beneficial Use Sites

CH2MHILL

GNV C:\GIS\Mississippi Images\MXDs\Hancock Jourdan River.MXD 06/02/2011

Legend

Potential Benifical Use Site

0 900

Approximate Scale in Feet

N

Biloxi River
Harrison County
Potential Beneficial Use Sites

CH2MHILL

GNV C:\GIS\Mississippi Images\MXDs\Harrison Biloxi River.MXD 06/02/2011

Legend

Potential Benifical Use Site

0 600

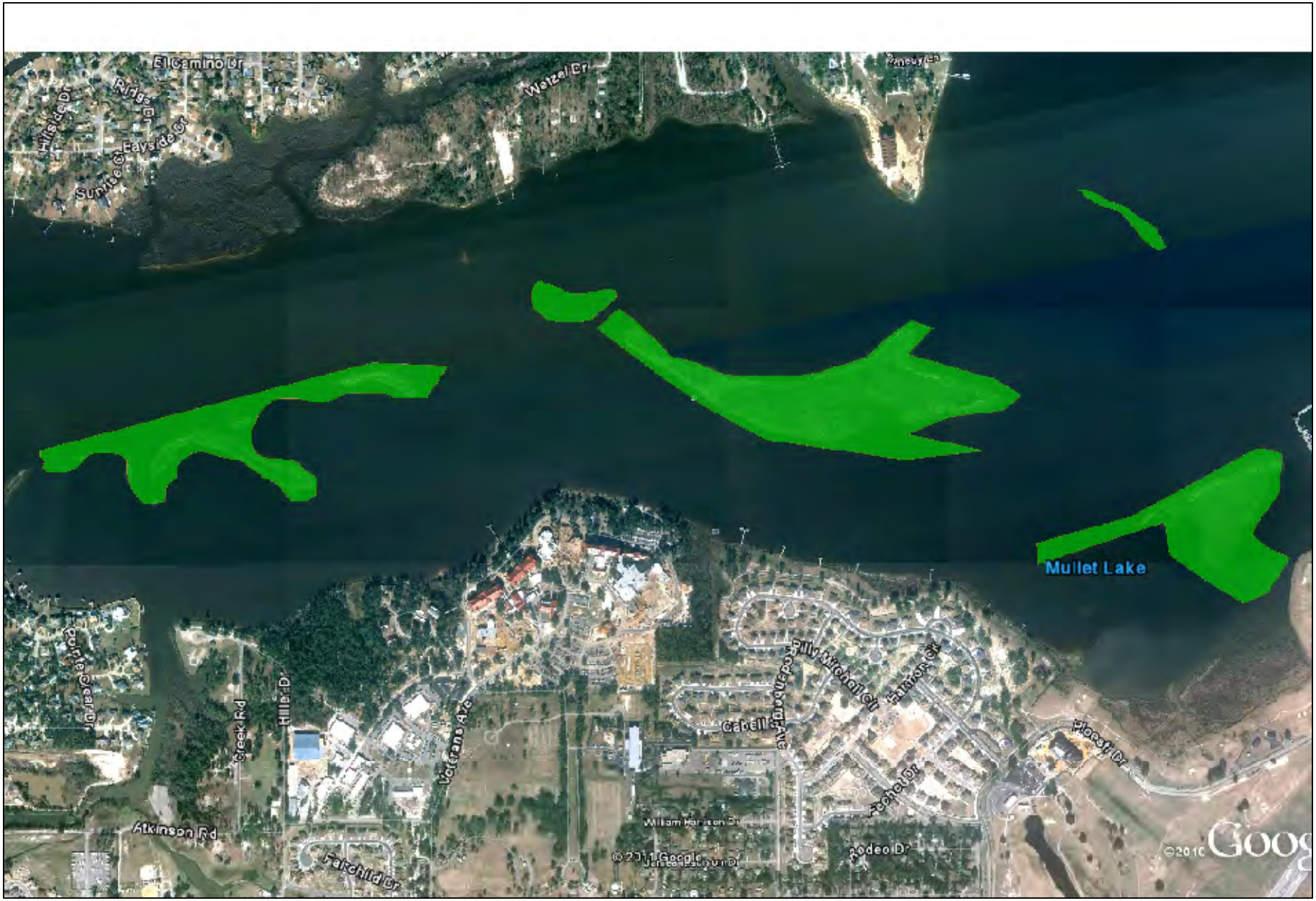
Approximate Scale in Feet

N

West Big Lake
Harrison County
Potential Beneficial Use Sites

CH2MHILL

GNV C:\GIS\Mississippi Images\MXDs\Harrison West Big Lake.MXD 06/02/2011



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Potential Benifical Use Site

0 1100

Approximate Scale in Feet

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Biloxi Bay Spoil Islnads
Harrison County
Potential Beneficial Use Sites

CH2MHILL

GNV C:\GIS\Mississippi Images\MXDs\Harrison Biloxi Bay Spoil Islands.MXD 06/02/2011

Legend

Potential Benifical Use Site

0 600

Approximate Scale in Feet

N

Biloxi Bay Point
Harrison County
Potential Beneficial Use Sites

CH2MHILL

GNV C:\GIS\Mississippi Images\MXDs\Harrison Biloxi Bay Point.MXD 06/02/2011

Legend

Potential Benifical Use Site

0 500

Approximate Scale in Feet

N

Marsh Island
Harrison County
Potential Beneficial Use Sites

CH2MHILL

GNV C:\GIS\Mississippi Images\MXDs\Harrison Marsh Island.MXD 06/02/2011

Legend

Potential Benifical Use Site

0 750

Approximate Scale in Feet

N

Goat Island
Harrison County
Potential Beneficial Use Sites

CH2MHILL

GNV C:\GIS\Mississippi Images\MXDs\Harrison Goat Island.MXD 06/02/2011

Legend

Potential Benifical Use Site

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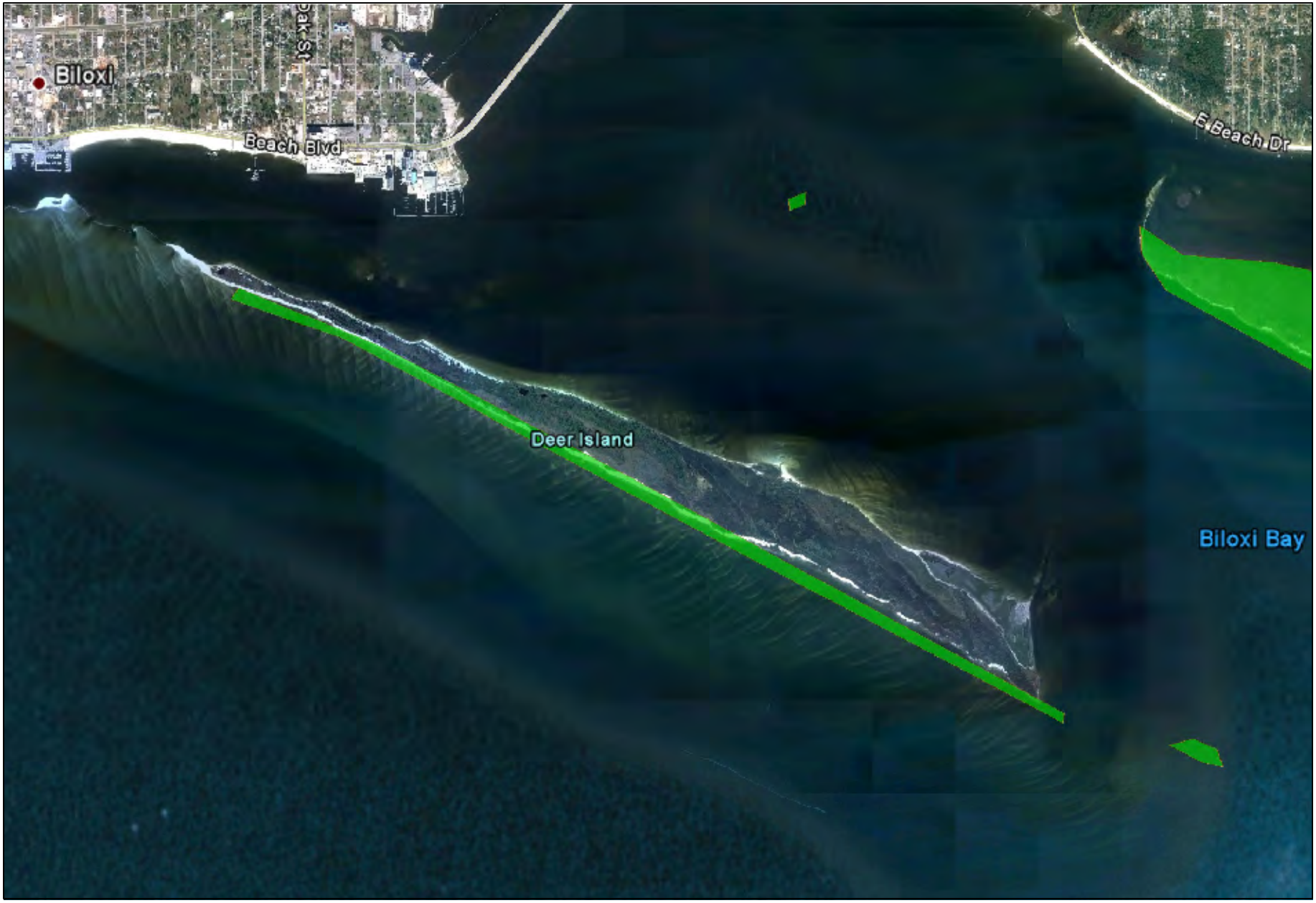
Approximate Scale in Feet

N

Round Island
Jackson County
Potential Beneficial Use Sites



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Potential Benifical Use Site

0 3000

Approximate Scale in Feet

N

Deer Island
Jackson County
Potential Beneficial Use Sites

CH2MHILL

GNV C:\GIS\Mississippi Images\MXDs\Jackson Deer Island.MXD 06/02/2011

Legend

Potential Benifical Use Site

0 3600

Approximate Scale in Feet

N

Lake Mars Shoreline West
Jackson County
Potential Beneficial Use Sites

CH2MHILL

GNV C:\GIS\Mississippi Images\MXDs\Jackson Lake Mars Shoreline West.MXD 06/02/2011

Legend

Potential Benifical Use Site

0 1400

Approximate Scale in Feet

N

Lake Mars Shoreline East
Jackson County
Potential Beneficial Use Sites

CH2MHILL

GNV C:\GIS\Mississippi Images\MXDs\Jackson Lake Mars Shoreline East.MXD 06/02/2011

Legend

Potential Benifical Use Site

0 1000

Approximate Scale in Feet

N

Fort Bayou
Jackson County
Potential Beneficial Use Sites

Legend

Potential Benifical Use Site

0 1800

Approximate Scale in Feet

N

Lower Escatawpa
Jackson County
Potential Beneficial Use Sites

CH2MHILL

GNV C:\GIS\Mississippi Images\MXDs\Jackson Lower Escatawpa.MXD 06/02/2011

Appendix D
Sources of Dredged Material

APPENDIX D

Potential Material Sources for Beneficial Use Projects for Coastal Mississippi

Source Name	Maintenance Cycle	Date Last Dredged	Next Dredging	Typical Quantities/ Current Disposal	Type of Material	Remarks
Hancock County						
Bayou Caddy/Point Clear (fed)	Every 6–7 yrs	2010	Unknown	170,000 yd^3—open water disposal and new ecosystem restoration site	Fine grains	Recent restoration using adjacent sandy borrow and silty channel material
Hancock County Finger Canals (inland of Caddy) (fed)	N/A	2010	Unknown	10,000 yd^3—material used in Bayou Caddy restoration	Sand/silt	Material used in 2011 in Bayou Caddy restoration project
Bay-Waveland Yacht Club	As needed	2/2007	Unknown	2,500 yd^3—disposal site is Bayou Portage	Silt/sand	—
New Bay St. Louis Marina	New project	N/A	N/A	300,000 yd^3	N/A	—
Diamondhead	As needed	1998	Unknown	Unknown	Unknown	—
Devil's Elbow	New project	N/A	Unknown	Unknown	Mixture of fine and coarse grained.	A lot of fertilizer in it due to runoff from the golf course
Gulf Intracoastal Water Way (fed)	As needed	—	Unknown	Open water disposal	—	Minimum to little material
Hancock County Port & Harbor	As needed	2003	2011	2,500 yd^3	Fine silt	Requires permit
Wolf/Jourdan River (fed)	Every 5 yrs	2009	Unknown	Open water	Fine grains	—

APPENDIX D
Potential Material Sources for Beneficial Use Projects for Coastal Mississippi

Source Name	Maintenance Cycle	Date Last Dredged	Next Dredging	Typical Quantities/ Current Disposal	Type of Material	Remarks
Little Lake	As needed	2005	Need it now	Unknown	Fine silt	Immediate dredging need, Requires permit
Port Bienville Harbor (fed)	As needed	Unknown	Unknown	Permit allowed 2,500 yd^3 over 5 yrs	Sand	Inactive project
On I-90E, toward Waveland; crosses over Bayou Lacroix	N/A	Unknown	Unknown	Unknown	Black sand	Private land owner
Pearlington Dirt Pit	N/A	2007–2008	Can dredge 5 acres without DEQ permit	Unknown	Heavy clay, doesn't wash off	Private land owner
Harrison County						
Bayou Portage Navigation Channel (fed)	As needed	2001	N/A	93,000 yd^3	Fine grains w/areas of sand	Upland
Harbor Channel	Every 6 yrs	—	—	19,800 yd^3	—	—
Upland Disposal Site (Bayou Portage Upland Site)	N/A	N/A	N/A	Dry sediment		Material available
Biloxi Harbor (fed)	Every 2 yrs	2009	2011	0.75M yd^3 —open water sites	Fine grains and some sand	Channel material used in West End Deer Island Marsh creation
Harrison County Industrial Seaway	Every 4–5 yrs	2009	Unknown	300K yd^3—upland sites C-1 and C-6	Sand	—
Upland Disposal area C-6	N/A	N/A	N/A	Dry sediment	Sand	Material placed into site 2009

APPENDIX D

Potential Material Sources for Beneficial Use Projects for Coastal Mississippi

Source Name	Maintenance Cycle	Date Last Dredged	Next Dredging	Typical Quantities/ Current Disposal	Type of Material	Remarks
Upland Disposal area C-1	N/A	N/A	N/A	Dry Sediment	Sand	Material placed into site 2009
Harrison County Beach Restoration	N/A	2007	N/A	2M yd^3 placed on the existing beach	Sand	Borrow source nearshore to beach template
Bernard Bayou	—	—	—	No approved disposal site	—	Inactive
Back Bay	—	1986	—	No approved disposal site	—	Inactive; minimal dredging when last dredged
East Harrison County Canal	—	1986	—	No approved disposal site	—	Inactive
Ott Bayou	Every 14 yrs	2006	Unknown	21K yd^3 —approve for Open Water D/A 6	Sand/silts	Inactive at sponsors request
Gulf Intracoastal Water Way (fed)	As needed		Unknown	Open water disposal	—	Minimum to little material
Gulfport Harbor (fed); Sound (combined)	Every 1–1.5 yrs	2010	2011	1.6M yd^3	Fine grain	Open water
Gulfport Bar (fed)	Every 1.5 yrs	2010	2011	0.75M yd^3	Sand	Littoral and Ship Island restoration 2011
Gulfport Entrance Channel (fed)	Every 2 yrs	2010	2011	0.75M yd^3	Sand with some fine grains	Ocean disposal

APPENDIX D

Potential Material Sources for Beneficial Use Projects for Coastal Mississippi

Source Name	Maintenance Cycle	Date Last Dredged	Next Dredging	Typical Quantities/ Current Disposal	Type of Material	Remarks
Harrison County Development Corporation—Port Intraplex	Every 10 yrs	2000	2010	15K yd^3	Clay	—
MS Power—Plant Watson (#10)	As needed	2006	As needed, every 8-10 yrs	90K yd^3 available now	White river sand	Plant Watson is on Biloxi River
MS Power—Plant canals (#10)	3-yr cycle	N/A	As needed	2.5K yd^3	Silty sand	—
MS Power—Fleet Area (#11), just outside old back bay bridge	3-yr cycle	N/A	As needed	1K yd^3	Silt	Has never been dredged since MS Power gained ownership
Pier 6—MS State Port Authority	As needed, every 3 yrs	8/09	As needed	5K–10K yd^3	Silty sand	April/May dredging by USACE
Pier 7—MS State Port Authority	As needed, every 3 yrs	8/09	As needed	130K yd^3	Silty sand	—
Pier 7—MS State Port Authority	As needed	8/09	As needed	2.9M yd^3	Stiff marine clay	—
84-acre expansion project—3rd approved phase (24 acre)	N/A	N/A	Summer 2011	300K yd^3/ Deer Island	Unknown	Possible new material source
Pass Christian Harbor (fed)	As needed	1995	N/A	100K yd^3	Fine grains	No approved disposal site

APPENDIX D
Potential Material Sources for Beneficial Use Projects for Coastal Mississippi

Source Name	Maintenance Cycle	Date Last Dredged	Next Dredging	Typical Quantities/ Current Disposal	Type of Material	Remarks
Expansion of the Pass Christian Harbor Project	New project	N/A	N/A	300K yd^3	Sand	All to be used for beach renourishment in Pass Christian
Disposal sites along the Gulfport Navigation Channel	N/A	N/A	N/A	—	Coarse material (especially on the Gulf side)	—
Jackson County						
Pascagoula Sound (fed)	Every 2 yrs	2011	2012	2M–3M yd^3—open water	Silts and fines with some sand	—
Pascagoula Entrance (fed)	Every 2 yrs	2011	2013	2M yd^3—ocean site	Sand	—
Greenwood Island (fed)	N/A	N/A	N/A	None	N/A	Rock dike perimeter established for future marsh creation
Horn Island Pass (fed)	Every 1–2 yrs	2011	2012	1M yd^3—Littoral D/A 10	Sand	—
Bayou Casotte Inland (fed)	Every 3 yrs	2009	2012	0.5M yd^3—upland site	Silt/sand mix	Bayou Casotte Dredge Material Management Site #55; D/A material used to create 26-acre marsh site 2005

APPENDIX D
Potential Material Sources for Beneficial Use Projects for Coastal Mississippi

Source Name	Maintenance Cycle	Date Last Dredged	Next Dredging	Typical Quantities/ Current Disposal	Type of Material	Remarks
Bayou Casotte Sound (fed)	Every 1 year	2011	2012	1M–2M yd^3—open water	Silts with some sand	—
Bayou Casotte Dredge Material Management Site (fed)	N/A	2003	N/A	Dry sediment	Silt/sand mix	Site managed; good material haul-out capability
Triple Barrel Disposal Site (fed)	N/A	N/A	N/A	Dry sediment	Sand with large amounts of silts	Site managed; good material haul-out capability
Upper Pascagoula River (above Hwy 90) (fed)	Every 5 yrs	2009	Unknown	200K yd^3—upland sites from Hwy 90 to I-10	Sand	—

Appendix E
Containment Options

Containment Options

A variety of new containment materials, products, and methods for containing dredged material has been developed to address shoreline erosion. Options for containment include hard structures constructed of concrete and soft methods, such as using earthen berms. The containment option to be used will depend on the location to be restored, the wave action (if any), and the long-term goals for the site.

Alternative to Manual Planting

A new method for planting grasses, one that is much less labor intensive is being tested. The tests have three goals: (1) to test if rhizomes or seeds can survive passing through a dredge pipe, (2) to determine if this method gives an even distribution of plants, and (3) to determine the optimal time to input the rhizomes for maximum growth and distribution. This method includes installing a hopper on the dredge pipe that would allow rhizomes or seeds to be carried to the dredge placement site with the dredge material. A test of the potential success of this method would compare it to natural recruitment and hand planting. Suggested timing of the release of seeds would be tested in several different ways including one test that included no planting, one that would occur the last 15 minutes of dredge cycle, one that would occur the last 30 minutes of the dredge cycle, and finally manual plantings. The preliminary benefit would be to reduce the cost of planting and increase habitat value.

Autoclaved Aerated Concrete for the Coastline

The primary goal is to manufacture, deploy, and demonstrate the effectiveness of Autoclaved Aerated Concrete as a viable alternative to traditional shoreline protection and stabilization materials. The first application of this material as a shoreline protection feature is as an alternative to shoreline armoring via concrete or rock rip rap along shorelines with high risk for failure due to low load-bearing capacities. This product is only 20 percent the weight of solid concrete; therefore it will greatly reduce the likelihood for increased subsidence and could present an option where other heavier materials would have never been considered. Another application for this product is as an artificial oyster reef and as a structure to break up wave action in areas where conditions are unsuitable for foreshore rock dikes or revetments. As oysters accumulate on these structures, the effectiveness of this project as a reef increases. The product's potential benefits include dissipating and absorbing wave energy and protecting existing shoreline; as a light alternative to riprap structures, there is the possibility for multiple applications of the product. Photos and videos can be seen at:

Bayou Backer

Bayou Backer is a long-lasting wave-energy reducer that is suited for wetlands protection and revegetation. Plugs are dispensed from rolls of 3- to 6–feet-wide corn oil–based (biodegradable) plastic strip. In very loose ground, plugs up to 38 feet inches are pushed 16 feet deep. This leaves two 3-foot-long blades above the surface. The product is a low-cost alternative to rock, dirt, and vegetative plantings, as it can be easily transported and

installed compared with these other methods. It is expected to last several years in the Gulf waters, and assist in abating shoreline erosion to allow plants recovery and establishment time. Wave pool testing was recently performed at Louisiana State University and can be seen in photos and videos at http://www.grastic.com/subPages/pictures.html.

This product could be a low-cost option in shoreline protection, for initial terrace or marsh creation erosion control until vegetation establishes, direct creation of habitat in shallow waters where turbidity could be decreased, and used as an addition to both interior lake and exposed coastal bay shorelines and open bay waters.

Bioengineering Solutions Using Fascines and Coir Mattresses

Bioengineering is the method of design and construction that uses vegetation (live, dead, and dormant) in combination with natural structural components, such as fascines, mattresses, live staking and coir fabric, and "live lifts," for engineering purposes. The advantages of bioengineering are based on the premise that a natural plant community with a solid foundation is the most effective approach to preventing erosion and establishing a natural biological community. This bioengineering solution does not require special skills or equipment to install, is cost effective to acquire and install, and is aesthetic, as it results in a natural, indigenous plant community. The bioengineering solution relies on natural, locally sourced materials, grows stronger over time, and is self-repairing and maintaining. Roots spread, bind to soil, and hold it in place; vegetation shields the soil surface from waves, wind, rain, and sheet flow, and the plant community provides the basis for the rest of the ecological community.

Deltalok

Shoreline protection and vegetation plantings can be implemented utilizing the Deltalok Terra-Soft Block (TSB) system. It is a completely new category of civil engineering products, as it is a highly adaptive soft material product that exhibits hard material capabilities. These TSBs serve two purposes: stop further erosion and provide a stable foundation for growth of

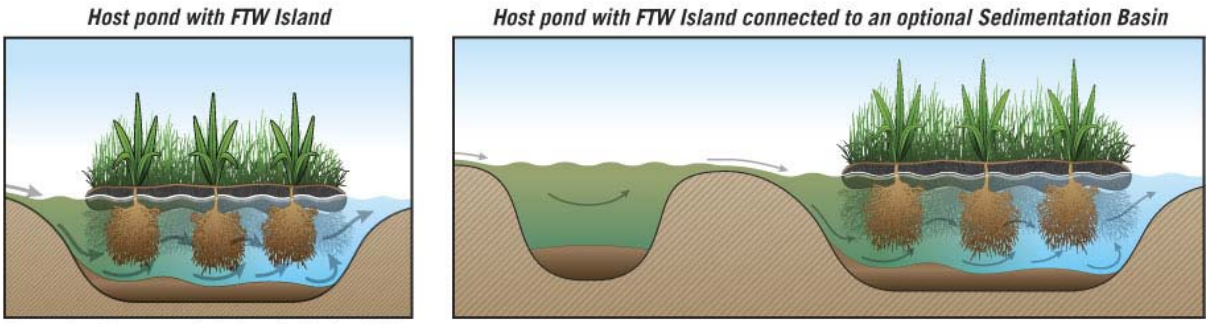
vegetation. TSBs will blend with the local environment to leave a natural finish (unlike riprap or other hard material), and follow the natural contours of the marsh. Once built, the Deltalok shoreline would be planted with indigenous vegetation plugs. The TSBs offer the structural integrity of hard structure and the vegetation of an earthen berm.

The product benefits include reducing the cost of shoreline stabilization (two-thirds the cost of riprap) and creating rapid and efficient, effective construction. It is durable, resists differential settlement and seismic activity, achieves 100 percent system strength on installation, and does not rely on root strength/reinforcement.

Floating Island Environmental Solutions BioHaven

BioHaven is a man-made ecosystem that mimics naturally occurring wetlands. The result is a highly efficient natural way to improve water quality by filtering pollutants and breaking down, removing, using, or retaining nutrients and organic waste. BioHaven islands are created from buoyant mats made from a matrix of fibers derived from 100 percent recycled plastic and bonded together with foam to provide buoyancy. The mats are planted with sod, garden plants, or wetland vegetation appropriate to their environment and launched into a body of water as a fully formed BioHaven floating island. The BioHaven floating island is an example of biomimetics, the science of adapting designs from nature to solve modern problems. BioHavens use natural microbial processes to cleanse water. The matrix and plant roots that grow through it provide essential surface area for microbes (bacteria) to reproduce. Microbes, occurring naturally in water, evolve quickly to remove contaminants of all kinds—nutrients caused by fertilizer runoff, organic waste, nitrates, phosphates, ammonia, and heavy metals from the water.

The effectiveness of BioHavens comes from the expanded matrix base, an efficient surface area for microbes to grow; for example, a 250-ft² island is the equivalent of 1 acre of wetland surface area. This extensive surface area allows microbes to create a concentrated wetland effect that makes BioHaven many times more effective than nature. Photos and videos can be seen at: http://www.floatingislandinternational.com/products/biohaven-technology/.



The two key factors to mimicking the Wetland Effect are circulation and surface area, both of which are eco-orchestrated with BioHaven FTWs.

BioHaven islands provide a surface area where microbes proliferate, starting off the food chain and supporting the diverse wildlife that come to inhabit the islands. The islands would be designed and planted to attract specific kinds of birds and fish. It is assumed ducks could use the islands for brooding and roosting, loons would nest on them, and the roots that would grow through the protective core of the island provide a food source for fish.

Habitat Enhancements Through Vegetation Planting Using Gulf Saver Bags

The Gulf Saver Bag is a package of native marsh grasses with its own supply of totally natural nutrients and billions of oil-eating microorganisms to support, feed, and protect the marsh grasses, promoting survival and growth, and restoring the ecosystems and habitats. Each Gulf Saver Bag protects and restores 1 ft² of wetland. A Gulf Saver Bag is a USACE standard biodegradable "burlap (sand) bag" that is filled with an all-natural humus mix rather than sand (weight and size adapted for easy handling by volunteers). The humus inside the Gulf Saver Bag is a mixture of all natural organic nutrients that support maximum plant growth and survivability. The humus is custom mixed to be site specific, and included in the humus mixture are billions of all-natural oil-eating microorganisms, already being used by nature, to support as well as protect plants from potential toxins. The plants "plugged" into the Gulf Saver Bag are native marsh plants that are vital to protecting, holding together, and restoring the ecosystems that are essential to the Gulf Coast. The 100

percent all-natural biodegradable Gulf Saver Bags decompose and continue to provide additional food for the marsh plants as they thrive and grow.

Gulf Saver Bags provide more efficient, reliable, and cost effective vegetative planting techniques. The bags demonstrate the relative success, applicability, and cost effectiveness of this method. The bags would be planted with a diverse selection of native marsh grasses and deployed at critical sites. It is recommended that treatments would be monitored immediately after deployment, and at least at 2- and then 6-month intervals to ascertain success of the plantings. Photos and videos can be seen at http://www.gulfsaversolutions .com/gulf-saver-bags.php.

Polders for Marshland Creation

Using Dutch technology, polders for marshland creation should enclose shallow, open-water areas with dikes and lower the water table within. A succession of vegetation builds up organic rich sediments, increases the water table, introduces fine sediments, and reinstates open connections with surroundings. The objectives for polders for marshland creation are their having the best construction method for low, stable, affordable soft dikes; optimal mix of water discharge, sediment input, and flooding to maximize accretion rates; and providing for free movement of fisheries while manipulating water levels.

Rapidly Deployable Precast Sediment Retention Barrier

This product demonstrates the use of specially designed precast concrete barriers as retention structures for dredged sediments and marsh that can be constructed to any length compatible with their delivery and deployment. The barriers are strengthened by solid concrete columns on each end and on 5- to 10-foot centers along the length. Parallel baffles stretch between the columns. The baffles are lowest on the sediment side and separated vertically by 0.5 to 1.5 feet as necessary to retain sediment while allowing appropriate water and biotic interchange.

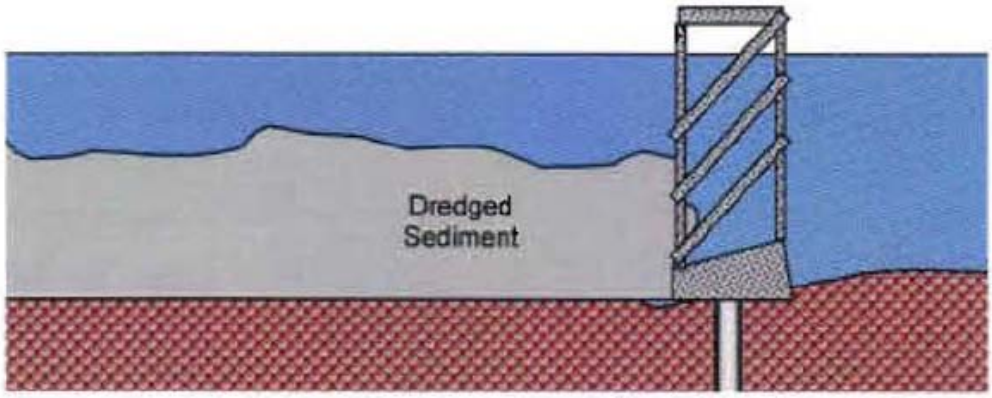


Figure 1. Side view of precast Rapidly Deployable Sediment Retention Structure; angled baffles retain dredged sediment while allowing bi-directional water flow.

The Sediment Retention Barriers are constructed such that their ground pressure is less than the strength of the soft sediments, allowing the barriers to "float" on the sediment surface.

The Sediment Retention Barriers are precast in the proper design and delivered to the site on a shallow-draft barge. The precast construction of the barriers allows them to be deployed rapidly. They may also be removed after the marsh is sufficiently mature to remain stable without the barriers. Removed barriers could be reused for similar projects. The barriers would be placed using a crane capable of reaching to the placement location either from a shallow-draft barge or land feature. The barriers would be pressed onto the sediment with the pilings down to provide stability. Barriers would be placed end-to-end to provide a continuous sediment retention structure. Ideally, the Sediment Retention Barriers would be used as part of a marsh restoration project where an earthen dike structure is planned. A series of barriers would be used in lieu of the earthen dike.

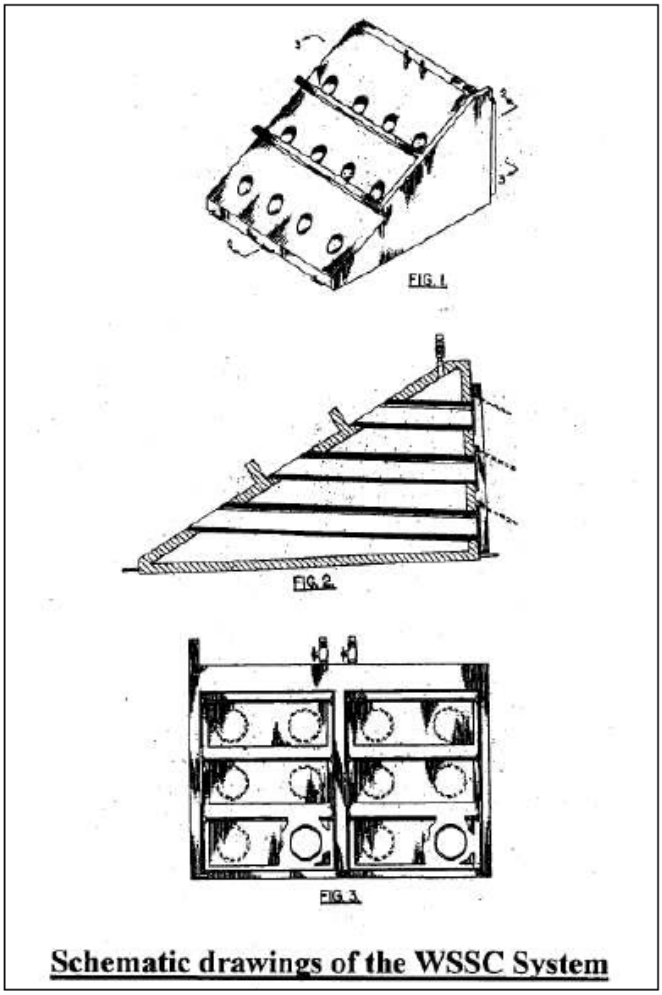
Sediment Vegetation Ribbons to Enhance Dredged Sediment Retention and Reduce Storm Surge

Ideally, vegetation ribbons would be installed in conjunction with a planned dredging project in a channel that requires routine maintenance dredging and has large areas of marsh in need of restoration or nourishment within pumping distance. Suitable dredged sediments will be placed in a series of tubular geobags. The bags will be placed in a manner as to allow tidal interchange between them but minimize sediment flow. The sediment ridges will be constructed in a manner convenient for the discharge of dredged sediment from future maintenance dredging projects. After the filled geobags have stabilized, woody and herbaceous vegetation will be planted in the tops of the bags at appropriate spacings. Holes will be cut along the top ridge to provide openings large enough to allow the planting to occur and to accommodate growth.

Sediment ribbons are used to create vegetated sediment ridges in coastal marshes. These preplaced ridges facilitate long-term coastal restoration efforts. The primary purpose for these ridges would be to serve as retention structures for the placement of sediment from future maintenance dredging projects. Additionally, woody and herbaceous vegetation grown on these ridges could reduce storm surge in adjacent areas during tropical storms and hurricanes.

The Wave Robber Wave Suppressor Sediment Collection System

Wave Suppressor Sediment Collection System (WSSC) addresses two critical areas of need: protecting the shorelines and wetlands from erosion caused by wave action or tidal surge and rebuilding shorelines and restoring



Schematic drawings of the WSSC System

wetlands loss. The WSSC system serves as a barrier to disrupt the tidal wave flow into the shorelines and wetlands while at the same time allowing sediment to be carried through the system by the wave action and water currents. The sediment is trapped and deposited between the system and the shorelines and wetlands. Trapped sediment then consolidates to form a solid base for the establishment of emergent marsh. One major advantage is that the WSSC system is transportable and can be easily installed along shorelines and wetlands. Additionally, the WSSC units are reusable and designed to be removed from one location and easily moved to another. The WSSC system is also less expensive than fixed dike structures, a distinct advantage in managing project cost. Last, the WSSC system allows a continuous water exchange for ecological support rather than isolating areas behind the structure. See http://www.mvn.usace.army.mil/pd/PPL%2020%20DEMO%20Projects_reduced.pdf.

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