CAILLOU LAKE HEADLANDS
RESTORATION PROJECT (TE-100)

ENVIRONMENTAL ASSESSMENT FOR ISSUANCE OF A NON-COMPETITIVE NEGOTIATED AGREEMENT FOR THE USE OF OUTER CONTINENTAL SHELF SAND

LDNR NO. 2503-12-22
TERREBONNE PARISH, LOUISIANA

Prepared for United States Department of the Interior
Bureau of Ocean Energy Management
On Behalf of the Coastal Protection and Restoration Authority of Louisiana
450 Laurel Street
North Chase Tower, Suite 1200
Baton Rouge, Louisiana 70801

CPRA
Coastal Protection and Restoration Authority of Louisiana

Prepared and Submitted By:

COASTAL ENGINEERING CONSULTANTS INC.

September 24, 2014

EXECUTIVE SUMMARY

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PROJECT OVERVIEW AND PURPOSE

On behalf of the Bureau of Ocean Energy Management (BOEM) and the Coastal Protection and Restoration Authority (CPRA), the Environmental Assessment (EA) for the Caillou Lake Headlands Restoration Project (TE-100) (hereinafter referred to as the Project) has been prepared in support of the Project permitting and coordination of a Non-Competitive Negotiated Agreement with BOEM for use of an Outer Continental Shelf (OCS) sand resource located in federally-owned waters. The Project includes restoring the barrier shoreline along the entire length of Whiskey Island through beach and dune fill placement utilizing an offshore sand source in Ship Shoal Area Block 88, and restoring the marsh platform along the western half of the Island using mixed sediment from a nearshore borrow area in Louisiana State-owned waters. The U.S. Army Corps of Engineers (USACE) requires a permit for all other aspects of the Project, including dredging of any state-owned water borrow areas, as well as conveyance and placement of sand resources. The operative federal authorities for USACE permitting are Section 10 of the Rivers and Harbors Act of 1899, which regulate dredging and filling of federally-owned waters and water bottoms, and Section 404 of the Clean Water Act, which regulates discharge of dredged sediment into federally-owned waters. BOEM and the USACE are working collaboratively to ensure effective implementation of the required National Environmental Policy Act (NEPA) process, the required Endangered Species Act (ESA) Section 7 consultations, the Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat consultation (Section 305); the National Historic Preservation Act Section 106 process; and the Coastal Zone Management Act Section 307 consistency determination.

The Project is needed because the combination of land subsidence, sea level rise, coastal erosion, storm damage, and lack of replenishing sediment have led to habitat loss and ecosystem degradation across the entire Terrebonne Basin Barrier Shoreline. Isles Dernieres Barrier

Island/Headland Restoration to reverse the deterioration, protect and enhance existing habitat creation projects, and provide additional storm surge attenuation for interior wetlands is an identified goal of the 2012 Master Plan.

The purpose of the Project is to restore Whiskey Island's geomorphological and ecological form and function (GEFF) through simulation of historical conditions by enlarging the existing barrier island, both in width and elevation, and by preventing breaching during the design life. Restoration of the Island's geomorphic form and function will provide the buffer to reduce the full force and effects of wave action, saltwater intrusion, storm surge, and tidal currents on associated estuaries and wetlands; and provide a marsh platform to capture overwash sediments during episodic events and serve as a roll over platform as the Island migrates landward. Restoration of the Island's ecologic form and function provides wetland habitat for a diverse number of plant and animal species and to help retain sediment.

PROJECT LOCATION

The Project area includes the Restoration Area on Whiskey Island; two (2) borrow areas located in the Gulf of Mexico, the sand source located approximately 8.2 nautical miles (NM) to the southwest of the Island on the OCS in Ship Shoal Block 88, and the mixed sediment source located approximately 4.2 NM to the southeast of the Island in state-owned waters; and two (2) conveyance corridors connecting the borrow areas to the Restoration Area.

The Restoration Area is in the Isles Dernieres chain of the Terrebonne Basin barrier islands. Extending approximately twenty-two (22) miles, west to east, the chain comprises Raccoon Island, Whiskey Island, and Trinity/East Island. The present (2013) subaerial island is approximately 3.6 miles long and approximately 0.7 miles at its widest. Whiskey Island retains approximately 230 acres of mangrove wetlands in two (2) locations, at its east end and in its middle.

Unlike other islands in the Isles Dernieres chain, Whiskey Island does not migrate landward, but instead thins in place as the Gulf-facing shoreline retreats northward. Examination of shoreline change and bathymetry maps from the mid-19th century to the early 21st century show this thinning and little migration northward of the Island's bayside shoreline. It is surmised that overwashed sediments cannot accumulate behind the Island to retain its GEFF; rather, the sediments fall into the Caillou Boca channel and are lost from the active system. The same maps show little change in Caillou Boca's location or dimensions, confirming this assumption (Martinez, *et al*. 2009; Miner, *et al*., 2009).

PLANNING AND PERMITTING PROCESS

This Project was originally developed as part of the Louisiana Coastal Area (LCA) Program, authorized by the Water Resources Development Act of 2007 (WRDA 2007), which authorized a feasibility report for the Terrebonne Basin Barrier Shoreline Restoration project (TBBSR). The TBBSR Integrated Feasibility Study and Final Environmental Impact Statement (FEIS) (USACE, 2010) included detailed analyses of alternative designs for individual islands and combinations of islands as well as analyses of the costs and cost-effectiveness of the alternatives.

The four-island National Ecosystem Restoration (NER) Plan recommended by the TBBSR included restoration of Whiskey Island and this Project follows the design parameters set forth in the TBBSR NER Plan. The TBBSR Plan was formulated in compliance with the National Environmental Policy Act (NEPA), in coordination with the U.S. Fish and Wildlife Service (USFWS), the National Marine Fisheries Service (NMFS), and the Louisiana Department of Wildlife and Fisheries (LDWF), as per the Fish and Wildlife Coordination Act. A coordination act letter report is incorporated into the FEIS. As a consequence of all of the preceding planning and evaluation efforts, only two (2) alternatives were considered for this Project: the No-Action or Future-Without-Project Alternative and the Restoration Alternative.

As noted above, the proposed restoration plan will be evaluated by the USACE as part of the 10/404 permitting process. USACE will prepare an independent EA to determine the least damaging, most practicable project alternative. BOEM and USACE are working collaboratively to ensure effective implementation of the required NEPA process.

PROPOSED ACTION

Restoration Area

At present, Whiskey Island consists of a low, narrow sand beach in front of two (2) distinct mangrove wetlands separated by a recently-restored marsh (Whiskey Island Back-Barrier Marsh Creation, TE-50). A small spit extends the beach to the west towards Raccoon Island. There is no well-established dune present along the length of the beach. The restoration proposes to place sand along the entire length of the Gulf-side of the Island, 22,500 ft as measured along the proposed design alignment, to create a berm approximately 800 ft in width with a dune on top. The dune will be constructed at a target elevation of +6.4 ft NAVD88, with fore- and back-slopes of 1V:30H and a typical width of 232 ft at the base and 100 ft at the crest. The target elevation of the beach will be +4.2 ft NAVD88, with a slope of 1V:60H from the berm extending seaward to the intersection with the existing grade, and a typical width of 464 ft. A vertical tolerance of plus one (1) foot is proposed to account for construction as well as consolidation and settlement

of the fill for the beach berm and dune. The dune platform will be planted over 100 percent of the area immediately following construction with native dune vegetation.

The restoration also proposes to create an approximate 1,000 ft-wide marsh platform along approximately 5,500 ft of the Bay side of the spit. The marsh platform target elevation is +2.4 ft NAVD88 with a minimum width of 1,000 ft. A vertical tolerance of plus one (1) foot is proposed for the difference in relative sea level rise, consolidation and settlement of the marsh platform, and construction methods. After construction and consolidation, the newly created marsh platform will be planted with native wetland vegetation. The marsh areas will provide an adequate platform for overwashed sand to prolong the longevity of the Project.

The volumes of material required to accomplish the restoration have been estimated to be 11.6 million cubic yards (MCY) of sand, adjusted for cut to fill ratio, to provide 8.9 MCY on the restored beach and dune; and 1.3 MCY of mixed sediment, adjusted for cut to fill ratio, to provide 0.8 MCY on the created marsh platform.

Borrow Areas

The sand for the beach and dune will be mined from a designated Borrow Area within Ship Shoal Lease Block 88, located on the OCS approximately 8.9 NM from Whiskey Island along its conveyance corridor. Ship Shoal has been studied extensively to define the stratigraphy of the shoal and identify any potential cultural resources and infrastructure that may be present. Lease Block 88 was selected because of its proximity to the Project site. The surface area is approximately 650 acres. The sand thickness is up to eighteen (18) ft. The design depth ranges from -27 ft NAVD88 to -34 ft NAVD88 with a 2.0 ft allowable overdredge ranging from -29 ft NAVD88 to -36 ft NAVD88. The design volume is estimated to be 11.6 MCY. The available sediment is composed of over 96% sand, which is classified as very fine sand in the Wentworth scale and fine sand in ASTM soil size ranges.

The mixed sediment for marsh creation will be mined from the designated Whiskey 3A Borrow Area located in State-owned waters approximately 4.5 NM southeast of Whiskey Island along its Conveyance Corridor. This Borrow Area was subjected to geophysical and geotechnical studies during the planning and design phases of the TE-50 project. The stratigraphy showed a surficial muddy unit overlying a coarser sandy unit. Mining these two (2) units together would produce marsh-compatible mixed sediment. The surface area is approximately 77 acres. The marsh compatible sediment thickness averages approximately twenty (20) ft. The design depth is -37 ft NAVD88 with a 2.0 ft allowable overdredge to -39 ft NAVD88. The design volume is estimated to be over 2 MCY. The available sediment is composed of approximately 60% sand.

Excavation and Conveyance

The use of both hopper and cutterhead suction dredge alternatives for excavation, transportation, and placement were considered for conveying sediment from both the Ship Shoal Block 88 Borrow Area and the Whiskey 3A Borrow Area to Whiskey Island. The depths needed for efficient utilization of hopper dredges precludes their use for the Project without unnecessary dredging at both Borrow Areas and the approaches to Whiskey Island, so that alternative was not considered further. By eliminating the hopper dredge method, the preferred method for conveying sediment from both of the Borrow Areas to Whiskey Island shall utilize a hydraulic cutterhead dredge in combination with booster pumps and sediment pipeline.

Two (2) conveyance corridors, one (1) from each borrow area, were selected to avoid pipelines and production structures. Both were surveyed for cultural resource targets and other potential hazards and their alignments refined to minimize crossings of oil and gas pipelines and provide buffers from potential cultural resource targets. The Whiskey 3A Conveyance Corridor intersects seven pipelines and the Ship Shoal Block 88 Conveyance Corridor intersects nine pipelines. The construction specifications will require the contractor to independently verify the accuracy of the reported intersection data and use best industry practices to mitigate impacts from the temporary dredge discharge pipeline placement. Their pipeline placement plan must be approved by the Project Engineer and BOEM prior to Project implementation. No excavation is required for either conveyance corridor.

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

As required by NEPA, a broad range of resources and natural processes, from physical and biological processes and resources and critical biological resources to cultural and socioeconomic resources, are described for Whiskey Island and where relevant, the borrow areas and the conveyance corridors. Of particular interest are the faunal assemblages on Ship Shoal utilized by both estuarine and oceanic species assemblages; the Threatened and Endangered Species, particularly the avifauna (Whiskey Island is designated critical habitat for wintering piping plover); and the potential for cultural resource targets at Whiskey Island, the borrow areas, and conveyance corridors. The consequences of both implementation of the No-Action and Restoration Alternatives as they apply to Whiskey Island, the borrow areas, and conveyance corridors are described and discussed for each relevant Project feature including dredging operations, borrow area geometry, and fill placement in both beach/dune and marsh templates, and the physical, biophysical, critical biological, cultural, and socioeconomic resources and features. The Project will have either no effect or short-term negative effects on most of the features and resources, followed in the mid- to long-term by positive effects as the affected environments recover from initial disturbance and the additional habitats created mature and

reach equilibrium. Recent research (Schupp, et al., 2012) has reinforced the importance of long-term maintenance of overwash features to support the piping plover population.

The Project will provide additional beach, dune, and marsh habitat for marine and estuarine fisheries resources and their forage species as well as for a wide variety of avian communities including shorebirds, wading birds, colonial nesting birds, and migratory songbirds. A shorebird protection and bird abatement plan will be developed cooperatively by CPRA and the USFWS to protect avian resources during construction. Benthic resources on the borrow areas and at Whiskey Island will be disturbed by both excavation and fill placement during construction. These disturbances are unavoidable and the habitats recover over time. The cumulative impact of Project implementation will create nearly 900 acres of beach and dune, which will protect the adjacent wetlands, including the 140 acres of new marsh, from storm surge and breaching. A positive cumulative impact will also accrue to the ecological benefits, including pelagic and benthic estuarine productivity, wildlife habitat, Essential Fish Habitat, migratory bird habitat, and habitat for Threatened and Endangered Species into the future.

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1.0 INTRODUCTION

1.1 PROJECT AUTHORITY

The Coastal Protection and Restoration Authority (CPRA) serves as applicant for a Non-Competitive Negotiated Agreement with the Bureau of Ocean Energy Management (BOEM) for use of an Outer Continental Shelf (OCS) sand resource located in federally-managed waters. The CPRA is the designated State agency for the Caillou Lake Headlands Restoration Project (TE-100) (hereinafter referred to as the Project). This Project is one (1) of several that the State of Louisiana has proposed for the Natural Resources Damage Assessment (NRDA) process specifically to address the impacts of the Deepwater Horizon Oil Spill on the natural resources within the Project area. On April 20, 2010, an explosion on the Deepwater Horizon MC252 drilling platform occurred releasing an estimated 4.9 million barrels (bbl) of oil and adversely affecting large coastal areas of Louisiana including the Project area (Lubchenco, *et al*., 2010). BOEM noted that approximately 820,000 bbl of oil were directly recovered via the riser insertion tube tool and the Top hat. As a result, approximately 4.1 million bbl of oil were released into the Gulf of Mexico over a period of 87 days (BOEM, 2012). The Oil Pollution Act authorizes the Natural Resource Trustees (Trustees) to evaluate the impacts of the Deepwater Horizon oil spill on natural resources and develop restoration plans to offset these impacts. Co-Trustees for the Deepwater Horizon spill include:

- State of Louisiana,
- State of Mississippi,
- State of Alabama,
- State of Florida,
- State of Texas,
- U.S. Department of Agriculture, through the Natural Resources Conservation Service,
- U.S. Department of Commerce, through the National Oceanic and Atmospheric Administration (NOAA),
- U.S. Department of the Interior, through the U.S. Fish and Wildlife Service (USFWS), National Park Service, and Bureau of Land Management, ,
- U.S. Department of Defense, through the U.S. Army Corps of Engineers (USACE); and
- U.S. Environmental Protection Agency (EPA).

The Project includes restoring the barrier shoreline along the entire length of Whiskey Island through beach and dune fill placement utilizing an offshore sand source in Ship Shoal Block 88, and restoring the marsh platform along the western half of the Island using a nearshore mixed sediment borrow area. The CPRA intends for the design and construction of the Project to be contained entirely within the construction footprint of the Terrebonne Basin Barrier Shoreline Restoration (TBBSR) Integrated Feasibility Study and Environmental Impact Statement (USACE, 2010a) that was federally authorized under the Water Resources Development Act of 2007.

The Project's Consulting Team consists of Coastal Engineering Consultants, Inc. (CEC), Baton Rouge, Louisiana and Naples, Florida, and their subconsultants: Coastal Technology Corporation (CTC), Vero Beach and Sarasota, Florida; Elko Associates, Wadmalaw Island, South Carolina; EMC, Inc. (EMC), Grenada, Mississippi; GeoEngineers (GEO), Baton Rouge, Louisiana; Ocean Surveys, Inc. (OSI), Old Saybrook, Connecticut; and R. Christopher Goodwin & Associates (Goodwin), Frederick Maryland.

1.2 PROJECT PURPOSE AND SCOPE

Title VII of the Water Resources Development Act of 2007 (WRDA 2007) authorized the Louisiana Coastal Area (LCA) ecosystem restoration program (LCA Program). Included within that authority was the requirement for new restoration project construction. This authorization was recommended by the Chief of Engineer's Report, dated January 31, 2005. Under Section 7006 of WRDA 2007, the LCA Program has authority for feasibility level reports for six (6) near-term critical restoration features, including TBBSR. The CPRA and USACE co-sponsored TBBSR and completed the Integrated Feasibility Study and Environmental Impact Statement (USACE, 2010a) which received a favorable Chief's Report on December 30, 2010 (USACE, 2010). The TBBSR Feasibility Study was completed in compliance with the National Environmental Protection Act (NEPA).

The TBBSR project area is part of Louisiana's critically important coastal zone, a diverse complex of ecosystems that include highly productive wetlands and fresh- and estuarine waters and water bottoms that have high value as fish and wildlife habitat (Essential Fish Habitat, migratory bird habitat, *etc*.) as well as high commercial and recreational fishery value (finfish, crustaceans, shellfish, *etc*.). The barrier islands protect these interior environments from direct assault by tropical and extratropical storms, helping to maintain the estuarine conditions that make them so productive. In addition, the barrier islands protect a basin fringed by the public and private infrastructure associated with numerous communities that provide essential services to the offshore oil and gas industry and also filled with the private infrastructure associated with petroleum extraction and distribution. Protection and restoration of these barrier islands will prevent further degradation of these nationally important environmental and economic assets.

Protection of the barrier islands and headlands of the Terrebonne Basin parallels protection of the barrier islands and headlands of the adjacent Barataria Basin, another LCA goal.

TBBSR considered significant aspects within the Terrebonne Basin including the environmental, social, and economic effects; engineering feasibility; and comments received from CPRA, the public, and other resource agencies in producing the study. The NER Plan presented in the study was determined to be in the overall public interest, was determined to be a justified expenditure of Federal funds, and was recommended for implementation. The NER Plan, comprised of Raccoon Island with Terminal Groin - Plan E (minimum design plan with twenty-five (25) years of advanced fill) / Whiskey Island - Plan C (minimum design plan with five (5) years of advanced fill) / Trinity Island - Plan C / and Timbalier Island - Plan E, would restore the geomorphological and ecological form and function (GEFF) of these four (4) islands in the Terrebonne Basin barrier system (USACE, 2010).

Co-sponsored by the CPRA and USACE, this Project began as restoration of Whiskey Island Plan C, defined as the Recommended Component of Construction within the NER Plan (USACE, 2010), because it was an implementable increment of the NER Plan, met the LCA Program and project objectives, and was within the cost and scope of the WRDA authorization. The Project then transitioned to the "TE-100 Caillou Lake Headlands Restoration Project" on July 14, 2012 and is sponsored solely by the CPRA.

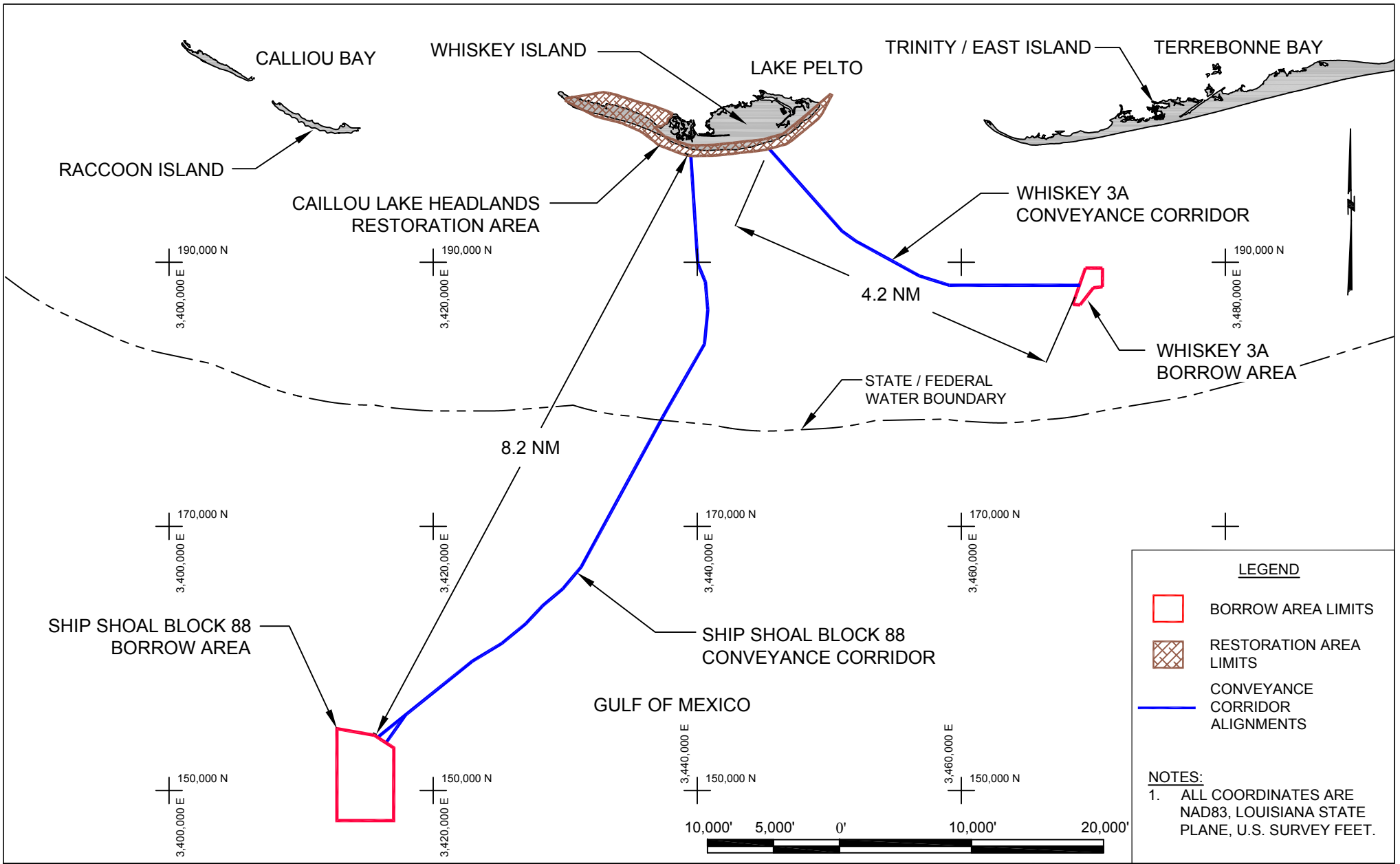
The overarching purpose of TBBSR was to address the goal of the 2004 LCA Plan (USACE, 2004a), specifically, to restore the GEFF of the barrier islands through simulation of historical conditions by enlarging the existing barrier islands, both in width and in dune crest elevation, and by reducing the number of breaches. The barrier islands are typically low lying and composed primarily of three (3) physical subaerial features: the beach, dune, and back-barrier marsh. They act as a buffer to reduce the full force and effects of wave action, saltwater intrusion, storm surge, and tidal currents on associated estuaries and wetlands. To restore their GEFF, and to provide this buffer, involves reinforcing the shoreline through beach and dune restoration. In addition, it includes providing a marsh platform to capture overwash sediments during episodic events; sediment that would otherwise be carried into back bay areas to form shoals or be lost into deeper waters. The marsh also serves as a roll over platform as the islands migrate landward. Restoration of ecologic form and function includes vegetating both the restored dunes and back-barrier marsh platforms with native plants, to provide wetland habitat for a diverse number of plant and animal species, and to help retain sediment. Barrier Islands protect the interior coastal wetlands, which also have high fish and wildlife value as well as significant economic value to commercial and recreational fisheries. The estuaries landward of the TBBSR are productive oyster habitat and have traditionally supported important fisheries. Restoration of the barrier islands will protect these national assets from further degradation.

1.3 PROJECT LOCATION

The Project area includes the Restoration Area on Whiskey Island; two (2) borrow areas located in the Gulf of Mexico, the sand source located approximately 8.2 nautical miles (NM) to the southwest of the Island on the OCS, and the mixed sediment source located approximately 4.2 NM to the southeast of the Island in state-owned waters; and two (2) conveyance corridors connecting the borrow areas to the Restoration Area (Figure 1-1). The length of the conveyance corridor to the sand source is approximately 8.9 NM and the length of the Conveyance Corridor to the mixed sediment source is approximately 4.5 NM. The corridors were aligned to avoid potential cultural resources and oil and gas infrastructure as well as minimize oil and gas pipeline crossings.

The Restoration Area is located within the Isles Dernieres Reach of the Terrebonne Basin barrier island chain. The Isles Dernieres Reach represents a barrier island arc approximately twenty-two (22) miles long in Terrebonne Parish and extends from Caillou Bay east to Cat Island Pass. Raccoon Island, Whiskey Island, Trinity Island, East Island, and Wine Island, the primary islands that comprise the Isles Dernieres barrier island reach, are backed by Caillou Bay, Bay Round, Lake Pelto, and Terrebonne Bay, and bordered by the Gulf of Mexico on the seaward side. The islands range from approximately 0.1 to 1.2 miles wide and are generally composed of a thin sand cap over a thick mud platform. Elevations are generally low and the islands are frequently overwashed (USACE, 2004b). The Isles Dernieres have been and continue to be an important commercial and recreational resource for Louisiana and the nation for more than 150 years. The islands support habitats that are critical to the State's commercial fishing industry, as well as important feeding and resting stopovers for neotropical migratory birds. Furthermore, the mineral-rich subsurface below the Terrebonne Basin has supported a high concentration of oil and gas wells. The first major coastal resort in Louisiana was located here and was washed away by the great hurricane of 1856 (USACE, 2004b).

Whiskey Island is centrally located in the Isle Dernieres chain and it represents a remnant of the single, large Isle Derniere (Last Island), which was segmented into multiple smaller islands by a major hurricane in 1856. The storm breached the Island in several places. That breaching coupled with subsequent erosion events and increasing tidal prism due to interior wetland loss during the remainder of the 19th Century and throughout the 20th, led to the gradual evolution of the tidal inlets that presently separate Raccoon, Whiskey, and Trinity Islands. The easternmost remnant of Isle Derniere was Wine Island, which disappeared by the middle of the 20th Century. Wine Island persists as a sand shoal between Wine Island and Cat Island Passes. Hurricane Carmen (1974) created New Cut, separating East Island from Trinity Island. New Cut eventually healed in 2007, aided by CWPPRA project TE-37.



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NRDA CAILLOU LAKE HEADLANDS RESTORATION PROJECT (TE-100)

PROJECT OVERVIEW MAP

FIGURE 1-1

1.4 PROJECT HISTORY

The Isles Dernieres are the location of seven (7) constructed Coastal Wetland Planning, Protection, and Restoration Act (CWPPRA) restoration projects. These projects include TE-29 (Raccoon Island Breakwaters Demonstration project); TE-48 (Raccoon Island Shoreline Protection and Marsh Creation project); TE-27 (Whiskey Island Restoration project); TE-50 (Whiskey Island Back Barrier Marsh Creation project); TE-24 (Isle Dernieres Restoration Trinity Island project); TE-20 (Isle Dernieres Restoration East Island); and TE-37 (New Cut Dune and Marsh Restoration project). In addition to the CWPPRA restoration projects, a restoration project on East Island was built by Terrebonne Parish Consolidated Government (TPCG) in 1985. A FEMA-funded restoration project to ameliorate the impacts of Hurricane Andrew on Raccoon Island was administered by the Louisiana Department of Wildlife and Fisheries (LDWF) in 1995. A separate FEMA funded restoration project to ameliorate the impacts of Hurricane Andrew on East Island adjacent to the previously constructed TPCG project was built on East Island in 1996 by Louisiana Department of Natural Resources (LDNR).

The first completed CWPPRA project, TE-29, was proposed as a demonstration for installation of a series of segmented, shore-parallel breakwaters at Raccoon Island extending from the east end, at Coupe Colin, to the west (Armbruster, 1999). The initial phase of the project was proposed to be seven (7) 300-foot long stone breakwaters, spaced 300 feet (ft) apart, constructed in four (4) to six (6) ft of water, parallel to the shoreline and approximately 300 ft from it. The number was increased by one (1), so at project completion in 1997, it consisted of eight (8) breakwaters. The sediment volume behind the western six (6) of the eight (8) breakwaters increased rapidly, but the volume behind the eastern two (2) diminished, apparently due to tidal current erosion. In response to those two (2) opposite results, construction of eight (8) additional breakwaters was proposed to the west, and a groin was designed to connect the easternmost breakwater to the shoreline to block the tidal current. This shoreline protection project was coupled with marsh creation as project TE-48, which was subsequently divided into two (2) phases: breakwaters and groin, and marsh creation. The former was completed in 2007 and the latter began construction in late 2012.

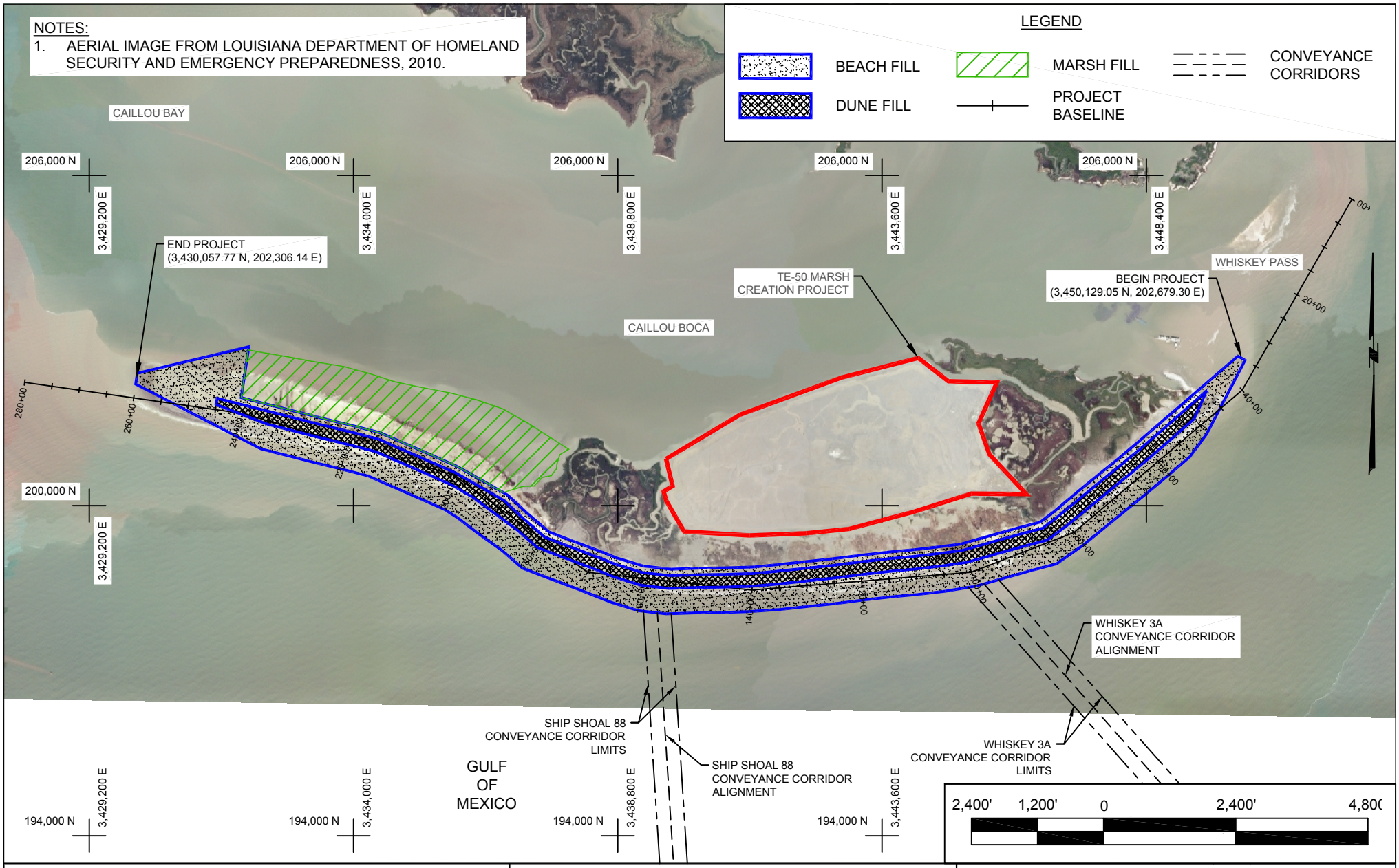
The Trinity (TE-24) and East (TE-20) Islands and New Cut (TE-37) projects served a common goal, to restore what had formerly been a one-island reach of the Isles Dernieres. Three (3) hurricanes breached Trinity Island between 1974 and 1992, creating New Cut between it and East Island. TE-20 and TE-24 were completed in 1999, with restoration of beach and dune and creation of bay-side marsh habitat (Rodrigue *et al.*, 2008a and 2008b). As described above, the breach that had been New Cut naturally closed in 2007, facilitated by construction that joined the beaches and dunes of the two (2) islands (T. Baker Smith, 2007).

West and Dearmond (2004) described the Gulf-side intertidal area of Whiskey Island as being an erosion-exposed marsh peat platform overlain by sand and shell hash above the high tide elevation. The central part of the Island, between the mangrove marshes, was a large sparsely-vegetated washover area. The mangrove marsh areas were vegetated with smooth cordgrass (*Spartina alterniflora*), black mangrove (*Avicennia germinans*), and several salt-tolerant succulents. The marsh vegetation traps overwashed sediment and continues to grow, but eventually the overwash buries the intertidal vegetation, ultimately resulting in replacement of marsh by beach/dune vegetation. The TE-27 project was a companion to the above-referenced TE-20 and 24 projects, all with the goal of restoration of the Isles Dernieres by constructing beach, dune, and marsh features using sediment dredged from passes and the bays to the north of the islands. The project placed almost 3 million cubic yards (MCY) of sediment on the Whiskey Island beach between the mangrove marsh areas and in front of the eastern marsh area in 1998, restoring more than 600 acres of marsh, closing a breach, and bolstering the dune. In 1999 these areas were planted with a palette of beach-stabilizing and marsh plants, including cordgrasses, and black mangrove.

A second project, Ship Shoal Whiskey West Flank (TE-47) was proposed for the western section of the Whiskey Island shoreline. It differed from its predecessors in proposing to import sediment from outside of the Isles Dernieres area, where adequate supplies of beach-compatible sediment were becoming difficult to locate. The restoration was designed and Ship Shoal was investigated and found to contain a large volume of compatible sand (C&C Technologies, 2003). TE-47 remains an authorized project; however it was never carried forward to construction.

Much of the restored sediment and vegetation was eroded by hurricanes and other storms, but the Island's GEFF remained to provide a foundation for the third project, TE-50, Whiskey Island Back-Barrier Marsh Creation. The project created approximately 300 acres of intertidal marsh and protective dune (completed in 2010) along the central and eastern reaches of the Island in the former overwash area between the two (2) mangrove marsh areas (T. Baker Smith and Moffatt & Nichol, 2007a).

The present subaerial Island is approximately 3.6 miles long and approximately 0.7 miles at its widest (Figure 1-2). Whiskey Island retains approximately 230 acres of mangrove wetlands in two (2) locations, at its east end and in its middle. Unlike other islands in the Isles Dernieres chain, Whiskey Island does not migrate landward, but instead thins in place as the Gulf-facing shoreline retreats northward. Examination of shoreline change and bathymetry maps from the mid-19th century to the early 21st century show this thinning and little migration northward of the island's bayside shoreline. It is surmised that overwashed sediments cannot accumulate behind the Island to retain its GEFF; rather, the sediments fall into the Caillou Boca channel and are lost from the active system. The same maps show little change in Caillou Boca's location or dimensions confirming this assumption (Martinez, *et al*. 2009; Miner, *et al*., 2009).



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NRDA CAILLOU LAKE HEADLANDS RESTORATION PROJECT (TE-100)

ISLAND OVERVIEW MAP

FIGURE 1-2

1.5 PLANNING PROCESS

1.5.1 Goal and Planning Objectives

The 2004 Louisiana Coastal Area (LCA) Plan was developed to address the ongoing problem of wetland loss in the Louisiana Coastal Zone (USACE, 2004a). TBBSR addressed the LCA Plan GEFF goal for the Terrebonne Basin through enlarging the existing islands and closing breaches (USACE, 2010a). Contained within that goal is improvement of the various habitats that are provided by the islands and increasing the sediment supply for coastal processes that improve the natural resiliency and longevity of the islands.

The primary purpose of TBBSR (USACE, 2010a) was to evaluate alternatives for restoration of the barrier system through barrier island restoration to address this severe erosion and land loss and to ensure the continuing geomorphic and hydrologic form and function of the islands. The following planning objectives were developed to assist the development, screening, and evaluation of alternative restoration plans to achieve this purpose:

- Provide an expanded footprint of minimized barrier island section to provide GEFF for the Terrebonne Basin barrier islands, reducing volume loss within the TBBSR study area below the historic average (1880 through 2005).
- Restore and improve various barrier island habitats that provide essential habitats for fish, migratory birds, and other terrestrial and aquatic species, mimicking, as closely as possible, conditions which would occur naturally in the area for the 50 year period of analysis.
- Increase sediment input to supplement longshore sediment transport processes along the gulf shoreline by mechanically introducing compatible sediment, and increasing the ability of the restored area to continue to function and provide habitat for the 50 year period of analysis with minimum continuing intervention.

1.5.2 Problems and Opportunities

The problems identified by TBBSR specific to Whiskey Island included the following:

- Land loss due to erosion threatens the geomorphic and hydrologic barrier systems.
- Longshore sediments are significantly reduced, limiting the ecosystem's ability to be self-sustaining.
- Loss of barrier island/headland ecosystem habitat.

The opportunities identified by TBBSR specific to Whiskey Island included the following:

- Restoration of Whiskey Island to achieve a more sustainable geomorphology will increase the longevity of its functioning as a barrier.

- Restoration of Whiskey Island's beach, dune, and back-barrier marsh will improve its value and diversity as habitat.
- Restoration of Whiskey Island using sand from Ship Shoal will increase the volume of sediment available to the longshore transport process.

1.5.3 Formulation of Alternative Plans

The TBBSR Project Development Team (PDT) undertook a tiered or phased process to develop the alternative plans and combinations of plans in accordance with the criteria of completeness, effectiveness, efficiency, and acceptability specified in the USACE 2000 Planning Guidance Notebook, Engineering Regulation ER 1105-2-100 (USACE, 2000).

Management measures, derived from the public scoping process, previous restoration projects, prior studies, and the collective experience of the Project Development Team (PDT), were identified for initial evaluation. Numerous measures were eliminated during the initial screening process based upon inconsistencies with specific USACE policies for ecosystem restoration, as well as Federal laws, regulations, and Executive Orders. The second level screening effort built on the initial screening process, with an emphasis on the combinations of measures that could be used to meet the specific objectives of the TBBSR study. As a result of the second level of screening, it was determined that a combination of beach, dune, and marsh restoration measures would be needed to achieve the primary objective of restoring GEFF. This screening process resulted in the elimination of additional measures. The beach, dune, and marsh components, as well as the measures that could provide supplemental benefits were carried forward. The final screening effort, which built upon the second level screening process, evaluated the supplemental measures, such as sand fencing, vegetation planting, breakwaters, and groins. Such measures would, in specific situations, complement the beach, dune, and marsh measures by contributing to their sustainability and overall success.

To continue the process, the PDT developed five (5) levels of alternatives ranging from "No-Action" to "Minimum Restoration Template" to "Minimum Restoration Template plus twenty-five (25) years of advanced fill," with various plan scalars in-between for individual islands and combinations of islands. The resultant alternatives were subjected to a benefit to cost analysis which led to defining the NER Plan and the Recommended Component of Construction. The plan formulation process is described in detail in the TBBSR study (USACE, 2010). The alternatives analysis is summarized in Section 2.2 herein.

1.5.4 Regulatory Issues

The nature of the Project, involving excavating (dredging) sediment from waters of the United States and the State of Louisiana, and discharge (fill placement) of that dredged material in waters of the United States and the State of Louisiana, triggers the requirements to comply with

two (2) Federal regulations administered by the USACE. Section 10 of the Rivers and Harbors Act of 1899 requires USACE permission to excavate or place fill in navigable waters. Section 404 of the Clean Water Act regulates discharge of dredged material into waters and wetlands and it too requires a permit for such activities. The basis for the former regulation is protection of navigation and the basis for the latter is protection of the environment. Both regulations require the Project to be advertised to the public, with a period for public comment, and review and consideration of the comments. In addition, the NEPA sets certain standards for public input and review. The NEPA requirements were satisfactorily met during TBBSR formulation (USACE, 2010). Additional NEPA compliance will be carried out by BOEM. Chapter 6 has detailed information herein regarding permits and commitments for the Project.

2.0 ALTERNATIVES ANALYSIS

2.1 PROPOSED ACTIONS

The design premise for the Project is to implement the TBBSR ecosystem restoration template for the Restoration Area and conceptual designs for the Borrow Areas (USACE, 2010a) and be consistent with the CPRA authority which defines the Project. The proposed actions for these Project components as well as the conveyance corridors for the transport of sediment between the borrow areas and the Island are summarized in the following sections. Detailed descriptions of the Project components are presented in the Final Design Report (CEC, 2013).

2.1.1 Restoration Area

The beach and dune fill template extends the length of the Island (Station 30+00 to Station 265+00) and involves placement of approximately 8.9 MCY of sand to create both beach and dune along approximately 22,500 ft of shoreline as measured along the design alignment. The fill template tapers at each end to minimize end losses resulting from abrupt changes in shoreline alignment. The east end taper is 2,500 ft long and the west end taper is 3,000 ft long. The dune will be constructed at a target elevation of +6.4 ft NAVD88, with fore- and back-slopes of 1V:30H and a typical width of 232 ft at the base and 100 ft at the crest. The target elevation of the beach will be +4.2 ft NAVD88, with a slope of 1V:60H from the berm extending seaward to the intersection with the existing grade, and a typical width of 464 ft. A vertical tolerance of plus one (1) foot is proposed to account for construction as well as consolidation and settlement of the fill for the beach berm and dune. Assuming a 30% cut to fill ratio, the recommended volume requirements for the sand source were set equal to 11.6 MCY. Construction of the fill template will create approximately 500 acres of beach and dune habitat.

The marsh component extends from Stations 185+00 to 240+00, north of the beach and dune, and involves placement of approximately 0.8 MCY of mixed sediments to create the marsh platform along approximately 5,830 ft of shoreline. The marsh platform target elevation is +2.4 ft NAVD88 with a minimum width of 1,000 ft. A vertical tolerance of plus one (1) foot is proposed for the difference in relative sea-level rise (SLR), consolidation and settlement of the marsh platform, and construction methods. This tolerance is based on the geotechnical surveys and analyses performed for the Project design (GEO, 2012). Assuming a 60% cut to fill ratio, the recommended volume requirements for the mixed sediments source were set equal to 1.3 MCY. Construction of the fill template will create approximately 170 acres of marsh habitat.

A beach separation dike constructed of *in situ* sediment will be located along the north side of the beach fill template to prevent fill material from flowing into the marsh fill area. The beach separation dike dimensions include 1V:8H side slopes, crest width of ten (10) ft, and crest elevation of +6.0 ft NAVD88. The width of the dike base will depend on the elevation of the

existing grade. East, north, and west containment dikes will be constructed to contain the marsh fill material. Should Ship Shoal sand be used for the marsh fill, the beach separation dike will not be required adjacent to the proposed marsh fill. The marsh containment dike dimensions include 1V:8H side slopes, crest width of 10.0 ft, and crest elevation of +4.4 ft NAVD88. The width of the dike base will depend on the elevation of the existing grade. A plus one (1) foot vertical tolerance is recommended to account for the difference in relative SLR, consolidation and settlement, and construction methods.

Primary (interior) and secondary (exterior) borrow channels are proposed as the sources of *in situ* sediment for dike construction. They are optional and one (1) or both may be selected depending upon the contractor's choice of construction equipment and methods. They are approximately 1,200 ft long with a maximum bottom width of 150 ft at a depth of -9.0 ft NAVD88. Their purpose is to provide channels for the bucket dredge to use when constructing the marsh fill containment dike and for maintenance access to the length of the back dike during and after marsh construction. Further, they will provide access to the Island for construction inspection and future monitoring purposes.

The dune platform will have approximately 24,800 linear ft of sand fencing installed. The single row of sand fence will promote deposition of windblown sand and conserve sand placed within the fill template. The sand fencing will be constructed of wooden slats, appropriately spaced laterally, and secured with fence wire to wooden posts to form a porous barrier constructed four (4) feet in height above the dune platform.

Vegetative planting of the dune and marsh is a vital component of barrier island habitat restoration. The Project includes vegetation of the entire length of the dune and marsh platform at a planting density and composition similar to recent barrier island restoration projects in Louisiana.

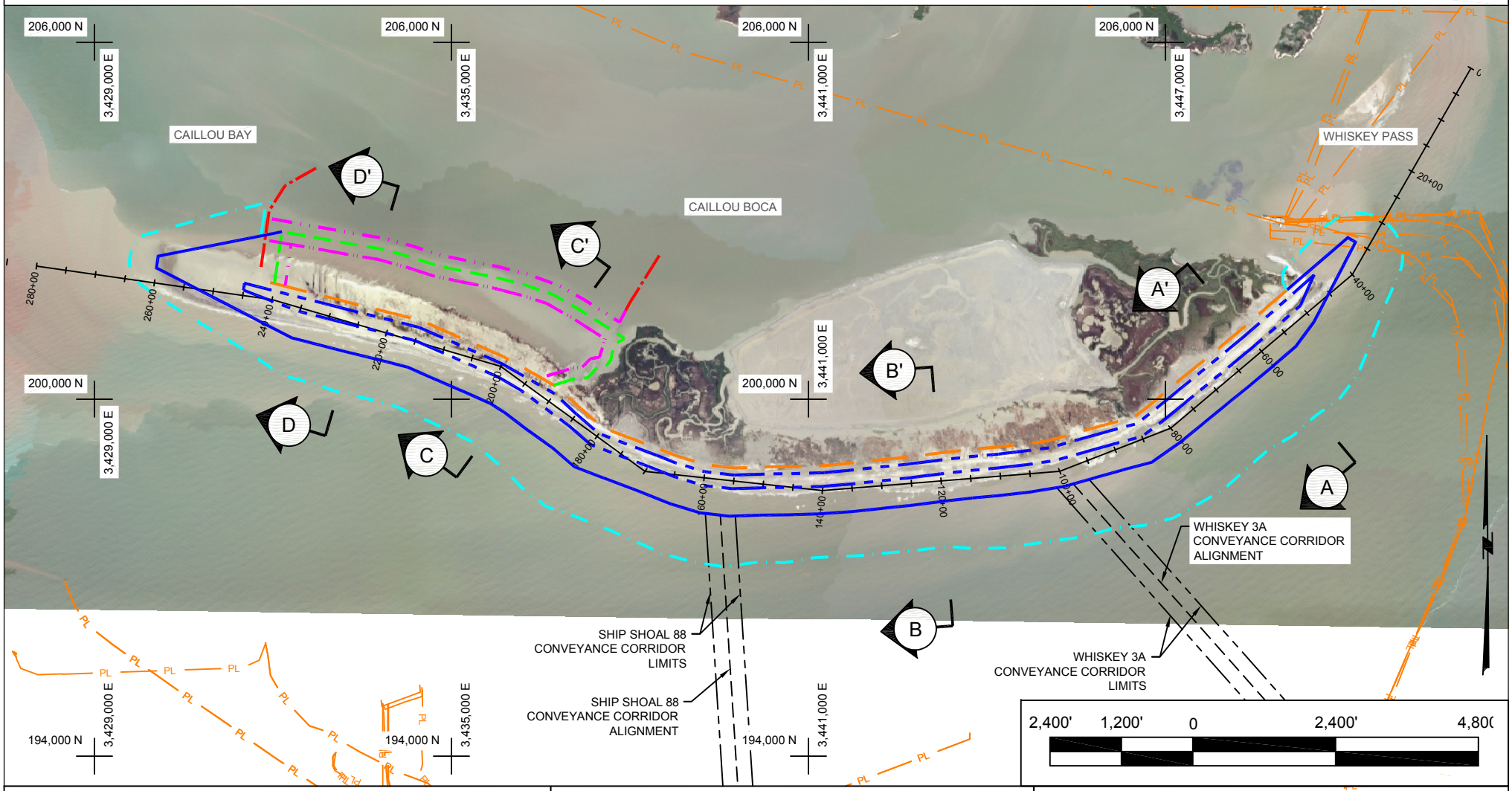
The dune platform will be planted over 100 percent of the area immediately following construction. The vegetative plantings would include a mixture of some or all of the following herbaceous species: Bitter Panicum (*Panicum amarum* var. *amarum* 'Fourchon'), Seashore Paspalum (*Paspalum vaginatum* 'Brazoria'), Seacoast Bluestem (*Schizachyrium maritimum* 'Timbalier'), Seashore Dropseed (*Sporobolus virginicus*), Sea Oats (*Uniola paniculata* 'Caminada'), Marshhay Cordgrass (*Spartina patens* 'Gulf Coast'), and Gulf Cordgrass (*Spartina spartinae*). Woody species would be planted landward of the restored dune and supratidal back berm area, at a planting density of fifteen (15) percent to mimic the sparsely vegetated native vegetative assembly that typically occurs in this area. Woody species for the dune and supratidal areas would primarily be Matrimony Vine (*Lycium barbarum*).

After construction and consolidation, the newly created marsh platform will be planted with Smooth Cordgrass (*Spartina alterniflora* var 'Vermilion') and other appropriate species.

The Restoration Area design components are presented in plan views (Figures 2-1 and 2-2) and cross section views (Figures 2-3 and 2-4). Note the design premise of TBBSR is to restore the Island's GEFF, thus at the time of construction, the design template shall be adjusted to match the Island migration patterns between the time of the design survey and actual fill placement.

NOTES:
1. AERIAL IMAGE FROM LOUISIANA DEPARTMENT OF HOMELAND SECURITY AND EMERGENCY PREPAREDNESS, 2010.

LEGEND
- BEACH CREST ALIGNMENT
- BEACH TOE ALIGNMENT
- DUNE TOE ALIGNMENT
- PROJECT BASELINE
- MARSH FILL CONTAINMENT DIKE ALIGNMENT
- INTERIOR / EXTERIOR CONTAINMENT DIKE BORROW CHANNEL ALIGNMENT
- BEACH FILL CONTAINMENT DIKE ALIGNMENT
- CONVEYANCE CORRIDORS
- ACCESS CHANNEL ALIGNMENT
- PL — POTENTIAL PIPELINES (LDNR, 2010)



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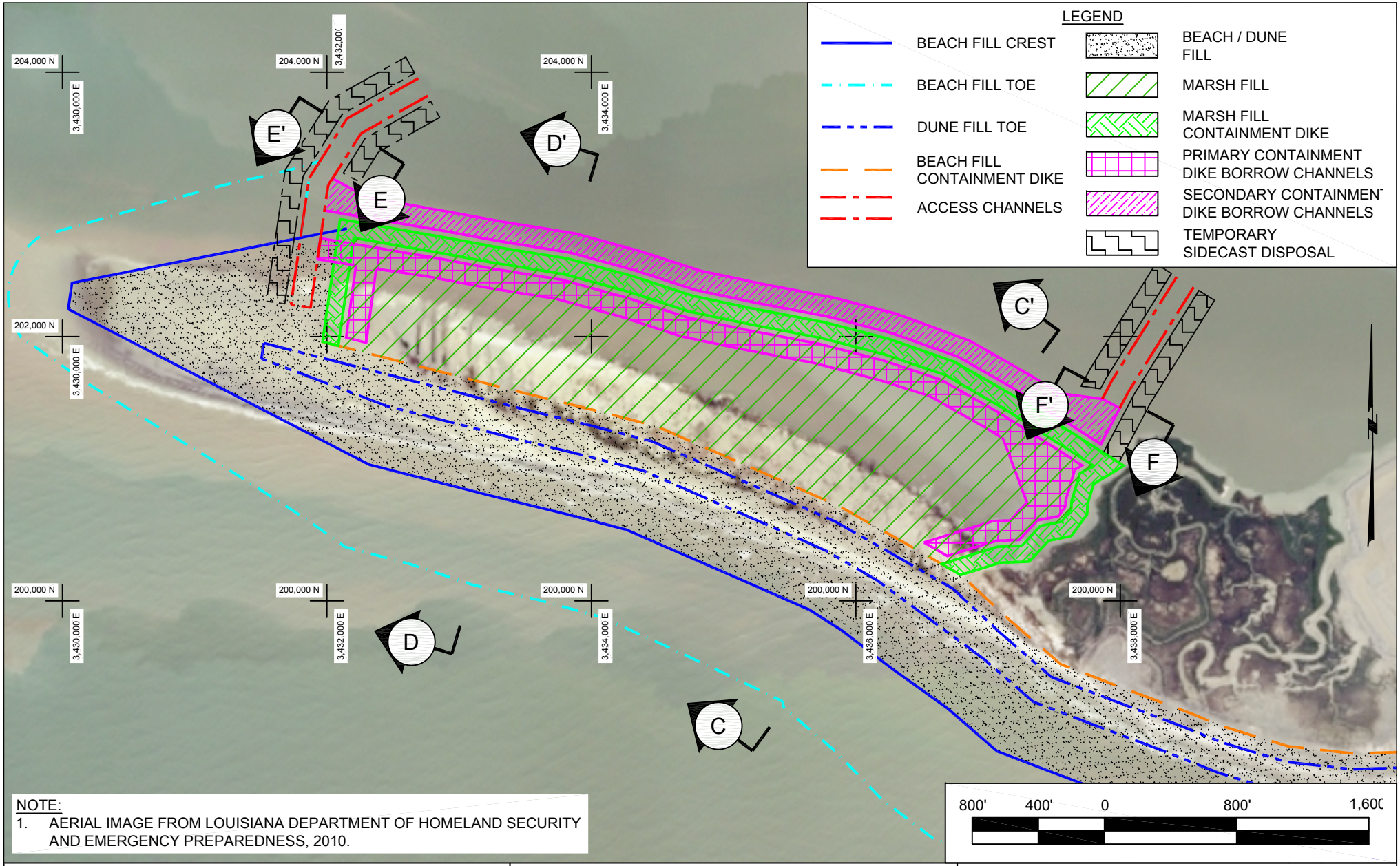
RESTORATION AREA PLAN VIEW

FIGURE 2-1



NOTE:
1. AERIAL IMAGE FROM LOUISIANA DEPARTMENT OF HOMELAND SECURITY AND EMERGENCY PREPAREDNESS, 2010.

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RESTORATION AREA PLAN VIEW INSET

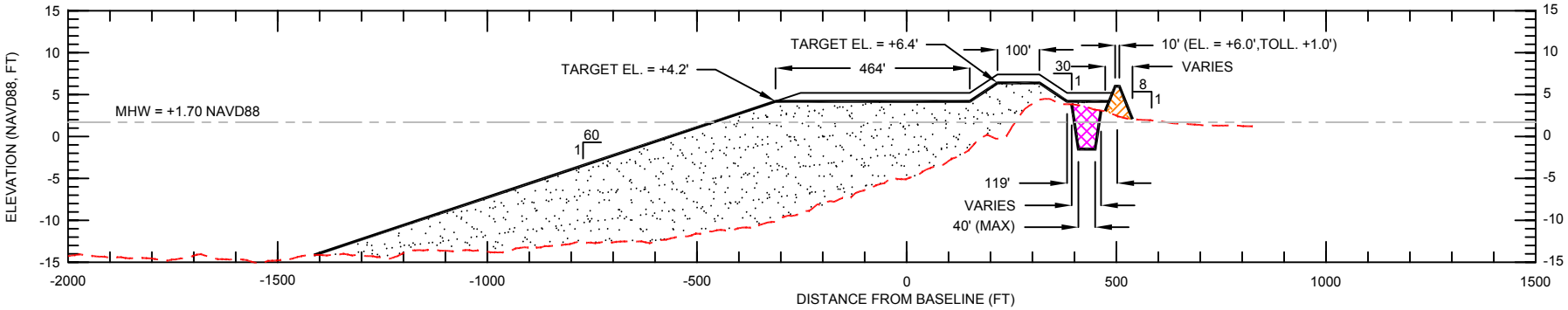
FIGURE 2-2

LEGEND:

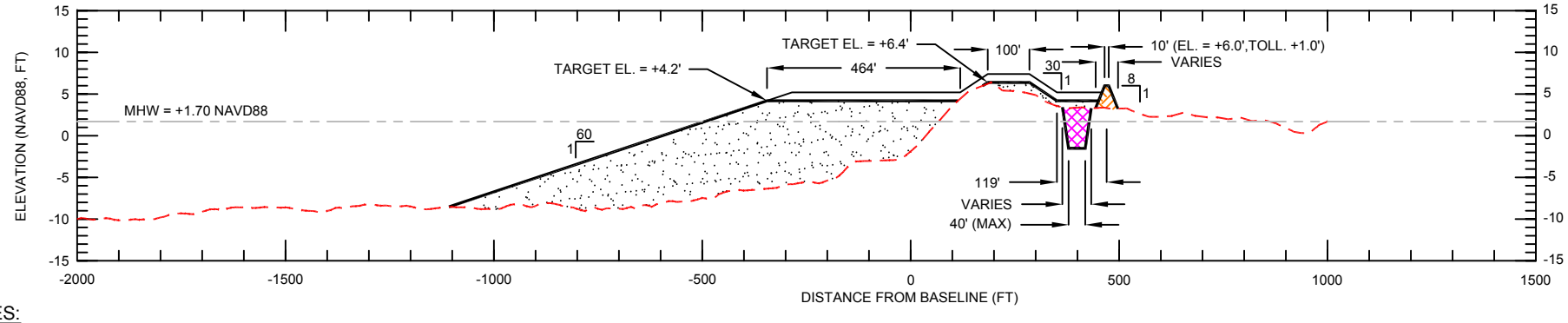
- BEACH / DUNE FILL
- EXISTING GRADE (2012)
- DESIGN
- BEACH FILL CONTAINMENT DIKE
- CONTAINMENT DIKE BORROW
- CONSTRUCTION TOLERANCE (SEE NOTE 3)

SCALE:
H: 1" = 400'
V: 1" = 20'

A - A'



B - B'



NOTES:
1. SECTIONS ARE VIEWED AS LOOKING WEST.
2. SURVEY PERFORMED BY EMC, INC. 2012.
3. A ONE FOOT TOLERANCE IS INCLUDED TO ACCOUNT FOR CONSTRUCTION METHODS AND CONSOLIDATION/SETTLEMENT OF THE FILL.
4. MEAN HIGH WATER (MHW) = +1.70' NAVD88, MEAN LOW WATER (MLW) = +0.66' NAVD88.

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NRDA CAILLOU LAKE HEADLANDS RESTORATION PROJECT (TE-100)

RESTORATION AREA TYPICAL SECTIONS

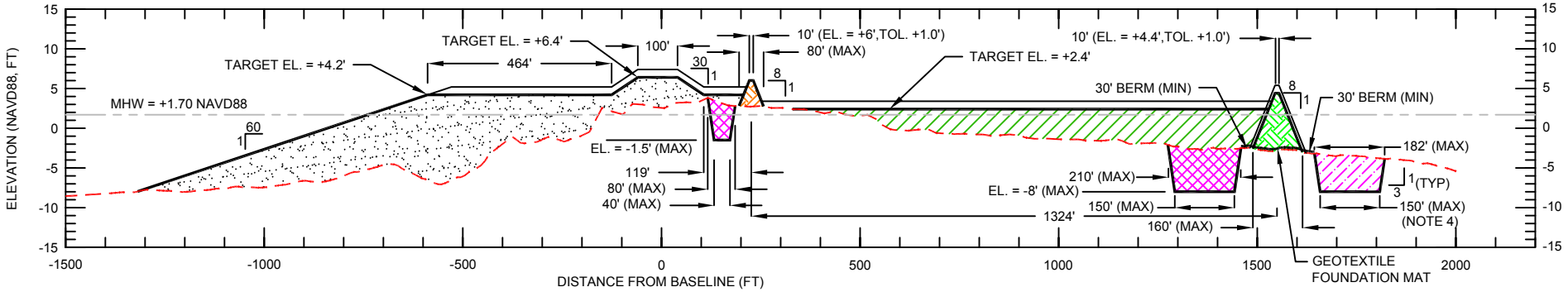
FIGURE 2-3

LEGEND:

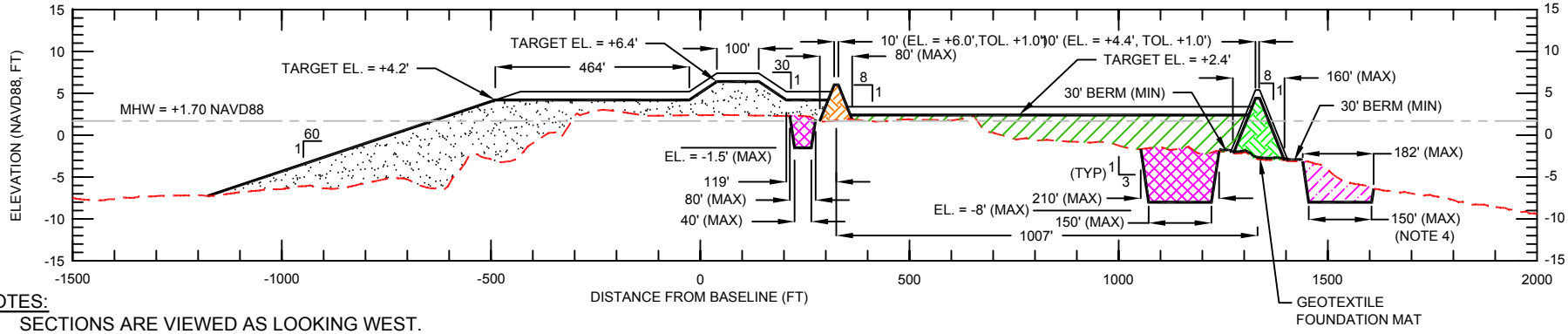
- BEACH / DUNE FILL
- MARSH FILL
- EXISTING GRADE (2012)
- DESIGN
- BEACH SEPARATION DIKE
- MARSH CONTAINMENT DIKE
- CONSTRUCTION TOLERANCE (SEE NOTE 3)
- PRIMARY CONTAINMENT DIKE BORROW CHANNELS
- SECONDARY CONTAINMENT DIKE BORROW CHANNELS

SCALE:
H: 1" = 400'
V: 1" = 20'

C - C'



D - D'



NOTES:

1. SECTIONS ARE VIEWED AS LOOKING WEST.
2. SURVEY PERFORMED BY EMC, INC. 2012.
3. A ONE FOOT TOLERANCE IS INCLUDED TO ACCOUNT FOR CONSTRUCTION METHODS AND CONSOLIDATION/SETTLEMENT OF THE FILL.
4. EXTERIOR CONTAINMENT DIKE BORROW CHANNEL MAXIMUM BOTTOM OF CUT WIDTH IS 150' EXCEPT AT INTERSECTION TO ACCESS CHANNELS.
5. MEAN HIGH WATER (MHW) = +1.70' NAVD88, MEAN LOW WATER (MLW) = +0.66' NAVD88.

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NRDA CAILLOU LAKE HEADLANDS RESTORATION PROJECT (TE-100)

RESTORATION AREA TYPICAL SECTIONS

FIGURE 2-4

2.1.2 Borrow Areas

2.1.2.1 Sand Source

The designated borrow area for the beach and dune fill is located in federally-owned waters on the OCS over 8.2 NM southwest of Whiskey Island and is denoted as the Ship Shoal Block 88 Borrow Area. Based upon extensive geophysical and archaeological studies of the Ship Shoal sand body, potential oil and gas infrastructure conflicts were identified and buffers established. The northeast end of the Block 88 sand body was selected for the Project due to its location being closest to the Restoration Area, thereby reducing both sand transport distance and construction costs.

Seafloor elevations within the study area range from less than -16 ft to deeper than -37 ft NAVD88. Both the depth surface generated from the bathymetric data and the sidescan sonar mosaic show a relatively featureless bottom, with no large scale bedforms present within the study area. Major sandy sedimentary strata are discernible and identified on the seismic profile data. The seismic profiles complimented by sidescan sonar data, vibracore data, magnetometer data, cultural resource targets, and navigation considerations were utilized to define the boundaries. The criteria used to select the borrow area included minimizing impacts to future projects within Block 88, minimizing impacts to existing infrastructure and cultural resources, and utilizing suitable resources in the most economical manner.

The cultural resource avoidance areas were respected during consideration for the alternative potential borrow areas. The closest avoidance area is over 1,500 ft from the borrow area. The magnetometer data identified few anomalies within the Block 88 study area, none of which were considered to be of cultural significance. The borrow area limits are over 3,000 ft from the closest known oil and gas infrastructure.

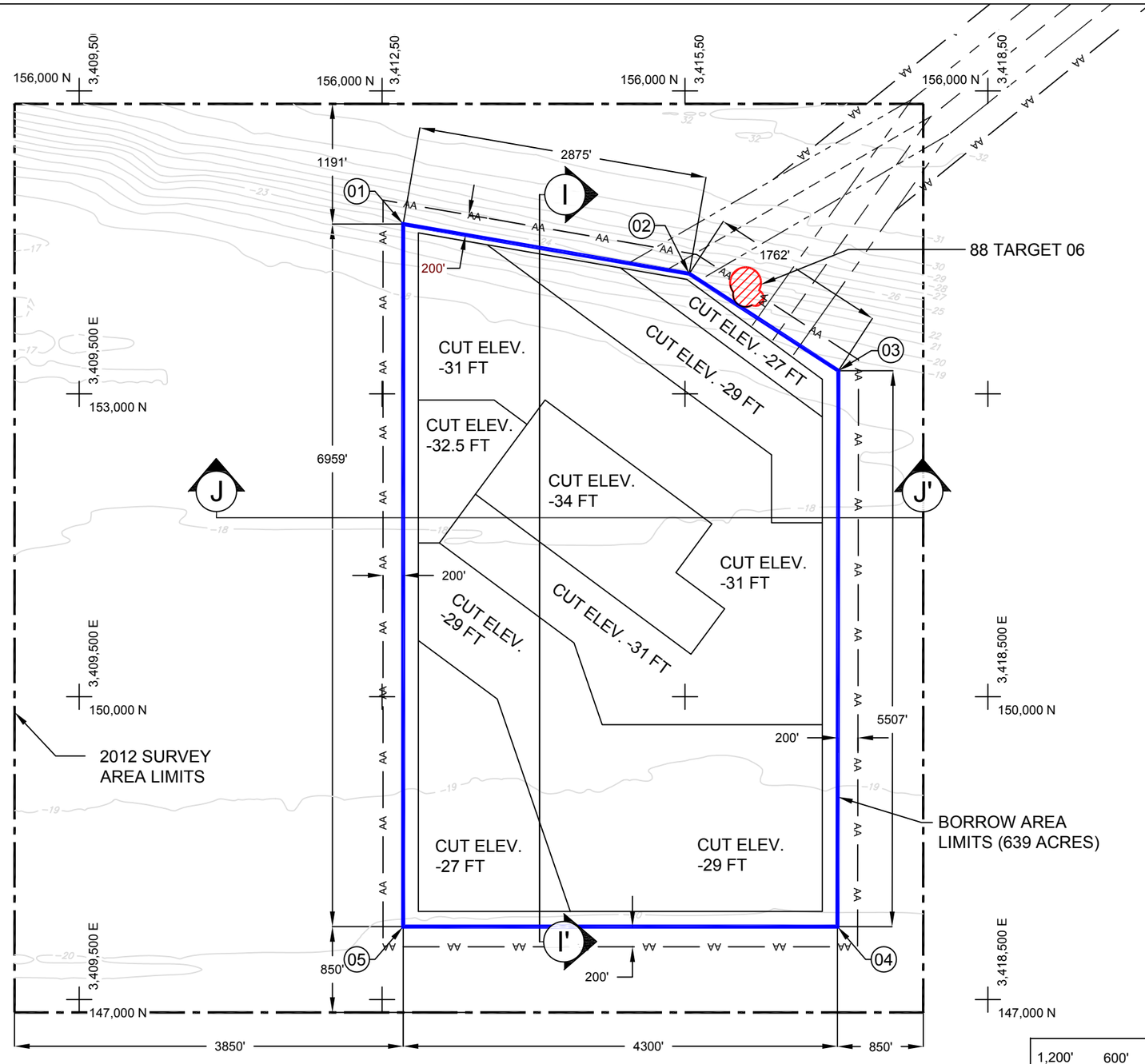
The Ship Shoal Block 88 Borrow Area is trapezoidal in form. The shape, length, width, and depth of the dredge cut were designed within the TBBSR limits. The dimensions of the borrow area vary significantly with an average length over 6,590 ft and average width over 4,300 ft. The surface area is approximately 650 acres. The sand thickness is up to eighteen (18) ft. The design depth ranges from -27 ft NAVD88 to -34 ft NAVD88 with a 2.0 ft allowable overdredge ranging from -29 ft NAVD88 to -36 ft NAVD88. The design volume is estimated to be over 12 MCY, exceeding the defined volume requirements. The vibracores indicate beach quality sediment classified as very fine sand in the Wentworth scale and fine sand in ASTM soil size ranges, and composed of over 96% sand.

Representative sediment samples collected from the native beach, dune and nearshore environments of Whiskey Island have a composite sample mean grain size of 0.18 mm.

Vibracore samples from the Borrow Area have a composite sample mean grain size of 0.19 mm. The composite curves have a high degree of similarity with the borrow area composite in close comparison to the coarsest beach sediment distribution. It is concluded that the sediments from the Ship Shoal Block 88 Borrow Area are suitable for beach and dune restoration.

The Ship Shoal Block 88 Borrow Area design plan and typical cross sections are shown in Figures 2-5 and 2-6, respectively.

BORROW AREA COORDINATES		
POINT	EASTING	NORTHING
1	3412709.2	154681.5
2	3415542.1	154189.9
3	3417018.8	153228.9
4	3417009.7	147722.3
5	3412709.2	147722.3



LEGEND

- BORROW AREA LIMITS
- CUT ELEVATION LIMITS
- BATHYMETRIC CONTOUR (OSI, 2012)
- 2012 SURVEY AREA LIMITS
- PIPELINE (LDNR, 2008)
- ANCHORAGE AREA
- AVOIDANCE AREA - NO ANCHORING OR DREDGING (C&C, 2003)
- SHIP SHOAL BLOCK 88 CONVEYANCE CORRIDOR
- CONVEYANCE CORRIDOR ALTERNATE SPUR

NOTES:

1. ALL COORDINATES ARE IN NAD83,
2. STATE PLANE - LOUISIANA SOUTH, US SURVEY FEET.
3. ALL UNITS ARE IN U.S. SURVEY FEET.
4. DEPTHS ARE SHOWN IN NAVD88, FEET.
5. ANCHORAGE IS NOT ALLOWED WITHIN THE AVOIDANCE AREA.

1,200' 600' 0 1,200' 2,400'

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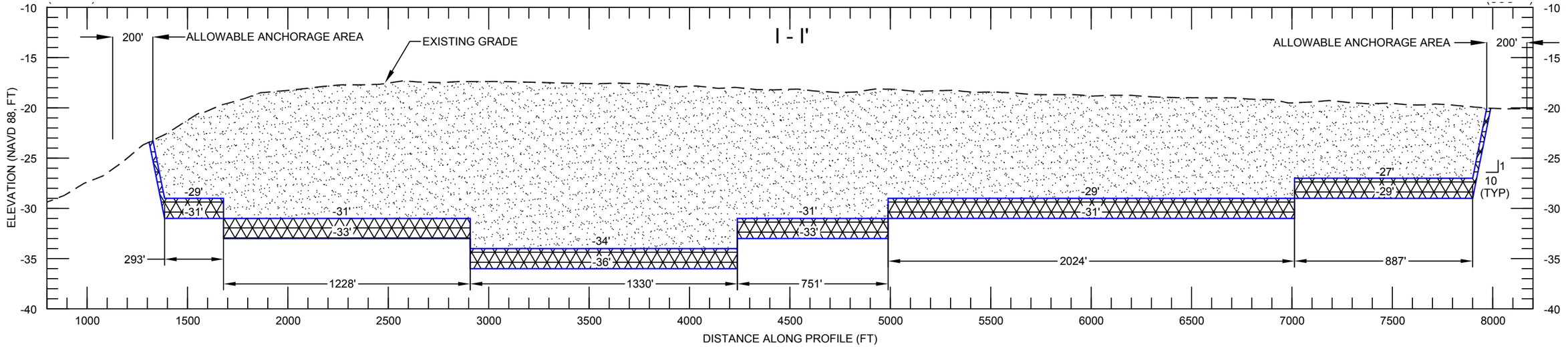
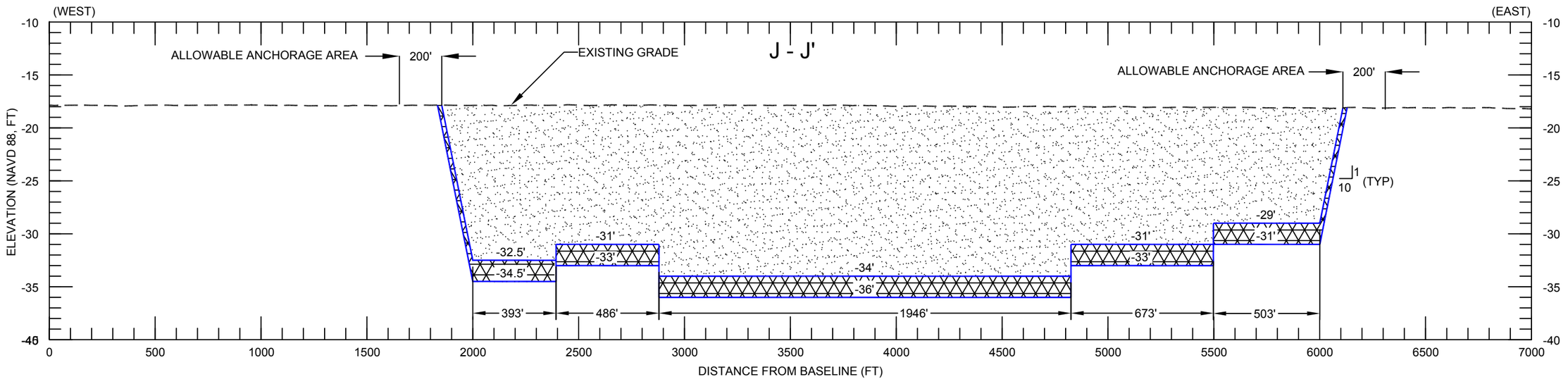
SHIP SHOAL BLOCK 88 BORROW AREA DESIGN PLAN VIEW

FIGURE 2-5





LEGEND:

- DESIGN CUT
- OVERDREDGE TOLERANCE
- EXISTING GRADE (2012)

SCALE:
H: 1" = 1000'
V: 1" = 20'

NOTES:
1. BATHYMETRIC SURVEY OSI (2012).
2. ELEVATIONS ARE SHOWN IN NAVD88, FEET

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SHIP SHOAL BLOCK 88 BORROW AREA
DESIGN CROSS SECTIONS

FIGURE 2-6

2.1.2.2 Mixed Sediment Source

The designated borrow area for the marsh fill is located in state-owned waters over 4.2 NM southeast of Whiskey Island and is denoted as the Whiskey 3A Borrow Area. Based upon extensive geophysical and archaeological studies, potential oil and gas infrastructure conflicts were identified and buffers established, and the sediment source was subdivided into three (3) areas denoted by 3A, 3B, and 3C. Whiskey 3A was selected for the Project due to its location, available volume, and sediment quality.

Within the study area seafloor elevations range from less than -15 ft to deeper than -23 ft NAVD88. Both the depth surface generated from the bathymetric data and the sidescan sonar mosaic show a relatively featureless bottom, with no bedforms present within the study area. Sedimentary strata are discernible and identified on the seismic profile data. The isopach data derived from the geophysical measurements displayed marsh compatible sediments up to twenty (20) ft in thickness. The seismic profiles complimented by sidescan sonar data, vibracore data, magnetometer data, cultural resource targets, and navigation considerations were utilized to define the boundaries. The criteria used to select the borrow area included maximizing sediment availability for future projects utilizing Whiskey 3A, minimizing impacts to existing infrastructure and cultural resources, and utilizing suitable resources in the most economical manner.

The cultural resource avoidance areas were respected during consideration for the alternative potential borrow areas. The closest archeological avoidance area is over 750 ft from the Whiskey 3A Borrow Area. Further, the magnetometer data identified few anomalies within the Whiskey 3A Borrow Area, none of which were considered to be of cultural significance. The Borrow Area limits are over 500 ft from the closest known oil and gas infrastructure.

The shape, length, width, and depth were designed within the TBBSR limits and the buffers recommended in TBBSR (USACE, 2010) were respected. The Whiskey 3A Borrow Area is irregular in form. The dimensions of the borrow area vary significantly with an average length over 2,000 ft and average width over 950 ft. The surface area is approximately 77 acres. The marsh compatible sediment thickness averages approximately twenty (20) ft. The design depth is -37 ft NAVD88 with a 2.0 ft allowable overdredge to -39 ft NAVD88. The two (2) foot overdredge tolerance is included to provide a buffer between the silty-sand and the lower sediment horizon comprised of more clayey sediments. The design volume is estimated to be over 2 MCY exceeding the defined volume requirements. The vibracore data indicate marsh compatible sediments comprised of approximately 60% sand.

The Whiskey 3A Borrow Area design plan and typical cross sections are shown in Figures 2-7 and 2-8, respectively.

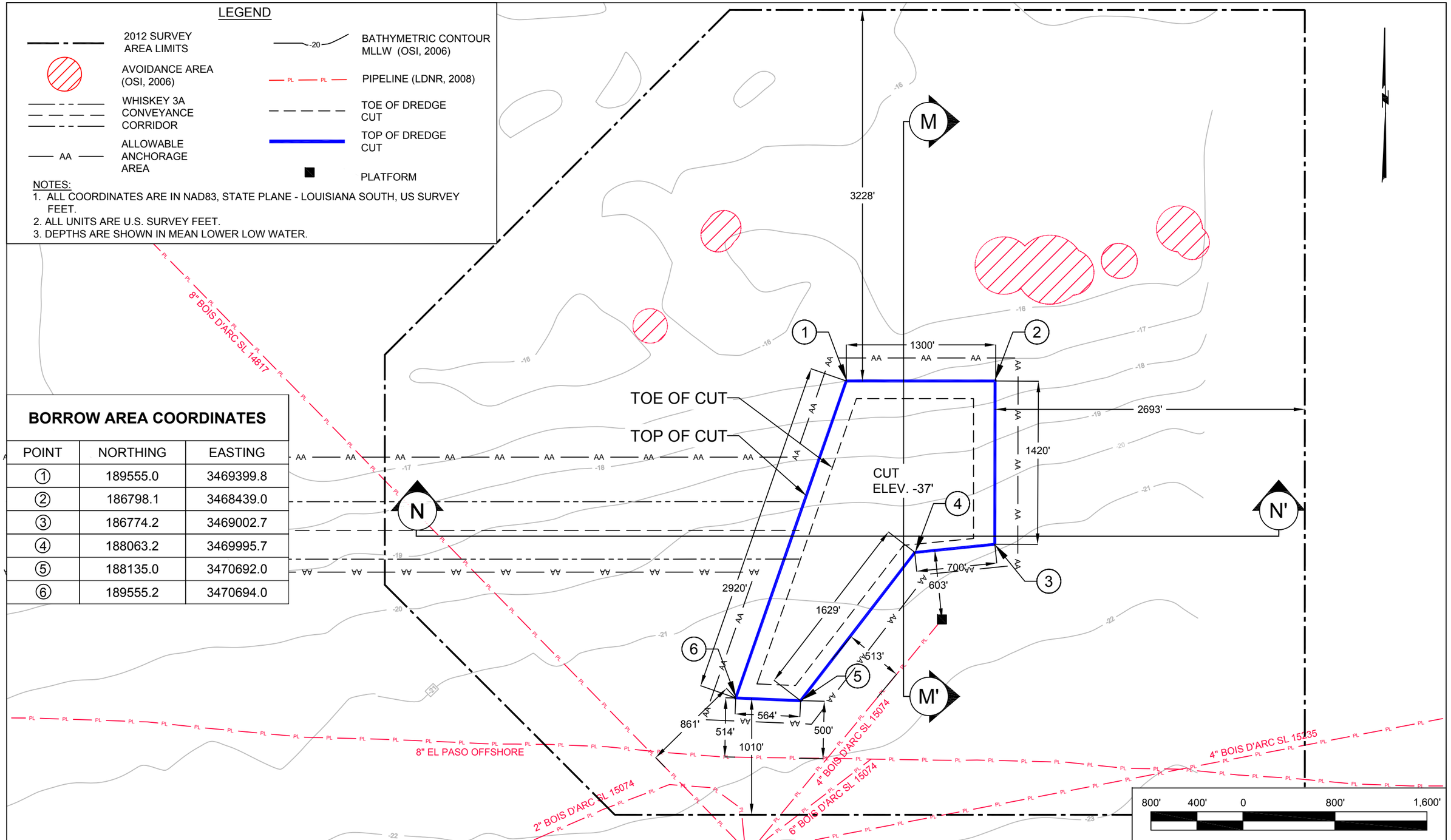
LEGEND

- 2012 SURVEY AREA LIMITS
- AVOIDANCE AREA (OSI, 2006)
- WHISKEY 3A CONVEYANCE CORRIDOR
- ALLOWABLE ANCHORAGE AREA (AA)
- -20 BATHYMETRIC CONTOUR MLLW (OSI, 2006)
- PL PL PIPELINE (LDNR, 2008)
- TOE OF DREDGE CUT
- TOP OF DREDGE CUT
- PLATFORM

NOTES:
1. ALL COORDINATES ARE IN NAD83, STATE PLANE - LOUISIANA SOUTH, US SURVEY FEET.
2. ALL UNITS ARE U.S. SURVEY FEET.
3. DEPTHS ARE SHOWN IN MEAN LOWER LOW WATER.

BORROW AREA COORDINATES

POINT	NORTHING	EASTING
①	189555.0	3469399.8
②	186798.1	3468439.0
③	186774.2	3469002.7
④	188063.2	3469995.7
⑤	188135.0	3470692.0
⑥	189555.2	3470694.0



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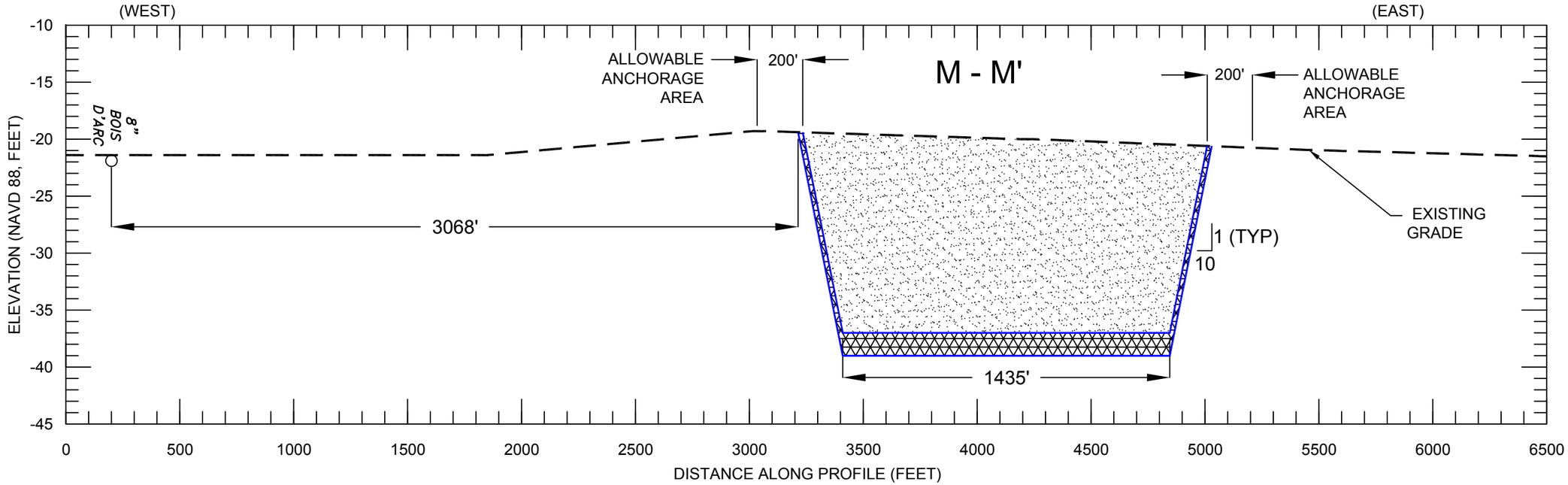
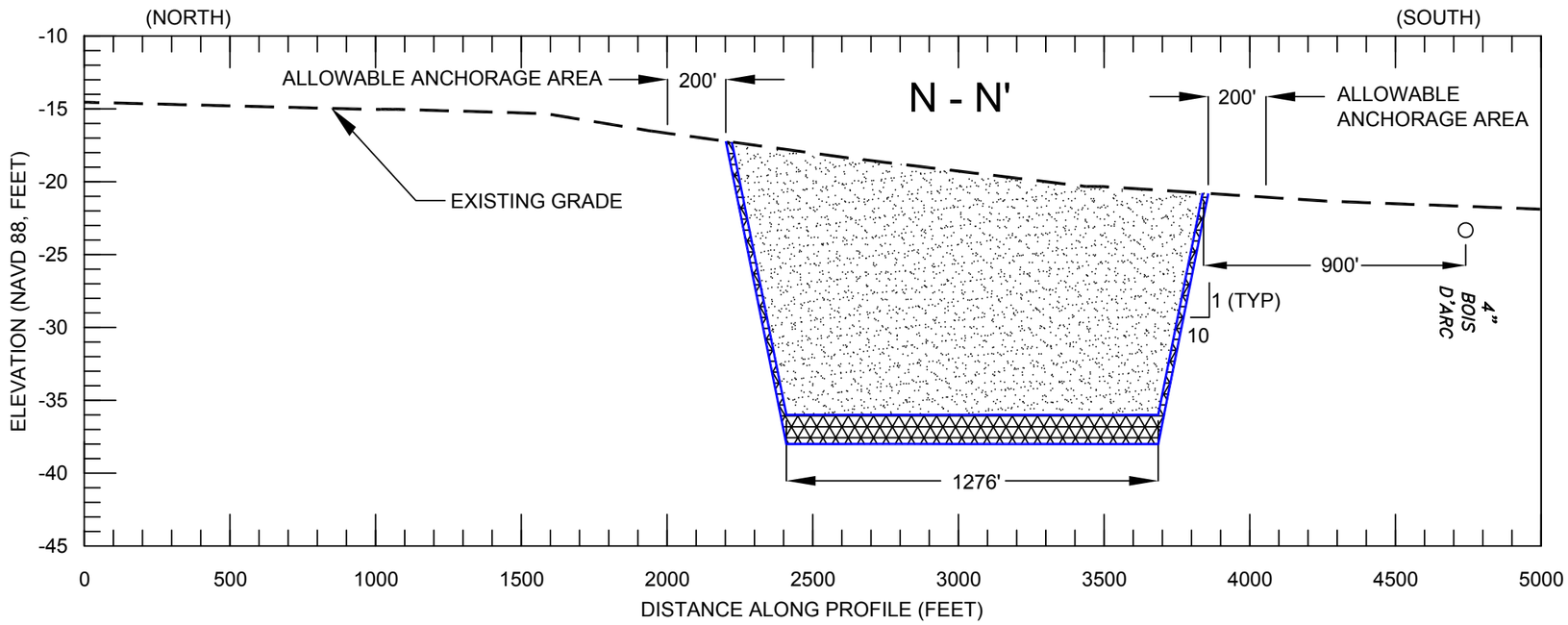
WHISKEY 3A BORROW AREA
DESIGN PLAN VIEW

FIGURE 2-7





SCALE:
H: 1" = 1000'
V: 1" = 20'

LEGEND:

- DESIGN CUT
- OVERDREDGE TOLERANCE
- EXISTING GRADE (2012)

NOTES:

1. ELEVATIONS ARE SHOWN IN NAVD88, FEET.
2. BATHYMETRIC SURVEY OSI (2006).

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WHISKEY 3A BORROW AREA
DESIGN CROSS SECTIONS

FIGURE 2-8

2.1.3 Conveyance Corridors

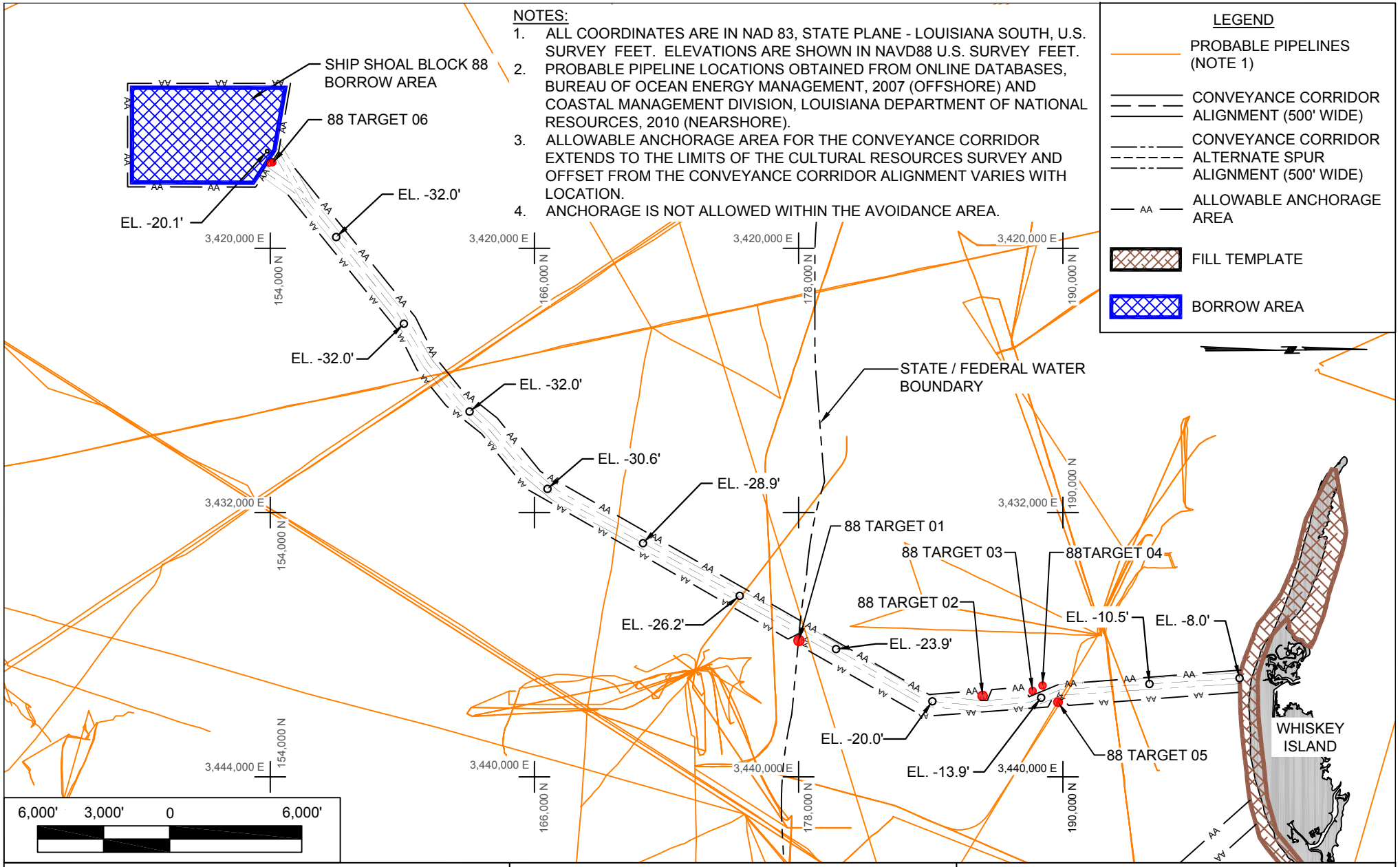
2.1.3.1 Sand Source

The Ship Shoal Block 88 Conveyance Corridor connecting the Ship Shoal Block 88 Borrow Area to Whiskey Island was sited based on a review of NOAA Nautical Chart Nos. 11356 (38th Edition, June 2008) and 11357 (41st Edition, May 2011), historical pipeline and infrastructure databases, and survey data and results from the prior investigations.

A detailed submerged cultural resources and geo-hazard survey of the conveyance corridor was conducted for the Project (OSI, 2012 and Goodwin, 2012). The survey area was over 980 ft in width and transects were surveyed at 30-m line spacing. The survey included collection of bathymetric soundings, sidescan sonar, marine magnetometer, and subbottom profiler data for 123 NM. The locations of the pipelines crossed by this conveyance corridor were confirmed by the magnetic anomalies identified through the magnetometer survey. The cultural resources investigation identified four (4) anomalies within the corridor and recommended avoidance buffers for those areas.

The conveyance corridor alignment is approximately 9.5 miles in length with a width of 500 ft and is aligned to avoid the buffered areas identified as potential cultural resources; water depths vary from -20 ft NAVD88 to 0 ft NAVD88 at the Island. A review of the data indicated that the alignment would cross two paired, parallel and five individual (9 total) oil and gas pipelines from the borrow area to the Restoration Area. The construction specifications shall require the contractor to independently verify the accuracy of the reported pipeline intersection data and to employ best industry practices to mitigate the impacts to all intersected pipelines from placement of the temporary dredge discharge pipeline. As part of their work plan, the construction contractor will be required to submit their plan for placement of the temporary dredge discharge pipeline in the conveyance corridor at the pre-construction meeting. The conveyance corridor plan shall be approved by the Project Engineer and BOEM prior to initiating work. One (1) exposed pipeline was identified during the survey and was avoided by adding a deflection angle in the corridor alignment. Both BOEM and the Bureau of Safety and Environmental Enforcement (BSEE) were notified of the exposure. The Ship Shoal Block 88 Conveyance Corridor design plan is shown in Figure 2-9.

Based on the results of the survey and investigation, this alignment was deemed to be technically feasible provided Project construction implements appropriate best management practices and maintains the recommended buffers, both of which will be detailed in the Project Technical Specifications.


NOTES:
1. ALL COORDINATES ARE IN NAD 83, STATE PLANE - LOUISIANA SOUTH, U.S. SURVEY FEET. ELEVATIONS ARE SHOWN IN NAVD88 U.S. SURVEY FEET.
2. PROBABLE PIPELINE LOCATIONS OBTAINED FROM ONLINE DATABASES, BUREAU OF OCEAN ENERGY MANAGEMENT, 2007 (OFFSHORE) AND COASTAL MANAGEMENT DIVISION, LOUISIANA DEPARTMENT OF NATIONAL RESOURCES, 2010 (NEARSHORE).
3. ALLOWABLE ANCHORAGE AREA FOR THE CONVEYANCE CORRIDOR EXTENDS TO THE LIMITS OF THE CULTURAL RESOURCES SURVEY AND OFFSET FROM THE CONVEYANCE CORRIDOR ALIGNMENT VARIES WITH LOCATION.
4. ANCHORAGE IS NOT ALLOWED WITHIN THE AVOIDANCE AREA.
LEGEND
PROBABLE PIPELINES (NOTE 1)
CONVEYANCE CORRIDOR ALIGNMENT (500' WIDE)
CONVEYANCE CORRIDOR ALTERNATE SPUR ALIGNMENT (500' WIDE)
ALLOWABLE ANCHORAGE AREA
FILL TEMPLATE
BORROW AREA
SHIP SHOAL BLOCK 88 BORROW AREA
88 TARGET 06
EL. -20.1'
EL. -32.0'
EL. -32.0'
EL. -32.0'
EL. -30.6'
EL. -28.9'
EL. -26.2'
EL. -23.9'
EL. -20.0'
EL. -13.9'
EL. -10.5'
EL. -8.0'
STATE / FEDERAL WATER BOUNDARY
88 TARGET 01
88 TARGET 02
88 TARGET 03
88TARGET 04
88 TARGET 05
WHISKEY ISLAND
3,420,000 E
3,432,000 E
3,444,000 E
3,440,000 E
154,000 N
166,000 N
178,000 N
190,000 N
6,000' 3,000' 0 6,000'
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SHIP SHOAL BLOCK 88 CONVEYANCE CORRIDOR PLAN VIEW
FIGURE 2-9

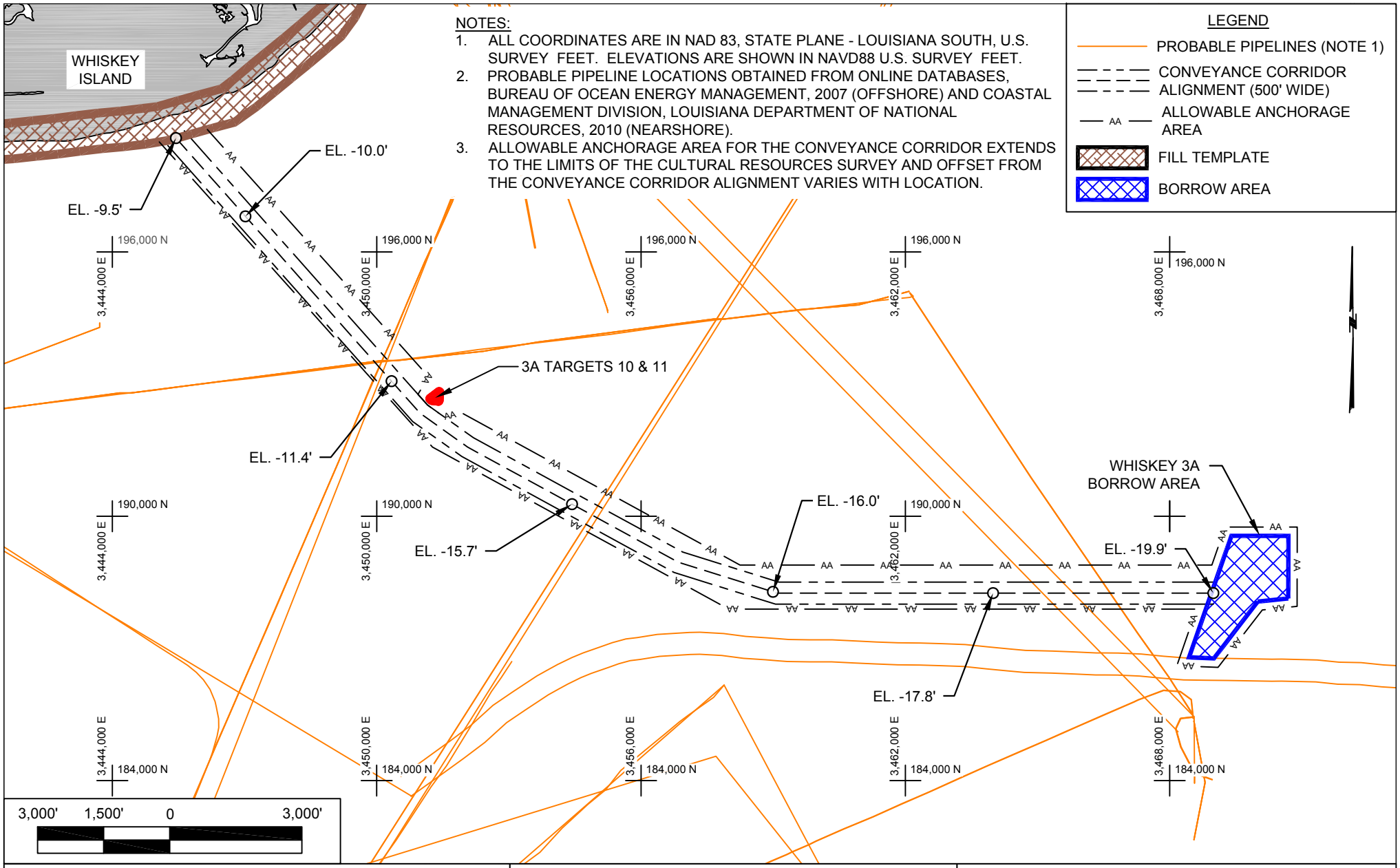
2.1.3.2 Mixed Sediment Source

The Whiskey 3A Conveyance Corridor connecting the Whiskey 3A Borrow Area to Whiskey Island was sited based on a review of NOAA Nautical Chart No. 11357 (41st Edition, May 2011), historical pipeline and infrastructure databases, and survey data and results from the prior investigations.

A detailed submerged cultural resources and geo-hazard survey of the conveyance corridor was conducted as part of the Project scope (OSI, 2012 and Goodwin, 2012). The survey area was over 980 ft in width and transects were surveyed at 30-m line spacing. The survey followed the same methodology as the offshore corridor for 57 NM of data collection (Section 6.2). The locations of the pipelines crossed by this conveyance corridor were confirmed by the magnetic anomalies identified through the magnetometer survey. The cultural resources investigation identified two (2) anomalies within the corridor and recommended avoidance buffers for those areas. Target 9 was resurveyed as part of the Island's Phase II cultural resources survey and determined to not be a cultural resource.

The alignment is approximately 4.5 miles in length and the water depths vary from -20 ft NAVD88 to 0 ft NAVD88 at the Island. The conveyance corridor has a width of 500 ft and is aligned to avoid the buffered areas identified as potential cultural resources. A review of the data indicated that the alignment would cross two paired, parallel and three individual (7 total) oil and gas pipelines from the Whiskey 3A Borrow Area to the Restoration Area. The construction specifications shall require the contractor to independently verify the accuracy of the reported pipeline intersection data and to employ best industry practices to mitigate the impacts to all intersected pipelines from placement of the temporary dredge discharge pipeline. As part of their work plan, the construction contractor will be required to submit their plan for placement of the temporary dredge discharge pipeline in the conveyance corridor at the pre-construction meeting. The conveyance corridor plan shall be approved by the Project Engineer and BOEM prior to initiating work. The Whiskey 3A Conveyance Corridor design plan is shown in Figure 2-10.

Based on the results of the survey and investigation, this alignment was deemed to be technically feasible provided Project construction implements appropriate best management practices and maintains the recommended buffers, both of which will be detailed in the Project Technical Specifications.



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WHISKEY 3A CONVEYANCE CORRIDOR PLAN VIEW

FIGURE 2-10

2.2 ALTERNATIVES ANALYSIS

2.2.1 TBBSR Study

The USACE six-step planning process (USACE, 2000) was completed in the TBBSR study. Included within the process were analyses of the No-Action Alternative, alternatives for island restoration, alternative sand sources, and alternative mixed sediment sources. The following sections summarize these analyses.

2.2.2 No-Action Alternative

This Alternative assumes that there will be no barrier island restoration in the future, thus no action to combat ongoing erosion and land loss. Through analysis of land loss and barrier island degradation, TBBSR determined that if no action were taken to restore Whiskey Island, the following significant environmental resources will be lost that have institutional, public, and technical importance:

- 443 acres of Essential Fish Habitat (EFH);
- Critical habitat for piping plover and red knot;
- 377 acres of supratidal habitat;
- Storm surge protection for Terrebonne Parish; and
- Protection of oil and gas infrastructure.

Whiskey Island was predicted to disappear sooner than several other islands in the Isles Dernieres and Timbalier Island Reaches. The island currently lacks dune habitat. If no action is taken on the island, the supratidal and intertidal habitats are expected to disappear in approximately seventeen (17) and thirty-one (31) years, respectively (USACE, 2010).

2.2.3 Restoration Area

2.2.3.1 Measures and Alternatives

A management measure is a feature or an activity that can be implemented at a specific geographic site to address one (1) or more planning objectives. Management measures are developed to address the defined problems and to capitalize upon identified opportunities. Management measures are derived from a variety of sources including prior restoration projects, prior studies, the NEPA public scoping process, and the PDT. Various permutations of scales and locations are considered. In order to consider a reasonable range of alternatives, stand-alone measures and combinations of management measures are assembled and screened to confirm they meet the planning objectives. Experience of the PDT along with supporting data that

includes geospatial data, surveys, previous restoration projects, and outcomes are used to establish the list of strategies and options that will be assessed during the screening process.

For TBBSR an array of measures was developed including nineteen (19) hard structural measures (e.g. shoreline armoring) and twelve (12) soft-structural measures (e.g. beach, dune, and marsh restoration). Qualitative screening of these measures based upon consistency with specific USACE policies for ecosystem restoration, and Federal laws, regulations, and Executive Orders resulted in the elimination of fifteen (15) measures and the retention of sixteen (16) measures to be carried forward for a second level of screening. The second level screening effort examined combinations of measures that could be used to meet the planning objectives. As a result of the second level of screening, it was determined that a combination of beach, dune, and marsh restoration measures would be needed to achieve the primary objective of restoring GEFF. This screening process resulted in the elimination of seven (7) additional measures. The final screening effort evaluated the use of supplementary measures including sand fences, vegetative plantings and herbivore control (soft-structural) as well as breakwaters and terminal groins (hard-structural) that would complement the beach, dune, and marsh restoration measures. These measures were evaluated on an island-by-island basis (USACE, 2010).

2.2.3.2 Minimized Restoration Template

Based upon the determination that a combination of beach, dune, and marsh restoration measures would be needed, TBBSR defined the minimized restoration design template as the construction of the minimal barrier island dimensions for the beach, dune, and marsh platforms that restore the barrier island's GEFF and retains this form and function after being subjected to the design storm events. The design storm events selected included a hypothetical 50-year design storm, and four (4) historic storms--Hurricanes Katrina and Rita of 2005, and Hurricanes Gustav and Ike of 2008. To achieve the design template, model simulations using the SBEACH (Storm-induced BEAch CHange) model were performed on an array of templates with widths changed in twenty-five (25) ft increments and elevations changed in 0.1 ft increments. Based on the results of these simulations, the following minimal beach and dune island dimensions were derived to meet the restoration template definition:

- Gulf-side beach width = 250 ft;
- Beach elevation = 3.8 ft NAVD 88;
- Dune width = 100 ft;
- Dune elevation = 6.0 ft NAVD 88; and
- Bay-side beach width = 100 ft.

Based on the post-storm observations from the recent historic storms, there is ample evidence that the back-barrier marsh width needs to be on the order of 1,000 ft to capture overwash

sediments during episodic events; sediment that would otherwise be carried into back bay areas to form shoals or be lost into deeper waters. Cross-shore sediment transport models, e.g., SBEACH, tend to underestimate the extent of overwash; therefore a literature review was conducted to support the design criteria for the width of the marsh platform. Examination of vertical aerial photographs of the Texas coast, made following Hurricane Ike (2008), show areas of overwash extending from 800 to 1,300 ft inland (Ewing *et al*., 2009). An extensive study of overwash on the Caminada-Moreau Headland by Ritchie and Penland found that, for much of the low shoreline, overwash penetrated from 700 ft to more than 1,000 ft beyond the beach (Ritchie and Penland, 1989). Examination of the aerial photographs in Williams *et al*. (1992) show overwash areas extending to 1,300 ft on Timbalier Island and greater than 700 ft on East Island. Therefore, 1,000 ft was defined as the minimal marsh platform width for the design to meet the restoration template definition. Based on similar Louisiana barrier island restoration plans, the average healthy marsh elevation, defined as the target elevation for the marsh platform, is typically within +/- 0.1 ft of Mean High Water (MHW). MHW was defined as the minimal marsh platform target elevation for the design to meet the restoration template definition.

2.2.3.3 Restoration Template Designs

Bathymetric / Topographic Data

The profiles used in the development of the TBBSR design templates were produced from the Barrier Island Comprehensive Monitoring (BICM) survey data set acquired in 2006. The survey data were utilized to develop representative profiles for each island. These profiles were also used in the SBEACH simulations and served as the basis for calculating fill volumes required for the restoration design plans.

Long-Term Erosion Rates

Because construction commencement was planned for 2012, the designs had to account for erosion that would occur between 2006 and 2012. Design long-term erosion rates were developed and used to calculate each barrier island's recession rate over the six (6) year period. Fill templates were shifted landward of the 2006 shoreline positions to account for the projected erosion of the barrier shoreline by 2012.

Relative Sea Level Change

Relative sea level change analysis was performed in accordance with the EC 1165-2-211 18-step guidance developed by USACE (USACE, 2011). According to this guidance, future subsidence rate remains constant, however, future eustatic SLR rate has three (3) trends: historic (constant), intermediate (increase), and high (increase). Based on the analysis, relative SLR derived from

the intermediate trend (NRC Curve I) between 2006 and 2012 is equal to 0.2 ft. Therefore, the minimized restoration template design elevations were adjusted by a 0.2-ft vertical shift.

Fill Compaction

The minimized restoration template was analyzed to determine whether the beach/dune and marsh would require a vertical adjustment to account for compaction defined as the combined foundation settlement of the subsoils due to the weight of the fill and the self-weight consolidation within the imported fill materials themselves. The compaction value is a function of fill thickness and was derived for each island individually. The relationship between the fill thickness and compaction was developed based on data obtained from the CWPPRA project designs for Whiskey Island (LDNR, 2007) and Raccoon Island (NRCS, 2007). Because the minimized template's beach/dune fill was sited above the mean low water line (MLW), the compaction value for the beach/dune portion of the fill was negligible. Based on the compaction analysis results, the minimized restoration template design marsh platform elevations were shifted vertically according to the compaction values (USACE, 2010).

Existing CWPPRA Projects

The beach/dune and marsh design templates were reduced/adjusted to account for the TE-48 project on Raccoon Island (NRCS, 2007) and the TE-50 project on Whiskey Island (LDNR, 2007).

Summary

In summary, the minimized restoration template dimensions for each component included the Gulf-side beach width, dune width, bay-side beach width, and marsh width equal to 250 ft, 100 ft, 100 ft, and 1,000 ft, respectively. The beach berm, dune, and marsh elevations were set equal to +4.0 ft NAVD88, +6.2 ft NAVD88, and +2.1 ft NAVD88, respectively.

To derive the plan scalars for each individual island, the elevations were adjusted to account for relative SLR and compaction multiplied by the advanced nourishment period of each specified plan scalar. Advanced fill for the beach / dune component and the marsh component were computed by multiplying the advanced nourishment period of each specified plan scalar times the long-term erosion rate (beach / dune) and the long-term land loss rate (marsh).

2.2.3.4 Array of Alternatives

Various combinations of islands, plan scalars, and hard-structural complementary measures were evaluated to determine the best combinations of features (i.e. alternatives) that would meet the

planning objectives and be consistent with the LCA program and 2007 WRDA authorization. Through an iterative process of plan development and screening, ten (10) alternatives were defined in the Array of Alternatives including the No Action Alternative. Two (2) additional plans were later added which formed the Final Array of Alternatives once it became apparent that there were no alternatives that could be constructed within the maximum cost as authorized by WRDA 2007. The details on development and screening to determine the final array of alternatives is presented in the TBBSR study (USACE, 2010). Several of the alternatives in the final array included beach, dune, and marsh restoration of Whiskey Island, one (1) as a single island plan and the others in combination with other islands.

2.2.3.5 CE/ICA

A Cost Effectiveness and Incremental Cost Analysis (CE/ICA) is applied to evaluate alternative plans and identify a NER Plan which meets the planning objectives and constraints and reasonably maximizes environmental benefits while meeting tests of completeness, acceptability, efficiency, and effectiveness. The CE/ICA analysis follows guidance from the USACE Institute for Water Resources (IWR) publication, "Evaluation of Environmental Investment Procedures Manual, Interim: Cost Effectiveness and Incremental Analyses, May 1995, IWR Report #95-R-1." The costs are converted to average annual costs and include engineering, design, permitting, and construction costs; interest during construction; and operations and maintenance costs after construction throughout the period of analysis. The benefits are derived in the form of average annual outputs. The environmental benefits for the TBBSR study were derived from the CWPPRA Barrier Island Wetland Value Assessment (WVA) Method and expressed as Average Annual Habitat Units (AAHUs) (CWPPRA, 2002).

The analysis was conducted by running the IWR model on the twelve (12) alternatives in the final array. The CE/ICA yielded several Best Buy and Cost Effective alternatives including several with the Whiskey Island restoration plans included. The detailed analysis is presented in the TBBSR study (USACE, 2010).

2.2.3.6 NER Plan

The NER Plan was selected because it represented a system-wide and cost-effective approach of restoring as many islands within the Terrebonne Basin barrier system that could be constructed with available sediment sources. Alternative 5 (Raccoon with Terminal Groin (Plan E) / Whiskey (Plan C) / Trinity (Plan C) / and Timbalier (Plan E)) was selected as the NER Plan because it is a Best Buy plan that fulfills the planning objectives of TBBSR. The alternative restores GEFF for the four (4) islands. Immediately after construction (TY1), the NER Plan would add 3,283 acres of habitat (dune, supratidal, and intertidal) to the existing island footprints of Raccoon, Whiskey, Trinity, and Timbalier Islands, increasing the total size of the islands to

5,840 acres. This included approximately 472 acres of dune, 4,320 acres of supratidal habitat, and 1,048 acres of intertidal habitat. The NER Plan would require approximately 27.3 MCY of sand (beach and dune) and 18.7 MCY of mixed sediments (marsh) for initial construction. The sediments would be dredged from a number of offshore Borrow Areas including South Pelto, Whiskey 3, New Cut, Raccoon, and Ship Shoal Block 88. The NER Plan was also selected because it protects existing critical mangrove habitats on Whiskey and Trinity Islands. Further, the NER Plan protects critical State investments, *i.e*. CWPPRA project restoration footprints, on several of the islands (USACE, 2010).

2.2.3.7 Recommended Component of Construction

Because the NER Plan could not be constructed within the maximum project cost as authorized by WRDA 2007, the PDT examined each subset of the NER Plan and determined that either Whiskey Island or Trinity Island's NER Plan recommendation could be constructed within the fiscal constraint. Whiskey Island was ultimately selected due to a number of qualitative benefits provided by its plan. The restoration template was designed to avoid approximately 286 acres of existing mangroves in order to minimize the ecologic impact during construction and to complement and protect TE-50. Since the Island is considered a valuable wildlife habitat and the LDWF is re-establishing a pelican rookery on the island, maintaining adequate areas of healthy beach, dune, and marsh is particularly important. The Island is also a critical habitat for threatened species including the piping plover and is a valuable stopover habitat for migratory birds. Raccoon Island, which also contains a rare mangrove habitat and is an important rookery, will benefit from increased sediment deposition as the long shore sediment transport moves some of the sediment from Whiskey Island westward to Raccoon Island. Lastly, Whiskey Island is the closest of the seven (7) barrier islands to the critical marsh habitat located in the southern-most portion of the Terrebonne Basin.

For the Recommended Component of Construction within the NER Plan for Whiskey Island, the adjusted beach berm elevation was +4.2 ft NAVD88, adjusted dune elevation was +6.4 ft NAVD88, and adjusted marsh elevation was +2.4 ft NAVD88. The five (5) years of advanced fill for the NER Plan component for Whiskey Island included 214 ft of additional sand volume on the gulf-side to provide the geomorphic form while protecting the existing mangroves located on the Island. Additional marsh acreage was incorporated to account for the five (5) years of advanced fill for the NER Plan component as well. The plan view and typical section derived in TBBSR for Whiskey Island are presented in Figures 2-11 and 2-12 respectively (USACE, 2010).

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TBBSR RESTORATION AREA PLAN VIEW

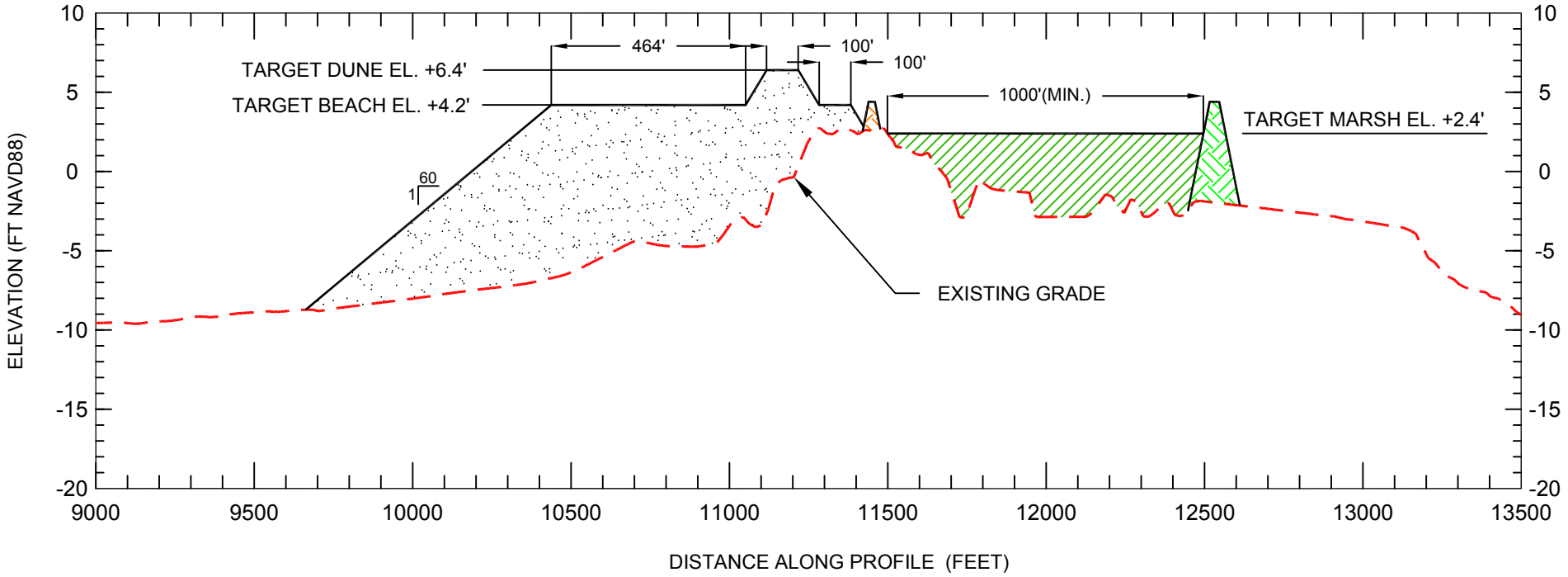
FIGURE 2-11

LEGEND:

- BEACH / DUNE FILL
- MARSH FILL
- EXISTING GRADE
- DESIGN
- MARSH CONTAINMENT DIKE
- BEACH SEPARATION DIKE

SCALE:
H=1"=500'
V=1"=10'

A - A'



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NRDA CAILLOU LAKE HEADLANDS
(TE-100)

TBBSR RESTORATION AREA
CROSS SECTION

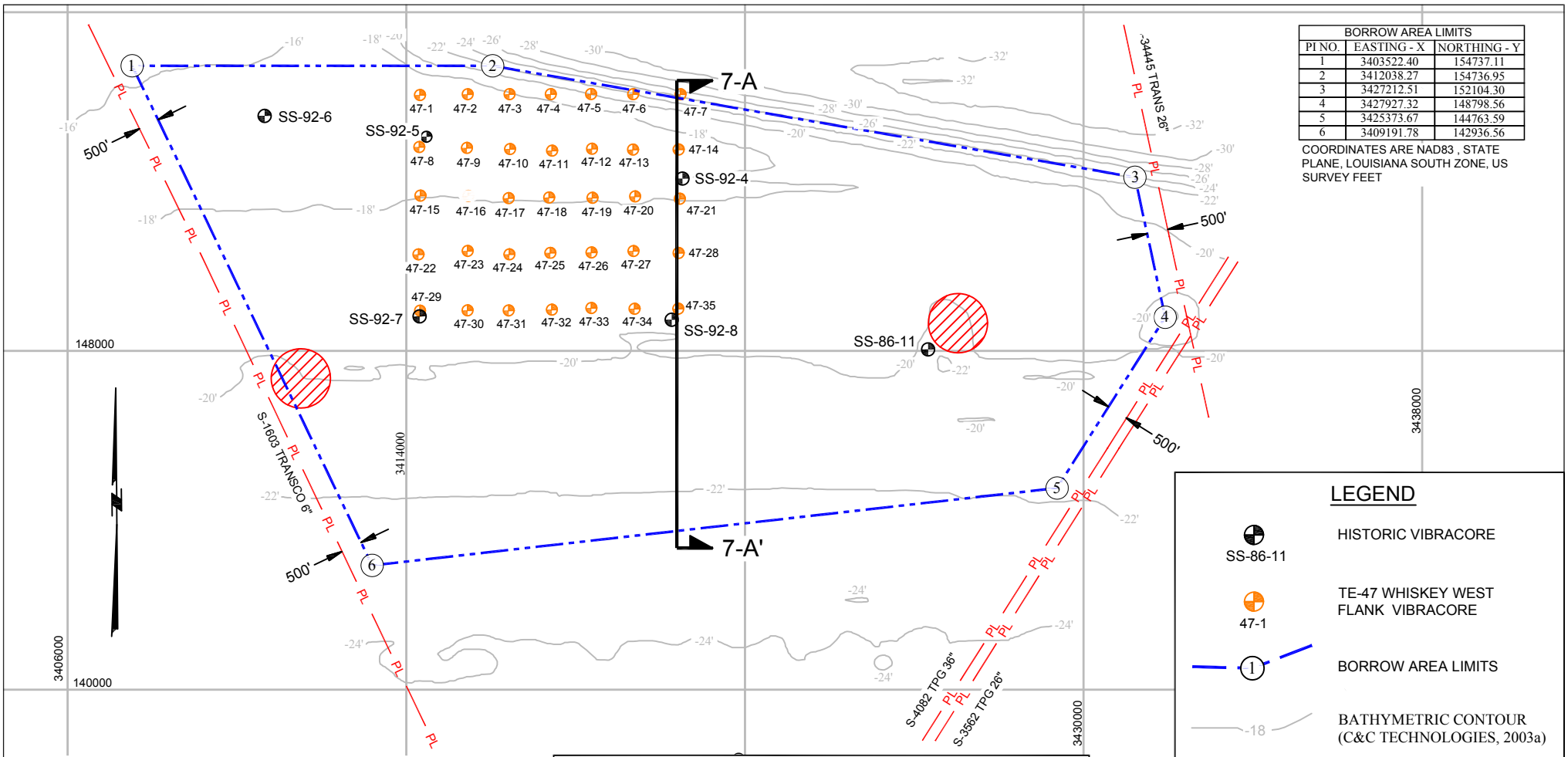
FIGURE 2-12

2.2.4 Borrow Areas

The search for suitable sediment resources for Louisiana barrier island restoration has been underway for over two (2) decades. Multiple target areas within the study area were identified as possible sediment resources composed of sand or mixed sediment or both. The initial screening process applied the criterion of depth of closure, the result of which identified nine (9) primary resource areas. Use of borrow areas inshore of the depth of closure has been reconsidered in recent years because of potentially adverse effects on normal coastal processes, specifically the interruption of sediment transport across tidal inlets and the shoreface and altered wave climate, with unanticipated impacts on neighboring and landward shorelines. The second screening process applied the additional criteria including available fill volume, adequacy and acceptability of geotechnical and geophysical survey data, and ability to obtain cultural resources clearance. The second screening resulted in five (5) potential borrow areas. The third and final criterion was a fiscal analysis which yielded the most cost effective sources for each specific island in the study area (USACE, 2010).

The results of the TBBSR screening analysis yielded the Ship Shoal Block 88 Borrow Area as the recommended sand source for Whiskey Island beach and dune restoration. The plan view and typical section for the conceptual design plan are shown in Figures 2-13 and 2-14, respectively. The results of the TBBSR screening analysis yielded the Whiskey 3A Borrow Area as the recommended mixed sediment source for Whiskey Island marsh restoration. The plan view and typical section for the conceptual design plan are shown in Figures 2-15 and 2-16, respectively.

It is noted that previous investigations for CWPPRA projects TE-47 and TE-50 identified the sand body within the Ship Shoal Lease Block 88 as a borrow area suitable for Whiskey Island beach and dune restoration (C&C, 2003) and the Whiskey Island Area 3 as a borrow area suitable for the proposed marsh component (LDNR, 2007). As part of the scope of the Project, both of these areas underwent detailed cultural resource surveys and investigations to both elaborate the extent of the sediment resources and to delineate any petroleum industry infrastructure and cultural resource avoidance areas (Goodwin, 2012 and OSI, 2012).



BORROW AREA LIMITS		
PI NO.	EASTING - X	NORTHING - Y
1	3403522.40	154737.11
2	3412038.27	154736.95
3	3427212.51	152104.30
4	3427927.32	148798.56
5	3425373.67	144763.59
6	3409191.78	142936.56

COORDINATES ARE NAD83 , STATE PLANE, LOUISIANA SOUTH ZONE, US SURVEY FEET

LEGEND

- SS-86-11 — HISTORIC VIBRACORE
- 47-1 — TE-47 WHISKEY WEST FLANK VIBRACORE
- (1) — BORROW AREA LIMITS
- -18 — BATHYMETRIC CONTOUR (C&C TECHNOLOGIES, 2003a)
- PL — PIPELINE
- AVOIDANCE AREA

0' 1750' 3500' 7000'

DATA AND INFORMATION SOURCES:

1. BATHYMETRIC CONTOURS AND PIPELINE IDENTIFICATIONS DERIVED FROM BATHYMETRY MAP, WHISKEY ISLAND WEST FLANK RESTORATION SHEET 1 OF 4 INCLUDED IN REPORT TITLED "HIGH RESOLUTION GEOPHYSICAL AND ARCHAEOLOGICAL SURVEY OF PORTIONS OF BLOCKS 87, 88, 89, 94 AND 95 SHIP SHOAL AREA", C&C TECHNOLOGIES, 2003. (DRAWING FILENAME: 4036.DWG)
2. VIBRACORE LOCATIONS AND SPECIFICS PREFIXED "SS" OBTAINED FROM REPORT TITLED "HIGH RESOLUTION GEOPHYSICAL AND ARCHAEOLOGICAL SURVEY OF PORTIONS OF BLOCKS 87, 88, 89, 94 AND 95 SHIP SHOAL AREA", PAGE 13, C&C TECHNOLOGIES, 2003.VIBRACORE LOCATIONS AND SPECIFICS PREFIXED "04-SS88" OBTAINED FROM REPORT TITLED "SAND SOURVE INVESTIGATION, SHIP SHOAL - BLOCK 88, SHIP SHOAL - WHISKEY ISLAND WEST FLANK (TE-47) RESTORATION PROJECT, DMJM + HARRIS, 2005.

TE-47 WHISKEY WEST FLANK VIBRACORE INDEX					
INDEX NO.	CORE NAME	INDEX NO.	CORE NAME	INDEX NO.	CORE NAME
47-1	04-SS88-01(P)	47-13	04-SS88-21(S)	47-25	04-SS88-09(S)
47-2	04-SS88-27(S)	47-14	04-SS88-20(S)	47-26	04-SS88-08(S)
47-3	04-SS88-28(S)	47-15	04-SS88-13(S)	47-27	04-SS88-07(S)
47-4	04-SS88-29(S)	47-16	04-SS88-14(S)	47-28	04-SS88-06(S)
47-5	04-SS88-30(S)	47-17	04-SS88-15(S)	47-29	04-SS88-04(P)
47-6	04-SS88-31(S)	47-18	04-SS88-16(S)	47-30	04-SS88-01(S)
47-7	04-SS88-02(P)	47-19	04-SS88-17(S)	47-31	04-SS88-02(S)
47-8	04-SS88-26(S)	47-20	04-SS88-18(S)	47-32	04-SS88-03(S)
47-9	04-SS88-25(S)	47-21	04-SS88-19(S)	47-33	04-SS88-04(S)
47-10	04-SS88-24(S)	47-22	04-SS88-12(S)	47-34	04-SS88-05(S)
47-11	04-SS88-23(S)	47-23	04-SS88-11(S)	47-35	04-SS88-03(P)
47-12	04-SS88-22(S)	47-24	04-SS88-10(S)		

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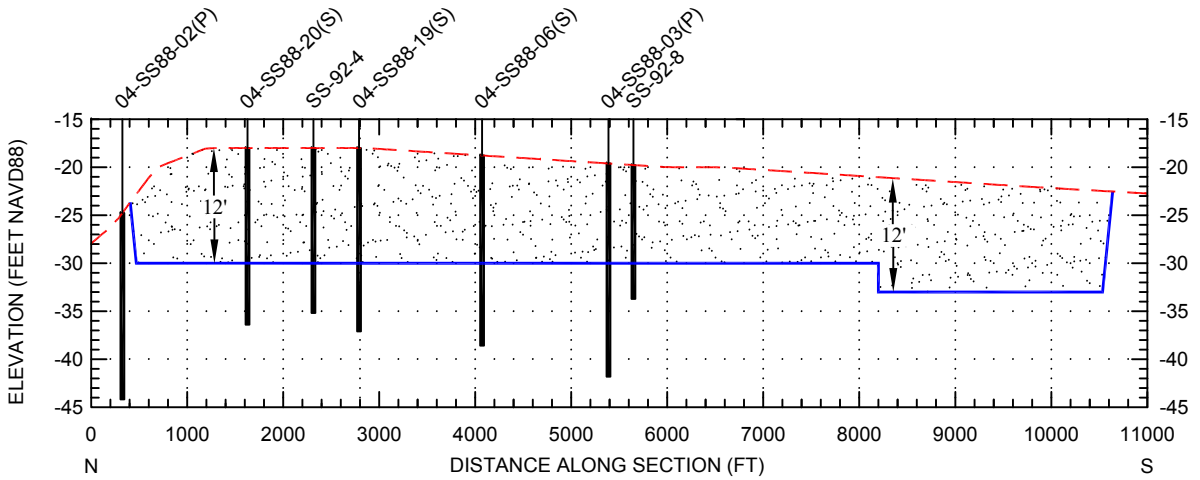
SHIP SHOAL BORROW AREA 7 PLAN VIEW

FIGURE 2-13

SCALE:
H: 1" = 20'
V: 1" = 2000'



7-A TO 7-A'

NOTES:

1. EXISTING GRADE DERIVED FROM BATHYMETRY MAP, WHISKEY ISLAND WEST FLANK RESTORATION SHEET 1 OF 4 INCLUDED IN REPORT TITLED "HIGH RESOLUTION GEOPHYSICAL AND ARCHAEOLOGICAL SURVEY OF PORTIONS OF BLOCKS 87, 88, 89, 94 AND 95 SHIP SHOAL AREA", C&C TECHNOLOGIES, 2003. (DRAWING FILENAME: 4036.DWG)
2. BORROW AREA CUT DEPTHS DERIVED FROM ISOPACH MAP INCLUDED IN REPORT TITLED "HIGH RESOLUTION GEOPHYSICAL AND ARCHAEOLOGICAL SURVEY OF PORTIONS OF BLOCKS 87, 88, 89, 94 AND 95 SHIP SHOAL AREA", C&C TECHNOLOGIES, 2003.
3. VIBRACORE LOCATIONS AND SPECIFICS OBTAINED FROM REPORT TITLED "HIGH RESOLUTION GEOPHYSICAL AND ARCHAEOLOGICAL SURVEY OF PORTIONS OF BLOCKS 87, 88, 89, 94 AND 95 SHIP SHOAL AREA", PAGE 13, C&C TECHNOLOGIES, 2003.
4. BORROW AREA SIDE SLOPES 1V:10H.

LEGEND

EXISTING VIBRACORE

BORROW AREA CUT LIMITS

EXISTING GRADE (C&C TECHNOLOGIES, 2003a)

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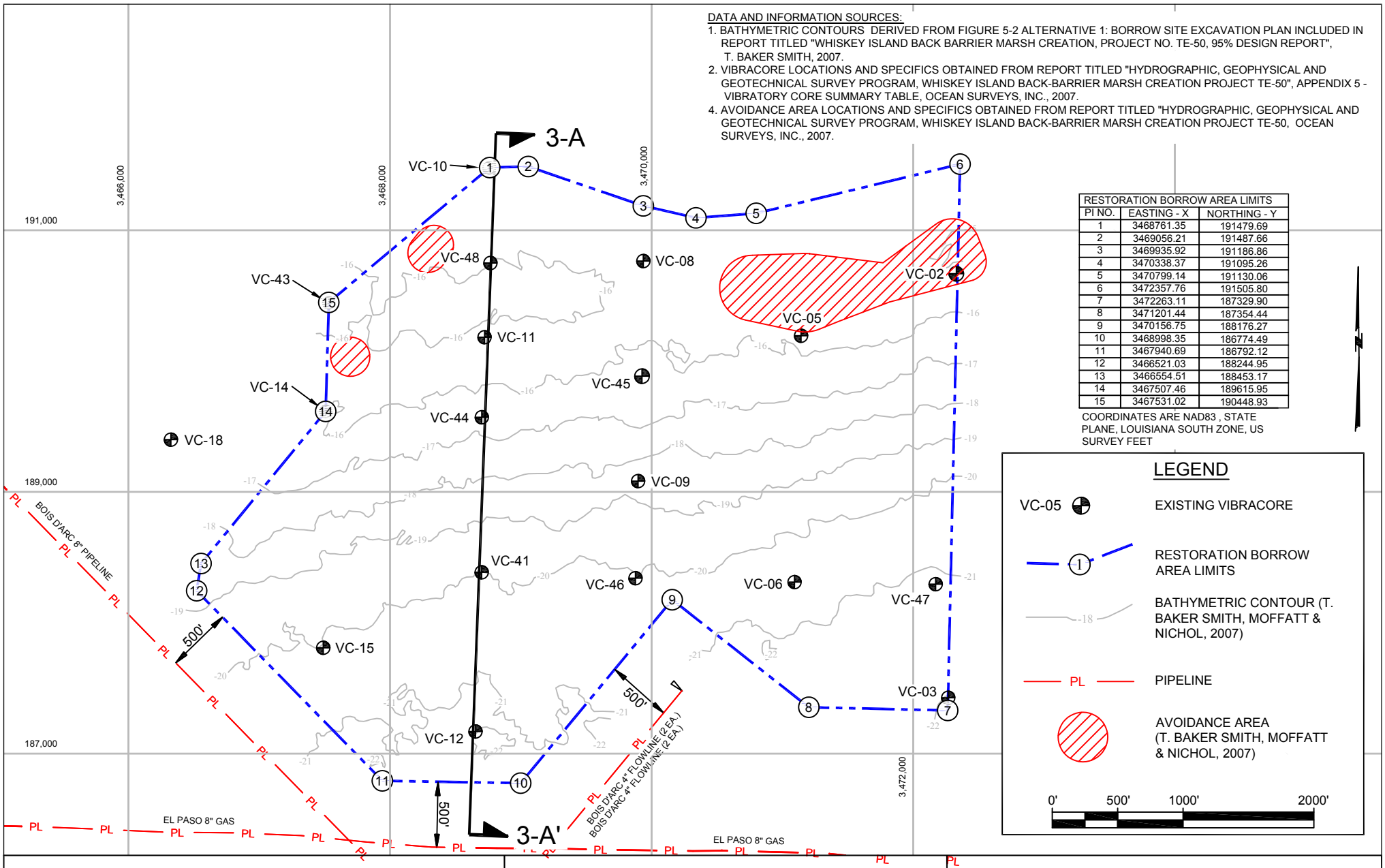
NRDA CAILLOU LAKE HEADLANDS RESTORATION PROJECT (TE-100)

SHIP SHOAL BORROW AREA
7 SECTION

FIGURE 2-14



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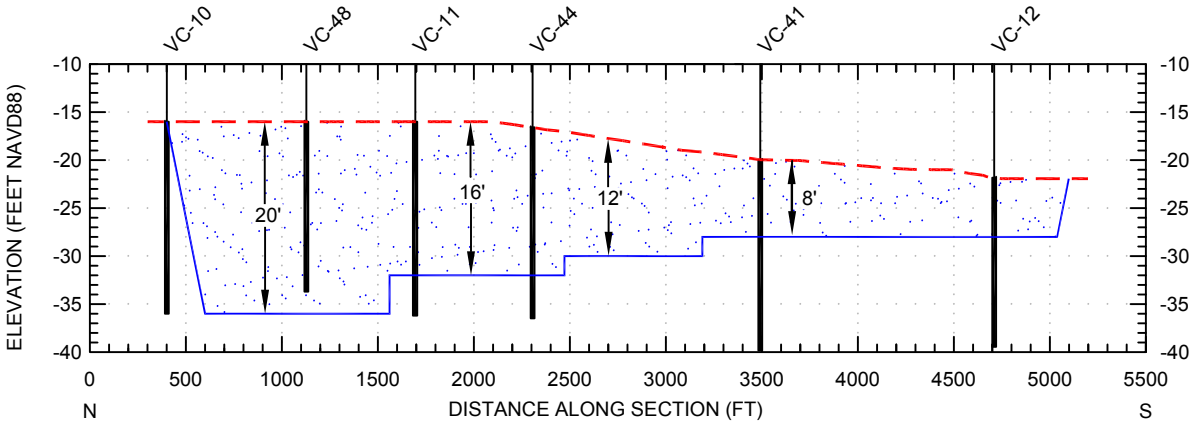
WHISKEY ISLAND RESTORATION AREA 3 PLAN VIEW

FIGURE 2-15

NOTES:

1. EXISTING GRADE DERIVED FROM FIGURE 5-2 ALTERNATIVE 1: BORROW SITE EXCAVATION PLAN INCLUDED IN REPORT TITLED "WHISKEY ISLAND BACK BARRIER MARSH CREATION, PROJECT NO. TE-50, 95% DESIGN REPORT", T. BAKER SMITH, 2007.
2. VIBRACORE SPECIFICS OBTAINED FROM REPORT TITLED "HYDROGRAPHIC, GEOPHYSICAL AND GEOTECHNICAL SURVEY PROGRAM, WHISKEY ISLAND BACK-BARRIER MARSH CREATION PROJECT TE-50", APPENDIX 5 - VIBRATORY CORE SUMMARY TABLE, OCEAN SURVEYS, INC., 2007.
3. RESTORATION BORROW AREA SIDE SLOPES 1V:10H.

SCALE:
H: 1" = 20'
V: 1" = 100



3-A TO 3-A'

LEGEND

EXISTING VIBRACORE

RESTORATION BORROW AREA CUT LIMITS

EXISTING GRADE (T. BAKER SMITH, MOFFATT & NICHOL, 2007)

COASTAL ENGINEERING CONSULTANTS, INC

NRDA CAILLOU LAKE HEADLANDS RESTORATION PROJECT (TE-100)

WHISKEY ISLAND RESTORATION BORROW AREA 3 SECTION

FIGURE 2-16

2.2.5 Excavation, Transportation, and Conveyance Methods

As part of the Project design phase, the use of both hopper and cutterhead suction dredge alternatives for excavation, transportation, and placement were considered for conveying sediment from both the Ship Shoal Block 88 Borrow Area and the Whiskey 3A Borrow Area to Whiskey Island. Following an analysis of bathymetry in the two (2) borrow areas and their respective conveyance corridors, it was determined that the hopper dredge alternative would require initial excavation of segments of both of the conveyance corridors to be able to access the borrow areas as well as to navigate within the conveyance corridors from the borrow areas to the Island. Further, several of the existing oil and gas pipelines could additionally constrain the hopper dredge alternative. Due to the significant costs and infrastructure constraints associated with the initial excavation, the hopper dredge alternative was deemed to be not cost effective and eliminated from further consideration (CEC, 2012).

By eliminating the hopper dredge method, the preferred method for conveying sediment from both of the borrow areas to Whiskey Island shall utilize a hydraulic cutterhead dredge in combination with booster pumps and a sediment pipeline. Cutterhead dredges utilize a rotary excavating bit to loosen the sand. The bit or cutter is located on the end of an arm (the ladder) that is hinged off the forward end of the dredge. The ladder can be maneuvered vertically to control its depth and the dredge and ladder maneuvered laterally and fore-aft using anchors deployed off the forward quarters in combination with vertical spuds. The loosened slurry is pumped up the ladder by a large suction pump in the dredge hull and, with the aid of booster pumps, conveys the sand ashore through a submerged pipeline. It is anticipated that a single booster pump will be required to assist moving the sediment from each borrow area to the Restoration Area.

Once the sediment has reached the Island it will be handled in the normal manner. The discharge pipeline will be extended the length of the beach and dune template using pipe-handling loaders and bulldozers and the sand will be graded to conform to the plan dimensions using bulldozers, front-end loaders, and other earth moving equipment. The marsh fill sediment will be discharged into the cells created by the marsh fill containment dikes and interior training dikes. The marsh fill will not be mechanically graded. Design elevation will be achieved by the construction contractor monitoring dredge discharge locations and dredged material settlement.

Access to the Island is limited, as there are no natural channels or approaches. Once constructed, the east, west, and back marsh containment dikes may provide limited pathways to the beach and dune template but the dike dimensions preclude their use by the majority of vehicles. Access for construction equipment may be feasible in the vicinity of the nearshore petroleum production facility off the east end of the Island; however the web of pipelines to and from that facility probably precludes channel dredging. A less impactive access channel, excavated as a

continuation of the dike access channel, may be feasible adjacent to the west segment of the marsh containment dike. No equipment, fuel, machinery, discharge pipe, or other restoration-associated devices can be moved across or placed in the mangrove wetland areas; all such material and devices must remain within the beach and dune fill template. Because Whiskey Island is part of the State of Louisiana's Isles Dernieres Barrier Island Refuge, access to and activities on it require permission from the LDWF.

2.2.6 Conveyance Corridors

As part of the Project design phase, various conveyance corridor alignments extending from the two (2) borrow areas to the shoreline of Whiskey Island were evaluated. The purpose of designating these corridors is to ensure that the sediment pipelines are sited in alignments that minimize environmental disturbances and potential conflicts with existing infrastructure. The analysis included a review of existing pipeline database maps and prior reports identifying potentially significant cultural resources. The conveyance corridor alignments were laid out to balance the shortest distance between each Borrow Area and the Island with the lowest number of pipeline crossings. Further, the conveyance corridors were aligned to avoid previously-charted obstructions and identified potential cultural resources. Once tentatively established, the conveyance corridors were surveyed for cultural resources and obstructions using sidescan sonar and magnetometer. Results of the analyses of those data were then used to further refine the conveyance corridor alignments. Anchoring activities may take place within the previously-surveyed areas associated with the conveyance corridors. No anchoring may occur within the delineated cultural resource buffer or avoidance zones.

3.0 AFFECTED ENVIRONMENT

This Chapter describes the existing environmental resources of the areas that would potentially be affected if the Project was constructed. Only those environmental resources that are relevant to the decision making process are described. This forms the baseline conditions for determining the environmental consequences, both impacts and benefits, of the Project.

3.1 PHYSICAL RESOURCES

3.1.1 Oceanographic and Coastal Processes

A detailed description of the oceanographic and coastal processes for the Project area is presented in the Preliminary Design Report (CEC, 2012). A brief summary of the shoreline change analysis, land area change analysis, and sediment budget development are presented herein.

3.1.1.1 Shoreline Change Analysis

For more than a century, the Isles Dernieres have experienced significant and persistent degradation and fragmentation. The average long-term (1887–2002) rate of shoreline change for the Isles Dernieres was -34.7 ft/yr with a range of -56.0/-17.0 ft/yr. The average short-term (1988 to 2002) rate of shoreline change was -61.9 ft/yr with a range of -60.5/-38.6 ft/yr (USACE, 2004a).

Utilizing historic and recent shoreline positions, five (5) shoreline change rates were developed for Whiskey Island, i.e. historical (1887-2005), long-term (1932-2005), short-term (1996-2005), near-term (2005-2011) and overall (1887-2011). The average Whiskey Island shoreline change rates for the five (5) periods are -51.0 ft/yr, -57.1 ft/yr, -27.7 ft/yr, -84.9 ft/yr, and -53.8 ft/yr. These rates capture the impacts of two (2) projects that were completed in 2000 (TE-27 Whiskey Island Restoration) and 2009 (TE-50 Whiskey Island Back Barrier Marsh Creation).

For TBBSR, the design shoreline change rate for Whiskey Island was based on the average historic shoreline change rate from 1956 to 1988 which was -42.7 ft/yr. This period was selected as it correlated to the time frame during which the Island's GEFF would be similar to restored conditions and thus represented how the Island would evolve after restoration (USACE, 2010a). The development of the advanced nourishment component of the Restoration Area template in TBBSR was based on this design shoreline change rate. This rate is on the same order of magnitude as the historic and long-term trends.

3.1.1.2 Land Area Change Analysis

Utilizing land acreages of Whiskey Island between 1985 and 2000 obtained from the U.S. Geological Survey (USGS) for TBBSR (USACE, 2010), pre-restoration land acreages were analyzed to derive a pre-restoration linear trend and project the Year of Disappearance (YOD) based upon the extrapolation of the trend line into the future until it reaches zero acres. Applying the same trend line from 2011 (after completion of the TE-50 project), a new YOD was projected. The pre-restoration YOD was projected to be 2091. Post-restoration (post-2011), the YOD was projected to be 2130. The trend line equates to an average annual land loss of approximately 8 (eight) acres per year.

3.1.1.3 Sediment Budget

A Whiskey Island design sediment budget was developed based on historic longshore sediment transport rates available in the literature sources, computation of subsidence utilizing the projected subsidence range for the Project area taken from the Louisiana CPRA Master Plan 2012 Update (CPRA, 2012a), and volumetric changes that occurred between 2006 and 2012. The budget consisted of two (2) cells, gulf-side, and marsh-side. The gulf-side cell extended from the depth of closure, -10.5 feet NAVD88, to the approximate seaward limits of the existing and proposed marsh areas. The depth of closure was calculated based on the empirical method developed by Birkemeier (1985) as presented in USACE (2010). The marsh-side cell encompassed the existing and proposed marsh areas as well as the effects of overwash. The marsh area created for the TE-50 project was excluded from the sediment budget analysis as the island design survey did not encompass this area.

Multiplying the 8.8 mm/year geologic subsidence rate (CPRA, 2012b) times the gulf-side cell and marsh-side cell acreages yielded approximately -79,000 cubic yards (CY)/yr and -26,000 CY/yr of erosion loss due to subsidence for the gulf-side and marsh-side cells, respectively. The predicted longshore transport rates reported in the literature were approximately 50,000 CY/yr moving west at the west end of the Island and approximately 5,000 CY/yr moving east at the east end of the Island (Stone and Zhang, 2001).

The total net gulf-side cell erosion loss between 2006 and 2012 equaled approximately -322,000 CY/yr. The total overwash rate transported from the gulf-side cell to the marsh-side cell was then computed by subtracting the gulf-side cell geologic subsidence rate and longshore transport rates estimates from the net gulf-side erosion loss, yielding approximately +188,000 CY/yr of overwash.

The total net marsh-side cell volume change between 2006 and 2012 equaled approximately +109,000 CY/yr of gains attributed to the overwash processes. Accounting for subsidence, the marsh losses into the back-bay were computed equal to approximately -53,000 CY/yr.

To validate the sediment budget, an analytical approach was developed. Based on professional judgment and historic profile comparisons, it was assumed that the active beach profile within which the majority of changes along the beach occur ranges from +3 ft NAVD88 to -7 ft NAVD88. Applying the design shoreline change rate of -42.7 ft per year along the Island's length of approximately 21,700 ft yielded approximately- 343,000 CY of beach erosion per year, which is the same order of magnitude as the gulf-side cell loss of approximately -322,000 CY/yr. Further, the marsh loss analysis performed in TBBSR resulted in an estimated trend of approximately 14.4 acres of marsh loss per year (USACE, 2010). Applying this acreage rate to the range of elevations defining the marsh component of the Island, from +2.0 ft NAVD88 to -1.5 ft NAVD88 (intertidal and subtidal zones), yielded approximately -74,000 cy/yr, which is the same order of magnitude as the combined marsh-side cell subsidence and back-bay losses of approximately -81,000 cy/yr.

3.1.2 Geology

Whiskey Island

The deltaic plains of coastal Louisiana consist of soils that can be divided into six (6) primary associations. These soils are primarily mineral deltaic, or mineral coastal deposits formed from alluvial or aeolian processes. The six (6) coastal associations often contain soils with organic matter in the upper horizon, or throughout the whole profile (USACE, 2004b).

The geology of Whiskey Island is characterized by the transgressive barrier island depositional environment associated with the deltaic cycle. These sediments are deposited by marine processes. The seaward edge of the Island is a curvilinear form consisting of loamy fine sand (fluid mineral soils) formed by means of marine reworking. The back-barrier saltwater marsh consists of level, very poorly drained soils that have a mucky surface layer (high levels of organic matter), and mucky or clayey underlying materials (USACE, 2010). Specific geotechnical investigations including test borings were conducted on Whiskey Island as part of the prior CWPPRA project designs (TE-47, Moffatt & Nicholl, 2004; TE-50, Eustis Engineering, 2007). Auger borings taken on the beach and dune revealed fine sand with shell fragments while the back-bay and marsh borings indicated soft clays and silty clays with lenses of sand, silt and shell composing the upper 65 ft, underlain by medium stiff pro-delta clays with silt and sand lenses (LDNR, 2007).

Sediment samples from the native beach were collected by Soil Testing Engineers (STE) in 2004 and submitted for textural analysis to enable evaluation and comparison to available Borrow Area sediments (STE, 2004). The range in sample mean grain size is presented in Table 3-1. There is a wide range of mean grain size both within and between the various locations sampled. The samples in this analysis ranging from 0.113 mm to 0.206 mm with a composite sample mean of 0.18 mm.

Table 3-1: Native Sediment Range of Sample Means*

Location	Approx. Elevation (ft, NAVD)	East Flank Mean (mm)	West Flank Mean (mm)
Subtidal – Gulf	<0	0.136	0.113
MLW – Gulf	0	0.205	0.204
Subtidal – West Flank Crest	<0	N/A	0.193
Intertidal – Gulf	0-2	0.185	0.198
Subaerial	>2	0.205	0.206

*Source: Moffatt & Nichol, 2004

Borrow Areas

Ship Shoal Block 88

Ship Shoal is an east-west elongate sand body approximately 40 miles in length and varies from two (2) to six (6) miles in width. The sand body encompasses approximately 100,000 acres. It is located approximately five (5) miles south of the Isles Dernieres. The shoal is the remnant of a barrier headland and island deposited during a previous Mississippi River delta-building episode, the Maringouin Delta complex, which has been dated at 7,000 to 6,000 Years Before Present (YBP). Its east-west extent runs from about fifteen (15) miles west of Raccoon Island eastward to the area offshore of Cat Island Pass. The Maringouin complex has been characterized as one (1) of a number of submerged relict deltaic headlands deposited during earlier stages in the evolution of the Mississippi Delta (Kulp et al., 2005).

As the need for material to restore the shorelines and marshes of Coastal Louisiana has increased in magnitude, Ship Shoal has been studied extensively during the past three (3) decades because of its size and large volume of sand. Analyses have indicated that greater than 90% of the sediment in Ship Shoal is quartz sand (Kulp et al., 2001). Most relevant to the Project are studies of the potential borrow site referred to as Ship Shoal OCS Lease Block 88, located south of Raccoon Island. Extensive geophysical and archaeological studies of this and adjacent blocks were undertaken in 2003 (C&C, 2003). Analyses including geotechnical data previously acquired by the Louisiana Geological Survey and the USGS were presented in a 2003 report

from the EPA covering portions of Ship Shoal Blocks 87, 88, 89, 94, and 95. The report included High Resolution Geophysical and Archaeological Surveys. Sand-rich strata were discernible and identified on the seismic profile data that, verified with sediment core data, indicated surficial sand thickness of up to sixteen (16) ft (*ibid.*).

As discussed above, Ship Shoal is a marine sand body that originated as sediment deposited during the growth of the Mississippi River Maringouin Delta Complex followed by fluvial abandonment of the delta complex and reworking of the abandoned delta to form an erosional barrier headland. Continued disintegration of the former delta complex resulted in mainland detachment of the headland to form a barrier island system. Ultimately, rapid relative sea-level rise resulted in submergence of the barrier island to form an inner shelf shoal that has undergone continued reworking so that no relict barrier island deposits are preserved in Ship Shoal. The south-facing (seaward) shoal front slopes gradually upward to the shoal crest, while the lee side-slope is steeper. The shoal crest, subject to wave and current action, consists of coarser sand and shell, while the shoal front is finer sand. Analyses have indicated that greater than 90% of the sediment in Ship Shoal is quartz sand (Kulp et al., 2001). The volume has been estimated to be greater than 900 MCY (Stone et al., 2004). The majority of the shoal is crisscrossed by oil and gas pipelines which constrain the limits and extent of sand excavation. The estimated volume of sand available in Ship Shoal Lease Block 88 is 74 MCY.

A detailed geotechnical investigation was conducted by STE within Ship Shoal Block 88 in 2004. Thirty-five (35) vibracores were collected from a refined 730 acre portion of the 2003 C&C study area within Block 88. The 20-foot long vibracores were collected by Alpine Ocean Seismic Survey in a grid pattern with an approximate spacing of 1,200 ft. STE analyzed the grain size, geology, and sand unit thickness in the Alpine vibracores to provide sediment characteristics and define the limits of suitable sediments for beach fill construction. The vibracores collected confirmed beach quality sand in the upper stratigraphic unit with the upper sand layer consisting of fine grained sand. The mean diameter grain size of the sandy deposit was approximately 0.19 mm and having a thickness ranging from four (4) ft to twenty (20) ft with an average thickness of approximately 15.4 ft. The sediment has a relatively uniform grain size with little variation from the upper limits to the lower limits of the sand body.

Whiskey 3A

OSI carried out geophysical and geotechnical surveys in a potential borrow area south of Trinity and Whiskey Islands and Whiskey Pass in Louisiana State waters (LDNR, 2007). Their analyses and interpretation identified strata indicative of sandy material and finer, silt-clay material led to delineation of three (3) potential borrow areas assumed to contain suitable sediment for beach, dune, and marsh restoration. OSI then conducted a vibracore investigation of the three (3) subareas within Borrow Area 7, redesignated as Areas 1, 2, and 3 (Khalil and Cantu, 2008).

Borrow Area 2 was utilized for the TE-50 project. Borrow Area 3 was subdivided into three (3) subareas, A, B, and C based on excluding avoidance areas, pipeline corridors, and other magnetic anomalies.

Within Area 3, the subbottom data revealed that sedimentary strata were discernible and identified on the seismic profile data. The isopach data derived from the geophysical measurements displayed marsh compatible sediments up to twenty (20) ft in thickness. Although the study area appeared to be composed of sand and mixed sediments, no paleo channels were detected in the shallow subsurface (OSI, 2006).

Over four (4) hundred samples were analyzed from the vibracores. The samples indicated the strata were comprised of silty-clay to silty-sand, suitable for marsh fill, above clay. The Whiskey 3A study area was composed of 27% to 61% sand with an average percentage of 46.4% sand. The sediment varied in percent sand with the sandier material located in the south and center portions of the study area. The upper strata ranged in sediment thickness from 15.4 ft to 20.1 ft. with an average thickness of 18.8 ft (OSI, 2006).

The estimated volume of sand available in Subarea 3A is 4.72 MCY. Above the identified sand strata is a layer of overburden consisting of silt and clay suitable for marsh creation. The estimated volume of overburden available in Subarea 3A is 7.97 MCY.

3.1.3 Air Quality

Air quality standards have been developed by the United States EPA for protection of public health and welfare, as required by the Clean Air Act. Jurisdiction over air quality on the OCS west of the Florida-Alabama border shifts to the BOEM, but the standards do not change.

Whiskey Island

There are no air quality monitoring stations in Terrebonne Parish, although existing air quality can be considered good. Except for minor boat traffic and small oil & gas processing facilities, there are no air pollution sources located on or near Whiskey Island. The closest major sources of air pollution are 70 or more miles away in the urban-industrial corridor from New Orleans to Baton Rouge (USEPA, 2004).

Borrow Areas

Ship Shoal Block 88 is located in an area that is in attainment for all of the National Ambient Air Quality Standards for all criteria pollutants and for Prevention of Significant Deterioration purposes is classified as a Class II area (MMS, 2004).

The Whiskey 3A Borrow Area is located in Terrebonne Parish where the air quality near Whiskey Island is considered good.

3.1.4 Water Quality

Whiskey Island

Water quality in the Terrebonne Basin is influenced by freshwater input from its watershed as well as outflows from the Mississippi and Atchafalaya Rivers. There is a great deal of seasonal and annual variability, however the maximum flows tend to occur in the spring and the minimum in the fall. The enormity of the Mississippi River watershed, which includes approximately two-thirds of the continental United States, makes controlling pollutant load a national issue.

The Louisiana Department of Environmental Quality (LDEQ) has established four (4) categories for water use under the Louisiana Environmental Regulatory Code (LAC Title 33, Chapter 11) that apply to the Project area: Primary Contact Recreation, Secondary Contact Recreation, Fish and Wildlife Propagation, and Oyster Propagation. None of them are prohibited around the Island; however the Louisiana Department of Health and Hospitals, along with the LDEQ and the LDWF, issued a fish consumption advisory (March 8, 2006) for king mackerel (*Scomberomorus cavalla*), cobia (*Rachycentron canadum*), blackfin tuna (*Thunnus atlanticus*), and greater amberjack (*Seriola dumerili*) caught off the coast of Louisiana due to elevated levels of mercury (LDEQ 2006). Further, the back-bay estuaries of Isles Dernieres are listed as fully supporting primary contact recreation, secondary contact recreation, and oyster production but do not fully support fish and wildlife propagation. Regardless, fishing remains a popular activity throughout the Isles Dernieres. In the Project area, oyster propagation was identified as being impaired in some areas. The U.S. EPA and LDEQ identified low dissolved oxygen levels and high fecal coliform levels as the suspected causes for impairment for oyster propagation, but were not able to identify the sources of these problems. This system has been listed as impaired for one (1) or more uses, but the cause of impairment is listed as a “non-pollutant” (USDA, 2005). The suspected impairment, turbidity, is caused by the close proximity of the Gulf of Mexico, erosion, and suspended sediments sourced from erosion within the Terrebonne Bay estuary and discharged from the Mississippi and Atchafalaya Rivers. The Island contains no fresh surface water and, due to the distance from any significant source, contains no threat of fecal coliform contamination. Consequently, there are no apparent water quality problems for Whiskey Island (USACE, 2010).

Borrow Areas

The Terrebonne Basin Coastal Bays and Gulf waters were listed as fully supporting all designated uses except fish and wildlife propagation. The suspected causes of impairment are

upstream sources and atmospheric deposition of phosphorus, nitrogen, and mercury. Discharges associated with drilling such as water-based mud and cuttings have been released in the region over the past several decades. All discharges are periodically tested and must meet the National Pollutant Discharge Elimination System limits set by the U.S. EPA. These limits are necessary since produced-water discharge may have higher salinity levels, organic content and dissolved metals, and lower dissolved oxygen levels than the receiving water. Hydrocarbons found in the Gulf of Mexico come primarily from natural seeps and anthropogenic shore-based and offshore sources (USACE, 2010).

3.1.5 Noise

Noise is typically associated with human activities and habitations. However, the Project area includes a remote Barrier Island, nearshore Borrow Area, and offshore Borrow Area. The noise from distant urban areas and oil and gas production facilities surrounding the Project area has little if any impacts on the area. As there are no noise-generation sources on Whiskey Island or on either Borrow Area, the only anthropogenic noise would be from transient vessel traffic. Since access to the Isles Dernieres Wildlife Refuge is restricted, disturbance to resident wildlife and avifauna should be minimal.

3.1.6 Water Resources

Whiskey Island is remote, uninhabited, and has no public or private infrastructure. Water resources, as commonly understood, do not exist.

3.1.7 Climate

General

The climate of coastal Louisiana is influenced by the Gulf of Mexico waters and winds. These maritime conditions give rise to a humid subtropical climate, with long, hot, humid summers, and mild, abbreviated winters (USACE, 2004b). Summer temperatures average approximately 81.0°F. Winters are typically mild, with average temperatures of approximately 52.0°F, however short periods of colder temperatures may be induced by dry continental arctic air. The daily averages for coastal Louisiana are 78.4°F, and 58.8°F for the maximum and minimum temperatures respectively. The climate in the Terrebonne Basin provides an extended frost-free period (264 day per year average), resulting in an average growing season of 317 days per year (USDA, 2005). The maritime tropical air masses typically move inland and mix with continental air masses, producing abundant rainfall, impeding winter air mass passage, and reducing extreme inland temperatures. Wind records indicate that annual average wind speed in coastal Louisiana is approximately 9.8 ft per second (~6.7 miles per hour) from the southeast (USACE, 2004b). Localized rain events, which consist of severe summer storms, and sporadic, high-energy winter

disturbances, are typically controlled by these offshore unstable air masses and winds. The average rainfall in the coastal zone of Louisiana is approximately 54 inches a year. Though rain events occur frequently (approximately 74 days each year), and are fairly well distributed throughout the year, storm frequencies are slightly elevated during the summer (July typically contains the highest storm frequency), and are typically least severe, and least frequent in October (USDC, 1998). Compounding the effects of severe wind and rain events is the low topography that is common along the coastal marsh and barrier islands. Coastal Louisiana is a vulnerable target for tropical waves, tropical depressions, tropical storms, and hurricanes generated in the tropical Atlantic, the Caribbean Sea, and the Gulf of Mexico. Historical data from 1899 to 2007 indicate that 30 hurricanes and 41 tropical storms have made landfall along the Louisiana coastline (National Weather Service website and National Hurricane Center website).

Whiskey Island

Whiskey Island and its neighboring islands are aligned in an east-west arc and are susceptible to both extratropical frontal storms and tropical storms. The former are primarily winter events, with winds from the south, while the latter occur in the warmer months and wind directions are quite variable, depending on the storm track. The Louisiana coast feels the impact of a tropical storm or hurricane on average every 1.2 years, with actual landfall on average every 2.8 years (Stone et al., 1997; Roth, 1998). Regardless, the shallow nature of the sea floor approaching the islands facilitates storm surge flooding of coastal areas, which increases beach erosion and island washover. As such storms approach or pass by the coastline the counterclockwise (cyclonic) wind circulation can drive waves and surges that can impact both the Gulf-facing and back–barrier shorelines. In addition to storm surge flooding, the post-storm retreat can erode tidal inlet shores and exacerbate breach formation.

Borrow Areas

The Ship Shoal Block 88 and Whiskey 3A Borrow Areas are completely submerged, however both are susceptible to storm-related sediment transport and impacts to oil and gas infrastructure located adjacent to the borrow areas. The shape of Ship Shoal, with a gradual seaward slope and a steeper shoreward slope, is indicative of its gradual migration to the north. Profile comparisons have demonstrated migration of approximately 0.6 miles during the last century (Penland et al., 1989). Stone (2000) observed sediment transport events on Ship Shoal associated with storm passage. The direction of transport (onshore vs. offshore) varied during and among the storms. Ship Shoal mitigates the wave field off the adjacent coast during storms (Stone et al., 2004).

3.2 BIO-PHYSICAL ENVIRONMENT

3.2.1 Vegetation Resources

Whiskey Island

Vegetation is an important factor in maintaining both the geomorphology and ecology of Whiskey Island because it serves to stabilize beach and dune sediment, assists in dune-building by trapping aeolian sand, stabilizing marsh soil against wave action, and building marsh by trapping overwashed sediment. It provides habitat for resident wildlife, shelter and foraging environment for migratory avifauna, and vegetative detritus, an important component of the estuarine food chain, particularly for planktonic fish and invertebrate larval and juvenile stages and for other detritus-feeding organisms.

Common beach and dune species include: smooth cordgrass (*Spartina alterniflora*), bitter panicgrass (*Panicum amarum*), eastern baccharis (*Baccharis halimifolia*), sea oxeye (*Borrichia frutescens*), coastal dropseed (*Sporobolus virginicus*), sedges (*Cyperus spp.*), marsh elder (*Iva frutescens*), beach morning glory (*Ipomoea imperati*), seashore paspalum (P*aspalum vaginatum*), sea blite (*Suaeda linearus*), seaside goldenrod (*Solidago sempervirens*), saltmarsh fimbristylis (*Fimbristylis castanea*), Olney's bulrush (*Scirpus olneyi*), and sea purslane (*Sesuvium portulacastrum*). Typical marsh species include: saltwort (*Batis maritima*), Bigelow's saltwort (*Salicornia bigelovii*), Black mangrove (*Avicennia germinans*), and marsh hay cordgrass (*Spartina patens*) (Ritchie et al., 1989).

Whiskey Island exhibits little topographic relief, thus the distribution of the vegetation does not reflect zonation associated with elevation differences (high dune, upland, etc.). Distribution appears to be controlled by overwash events and internal drainage, or the lack thereof. The vegetation associated with the two (2) mangrove marshes is the same mix of species, with apparent growth benefits from proximity to tidally influenced waterways.

Borrow Areas

No terrestrial or submerged vegetation is present.

3.2.2 Aquatic Resources

3.2.2.1 Planktonic Resources

Whiskey Island

Planktonic organisms form the base of the food chain in many estuarine communities. Their algal component, phytoplankton, perform photosynthesis, the primary source of energy driving the trophic "chain." Phytoplankton are consumed by zooplankton and filter-feeding benthic organisms, such as oysters and clams. Zooplankton is the link in the trophic chain between phytoplankton and higher-level consumers, such as the larvae, juveniles, and adults of many commercially-important invertebrates and fishes. The bacterioplankton community serves primarily as decomposers, returning nutrients to the water column and benthos. The plankton of Louisiana coastal waters were inventoried and studied by Perret et al. (1971) who noted that the dominant zooplankter throughout the area was the circumglobal calanoid copepod *Acartia tonsa*. Further studies by Conner and Day (1987) found that zooplankton abundance was affected by numerous environmental factors, including tidal flushing, organic detritus availability, freshwater inflows, turbidity, and dissolved oxygen concentration. They also noted that the fish larvae collected from the Barataria Basin included *Brevoortia patronus*, the Gulf Menhaden or Pogy of local commercial importance. Day et al. (1989) linked zooplankton species diversity to estuarine salinity, which means that floods, diversions, and intentional releases of freshwater all have the potential to alter the makeup of the planktonic community in the Isles Dernieres.

Borrow Areas

The Gulf waters over Ship Shoal support a more oceanic assemblage of plankton characterized by less variation in salinity, temperature, turbidity, and nutrient concentration. Phytoplankton productivity is improved because reduced turbidity results in lowering of the compensation depth. Studies have shown that the dominant phytoplankton group in the northern Gulf is diatoms, unicellular algae with a silica shell. The plankton assemblage above the continental shelf is more variable than the assemblage above deeper water, attributed to changes in nutrient availability, salinity, zooplankton predation, and vertical mixing (DOI-MMS, 2002).

There have not been specific studies of the planktonic assemblage on the Whiskey 3A Borrow Area. Since it is on the inner shelf, but still under the influence of the adjacent Terrebonne Basin estuary, the conditions should be similar to those described above for Whiskey Island.

3.2.2.2 Benthic Resources

Whiskey Island

While the waterbottom in the Isles Dernieres would appear to be almost uniformly mud, except where storm overwash has created a veneer of sand, it can present a diverse assemblage of benthic species. Day et al. (1989) described various groupings based on size, trophic ecology, and habitat selection: micro-, meio-, and macrobenthos (represented by protozoans, nematode worms, and polychaete worms and decapod crustaceans, respectively); suspension feeders, filter feeders, selective- and non-selective deposit feeders, raptorial feeders, and predators (represented by bryozoans, bivalve mollusks/oysters, sand dollars, gastropods/moon snails, oyster drills, and errant polychaetes, respectfully); and interstitial fauna, primarily small arthropods and micro mollusks residing between sediment particles on sandy beaches. In addition, oysters have created their own hard-bottom substrate, in the form of oyster reefs, where conditions have been appropriate (estuarine salinities, tidal flow).

Using existing information from the LDWF, Oyster Lease Survey Section web site (LDWF, 2011) and from CPRA, Landrights Division, it was determined that there are no oyster leases within 3,000 ft of the Project area.

Day et al. (1989) pointed out that the majority of above-ground biomass in salt marsh habitats is not consumed by herbivores, but rather dies back seasonally and decays, facilitated by bacteria and fungi, to produce organic detritus. The latter is exported, by means of tidal flow, to the adjacent estuary. Mitsch and Gosselink (1993) emphasized the importance of organic detritus in the estuarine food chain, with consumers in the water column, on the sediment, and within the sediment. The same situation holds for mangrove marsh habitats, which produce volumes of leaf litter that is broken down to detritus by bacteria, fungi, nematode worms, gastropods, and arthropods.

Borrow Areas

The average algal biomass over Ship Shoal varies seasonally. Sediment algal biomass was highest in spring and summer when it exceeded that of the overlying water column over much of Ship Shoal. Light reaches the seafloor on Ship Shoal to stimulate the growth of benthic algae year round. The bottom benthic algae biomass is high and the high proportion of diatoms (compared to settled phytoplankton) suggests that the benthic primary production may comprise most of the primary production on Ship Shoal (Stone et al., 2009).

According to Dubois et al. (2009) Ship Shoal has both high diversity (161 species) and high biomass (mean 26.7 g/m2) of macrobenthos, predominantly polychaete worms, crustaceans, and

chordates. Stone et al. (2009) found that the macroinvertebrate infauna community on Ship Shoal was a mixture of species from Northern Gulf bays and the continental shelves off Florida and Texas. The diversity and abundance of the macrobenthos is affected by the foraging activities of predators, such as shrimp, crabs, and croaker. They also emphasize the importance of this and similar sandy shoals in providing habitat diversity on a shelf dominated by soft, muddy substrate beneath seasonally-hypoxic water, and they postulate that the shoal may serve as a refuge for benthic species displaced by hypoxic events.

Of particular interest to Stone et al. (2009) was the presence of Blue Crab, *Callinectes sapidus*, spawning, reproducing, and foraging on the shoal from April through October. Female crabs apparently go through a continuous cycle of reproduction, producing a new egg mass (sponge) approximately every twenty-one (21) days. Fecundity appears to be correlated with infaunal prey density, which declines somewhat over the course of the crab reproductive season. While Blue Crabs are a significant inshore fishery resource in Louisiana, there is no fishery for them on Ship Shoal.

There have not been specific studies of the benthic species assemblage on the Whiskey 3A Borrow Area. Since it is on the inner shelf and obviously still under the strong influence of the adjacent Terrebonne Basin estuary, the conditions should be similar to those described above for the benthos at Whiskey Island.

3.2.3 Fisheries

Whiskey Island

A wide variety of commercially and recreationally important finfish species utilize the Barataria Bay-Terrebonne Bay estuarine environment, including the Isles Dernieres, at some or all stages of their life cycles. This has resulted in Louisiana's estuaries being considered the most productive in the United States (USACE, 2004a). In addition, the Barataria-Terrebonne estuarine system produces more white shrimp, *Litopenaeus setiferus*, and brown shrimp, *Farfantepenaeus aztecus*, than any other section of the Louisiana coast (USEPA, 1997). Unfortunately, the high resource productivity has been attributed to the ongoing deterioration of the barrier islands, back-barrier marshes, and interior bay marshes. As they degrade and break apart more "edge" habitat is exposed, and it is the edge interfaces that provide sloughed-off organic detritus, shelter, and other immediate benefits to organisms in the food chain.

The Timbalier and Isles Dernieres barrier island wetlands, flats, and subtidal habitat provide unique nursery, foraging, and spawning habitat for numerous marine and estuarine species of commercial and recreational importance. Coastal wetlands, such as occur throughout Terrebonne Bay, produce nutrients and detritus that contribute to the overall productivity of the

estuary aquatic food web. The Terrebonne-Barataria Area is utilized by distinct groups of fish and crustaceans that exhibit a preference for barrier island habitats over mainland habitats or are dependent on these habitats as transients during portions of their life history for foraging and predator refuge (USACE, 2010).

Common surf zone species include gulf menhaden (*Brevoortia patronus*), spot (*Leiostomus xanthurus*), striped mullet (*Mugil cephalus*), southern kingfish (*Menticirrhus americanus*), anchovies (*Anchoa spp*.), scaled sardine (*Harengula jaguana*), Florida pompano (*Trachinotus carolinus*), Atlantic bumper (*Chloroscombrus chrysurus*), spotfin mojarra (*Eucinostomus argenteus*), and rough silverside (*Membras martinica*). The surf zone temporarily is used by larval and juvenile life stages of some of these species awaiting tidal transport to back-barrier, bay, or mainland habitats. Barrier island flats typically are used by white mullet (*Mugil curema*), longnose killifish (*Fundulus similis*), darter goby (*Ctenogobius boleosoma*), and inland silversides (*Menidia beryllina*). Marsh edge and interior creeks are used by brown shrimp, white shrimp, Atlantic croaker (*Micropogonias undulatus*), spotted seatrout (*Cynoscion nebulosus*), sheepshead minnow (*Cyprinodon variegatus*), killifish, and sand seatrout (*Cynoscion arenarius*), some of which are constituents of assemblages that use the other island aquatic habitats (Foreman, 1968; Zimmerman, 1988). Additionally, shallow, back-bay areas are colonized by American oysters (*Crassostrea virginica*).

Economically important fish species such as spotted seatrout, red drum (*Sciaenops ocellatus*), black drum (*Pogonias cromis*), and southern flounder (*Paralichthys lethostigma*) use the barrier island habitats (e.g., shorelines and passes) for foraging areas, nursery habitat, and staging areas during spawning or associated migratory aggregations (Saucier and Baltz, 1993). Additionally, post larval and early juvenile red drum and mangrove snapper (*Lutjanus griseus*) have a preference for intra-island creeks and ponds, which provide both shelter and forage (Thompson, 1988).

Borrow Areas

Ship Shoal is located on the OCS and is surrounded by oceanic waters. As such, the ichthyofauna can include a seasonal mix of tropical and temperate pelagic species as well as adult representatives of the benthic species encountered in the adjacent estuary. Regarding the latter, the shoal is reported to support commercial harvesting of both white and brown shrimp and spotted sea trout (USACE, 2009). The seasonally-migratory pelagic species that may occur over Ship Shoal are dominated by the families Sciaenidae (drum, croaker, sea trout) and Scombridae (mackerel, tuna, and tuna-like fishes), along with dolphinfish (*Coryphaena hippurus*), cobia (*Rachycentron canadum*), amberjack (*Seriola spp.*), tarpon (*Megalops atlanticus*), bull shark (*Carcharhinus leucas*), sandbar shark (*C. plumbeus*), blacktip shark (*C. limbatus*), and others. Also to be expected are occasional occurrences of oceanic billfishes, such

as Atlantic sailfish (*Istiophorus platypterus*) and blue marlin (*Makaira nigricans*) (Gulf Of Mexico Fisheries Management Council, 2010).

There have not been specific studies of the fish assemblage on the Whiskey 3A Borrow Area. Since it is on the inner shelf and under the strong influence of the adjacent Terrebonne Basin estuary, the conditions should be similar to those described above for the ichthyofauna at Whiskey Island, with a preponderance of the demersal or benthic species (drums, croakers, and flatfishes).

3.2.4 Wildlife Resources

3.2.4.1 Herpetofauna (Amphibians and Reptiles)

There being no permanent fresh water bodies on Whiskey Island it is difficult to conceive of any amphibian presence. Two (2) species of toad have been reported from Louisiana salt marsh and beach habitats, but not on the barrier islands (Dundee and Rossman, 1989; USFWS, 2011a). The Gulf salt marsh snake, *Nerodia clarkii clarkii*, is known from Timbalier Island (personal observation by the TBBSR PDT), and the diamondback terrapin (*Malaclemys terrapin*) is a salt marsh resident that may occur in the Isles Dernieres.

3.2.4.2 Mammals

The only terrestrial mammals recently noted from the Isles Dernieres are raccoon, *Procyon lotor*, and coyote, *Canis latrans*, both of whose tracks were seen by the TBBSR PDT (personal observation). The destructive exotic nutria, *Myocaster coypus*, is an invasive rodent that is common throughout Louisiana's freshwater and estuarine marshes, so its presence at Whiskey Island would not be surprising. Neither amphibians and reptiles nor terrestrial mammals would be present at either Borrow Area, both being completely submerged in the Gulf of Mexico.

3.2.4.3 Marine Mammals

One (1) species of cetacean frequents the estuarine area of the Isles Dernieres, the bottlenose dolphin, *Tursiops truncatus*. A second species of dolphin, the Atlantic spotted dolphin, *Stenella frontalis*, does not occur in inshore areas, but is known to occur in nearshore shelf waters, thus it may be reported from both Borrow Areas.

3.2.5 Avian Communities

Terrebonne Bay is within the Mississippi Flyway, a migratory bird corridor that extends from the Mackenzie River in Canada south to Coastal Louisiana. For some species, the migration pattern extends all the way to Patagonia. It is utilized by a large cross-section of the avifauna of North

America, including waterfowl, shorebirds, and songbirds. Many of the migrants depend on the coastal wetlands for rest and sustenance both before and after crossing the Gulf of Mexico (Condrey et al., 1995; Moore et al., 1990). The continued loss of wetland habitat for wintering and neotropical migratory birds has increased concern for conservation measures (USACE, 2004b). Detailed species lists have been compiled for the birds of the Terrebonne-Barataria Basins and the Isles Dernieres (Leumas, 2010; LCWCRTF and WCRA 1999) that include numerous species in numerous families (waterfowl, wading birds, diving birds, colonial nesting birds, songbirds, shorebirds, migratory birds, seabirds, and raptorial birds). Raccoon Island, immediately west of Whiskey Island, is a brown pelican (*Pelicanus occidentalis*) rookery. From 2007 through 2009 the LDWF relocated pre-fledgling brown pelicans from Raccoon to Whiskey in an attempt to initiate formation of a new rookery. Monitoring through 2010 indicated that nesting was not observed at the relocation site. The monitoring is ongoing, but the conclusion was that protection and restoration of existing rookeries would probably be a more appropriate course of action (C. Lejeune, LDWF, personal communication, 2012; Walter, S.T. et al., 2011).

3.3 CRITICAL BIOLOGICAL RESOURCES

3.3.1 Essential Fish Habitat

Essential Fish Habitat (EFH) is defined as waters and substrates that are necessary for fish reproduction and growth to reproductive maturity. In the Isles Dernieres, EFH includes tidally-influenced wetlands and the subtidal shallows around Whiskey Island, the muddy sea floor, including the Whiskey 3A Borrow Area, Ship Shoal Block 88 Borrow Area, and the water column above the aforementioned substrates. The barrier islands of the Isles Dernieres and the Timbaliers form a partial barrier that protects and regulates the physical condition of the interior estuarine wetlands of the Terrebonne Basin. Without protection from unfettered intrusion of oceanic-salinity water the fresh water-dependent marsh vegetation could not survive. Once the vegetation dies, its sediment-binding roots will be gone and the sediment will be susceptible to rapid erosion from wave and tidal action. Converted to open water, the former marsh areas cease to provide the shelter and nursery habitat that is of so much value to the State's marine resources.

Protection of EFH is important because of Louisiana's commercial fisheries productivity, which is second only to Alaska, at greater than 850 million pounds in 2012 (NOAA Fisheries, 2012). Among the commercially important species occurring in the Isles Dernieres are striped and white mullet, Atlantic croaker, Gulf menhaden, Florida pompano, spotted and sand seatrout, southern flounder, black and red drum, white and brown shrimp, and blue crab. In addition, these and other species are commonly preyed upon by larger predators that are managed by federally-mandated fisheries management plans such as the Gulf of Mexico Fisheries Management Council.

The EFH at Whiskey Island consists of the waters and water bottoms surrounding the Island, including the beach and marsh areas, particularly the tidal creeks and ponds within the marsh. Those areas are supportive of larval and juvenile white and brown shrimp and stone crab, larval, juvenile, and adult drum and other sciaenid fishes, and the larvae and juveniles of a variety of snapper species (Lutjanidae). The water column and water bottom at the Whiskey 3A Borrow Area are supportive of the same range of organisms.

The EFH at Ship Shoal consists of the water column, sandy shoal itself, and adjacent soft mud bottom. Adult white and brown shrimp, stone crabs, and the sea trout species forage on and around the shoal. Over the shoal the pelagic species listed in Section 3.2.2.3, above, will be transient, rather than permanent residents. On Ship Shoal and elsewhere on the inner shelf, wherever there are oil and gas production and transmission structures, the fish fauna is altered by their presence. Hard structures provide substrate for algae, sponges, hard and soft corals, barnacles, and a wide variety of other encrusting invertebrates. They, in turn, attract an assemblage of small fishes which feed and gain shelter from the structures. The presence of such prey attracts pelagic and demersal predators, such as the mackerel-like Scombridae, amberjack, and snappers. Ship Shoal Block 88 lacks structures; however there are numerous structures on the Ship Shoal lease blocks to the east and west, as well as south (seaward) and north (landward) of the shoal, thus these species are likely to be encountered at an elevated frequency.

3.3.2 Threatened and Endangered Species

Of the list of threatened and endangered (T&E) species that inhabit Louisiana and the Northern Gulf of Mexico, only a few are known to occur in the Project area. Table 3-2 is a comprehensive annotated list of T&E species (USACE, 2010).

None of the T&E fish species are known from the Isles Dernieres or the Borrow Areas. Gulf sturgeon (*Acipenser oxyrhinchus desotoi*) occur from Lake Pontchartrain eastward, but not west of the Mississippi River (USFWS and GSMFC, 1995).

Table 3-2: Threatened & Endangered Species in Louisiana (from USACE, 2010)

Classification	Species	Scientific Name	Status	Jurisdiction	Found in Study Area?
Mammals	Florida Panther[a]	*Felis concolor coryl*	Endangered	USFWS	No
	Red Wolf[a]	*Canis rufus*	Endangered	USFWS	No
	West Indian Manatee	*Trichechus manatus*	Endangered	USFWS	Yes
	Louisiana Black Bear	*Ursus americanus luteolus*	Threatened	USFWS	No
Birds	Bachman's Warbler[b]	*Vermivora bachmanii*	Endangered	USFWS	No
	Eskimo Curlew[a]	*Numenius borealis*	Endangered	USFWS	No
	Ivory-billed Woodpecker[a]	*Campephilus principalis*	Endangered	USFWS	No
	Least Tern; interior population	*Sterna antillarum*	Endangered	USFWS	No
	Red-cockaded Woodpecker	*Picoides borealis*	Endangered	USFWS	No
	Piping Plover	*Charadrius melodus*	Threatened	USFWS	Yes
	Rufa Red Knot	*Calidris canutus rufa*	"Candidate"	USFWS	Yes
Reptiles	Hawksbill Sea Turtle	*Eretmochelys imbricata*	Endangered	USFWS/NMFS	Yes
	Kemp's (Atlantic) Ridley Sea Turtle	*Lepidochelys kempii*	Endangered	USFWS/NMFS	Yes
	Leatherback Sea Turtle	*Dermochelys coriacea*	Endangered	USFWS/NMFS	Yes
	American Alligator[c]	*Alligator mississippiensis*	Threatened	USFWS	No
	Gopher Tortoise	*Gopherus polyphemus*	Threatened	USFWS	No
	Green Sea Turtle	*Chelonia mydas*	Threatened	USFWS/NMFS	Yes
	Loggerhead Sea Turtle	*Caretta caretta*	Threatened	USFWS/NMFS	Yes
	Ringed Sawback Turtle	*Graptemys oculifera*	Threatened	USFWS	No
	Snake, Louisiana Pine	*Pituophis ruthveni*	Candidate[d]	USFWS	No

Fish	Pallid Sturgeon	*Scaphirhynchus albus*	Endangered	USFWS	No
	Gulf Sturgeon	*Acipenser oxyrinchus desotoi*	Threatened	USFWS/NMFS	No
	Dusky Shark	*Carcharhinus obscurus*	Candidate[d]	NMFS	No
	Sand Tiger Shark	*Odontaspis taurus*	Candidate[d]	NMFS	No
	Night Shark	*Carcharinus signatus*	Candidate[d]	NMFS	No
	Speckled Hind	*Epinephelus drummondhayi*	Candidate[d]	NMFS	No
	Saltmarsh Topminnow	*Fundulus jenkensi*	Candidate[d]	NMFS	No
	Goliath Grouper	*Epinephelus itajara*	Candidate[d]	NMFS	No
	Warsaw Grouper	*Epinephelus striatus*	Candidate[d]	NMFS	No
Invertebrates	Mussel, Fat Pocketbook	*Potamilus capax*	Endangered	USFWS	No
	Pink pearlymussel Mucket	*Lampsilis abrupta*	Endangered	USFWS	No
	Inflated (Alabama) Heelsplitter	*Potamilus inflatus*	Threatened	USFWS	No
	Louisiana Pearlshell	*Margaritifera hembeli*	Threatened	USFWS	No
Marine Mammals	Sperm Whale	*Physeter macrocephalus*	Endangered	NMFS	No
	Sei Whale	*Balaenoptera borealis*	Endangered	NMFS	No
	Humpback Whale	*Megaptera novaeangliae*	Endangered	NMFS	No
	Finback Whale	*Balaenoptera physalus*	Endangered	NMFS	No
	Blue Whale	*Balaenoptera musculus*	Endangered	NMFS	No
Plants	American Chaffseed	*Schwalbea americana*	Endangered	USFWS	No
	Louisiana Guillwort	*Isoetes louisianensis*	Endangered	USFWS	No
	Earth Fruit	*Geocarpon minimum*	Threatened	USFWS	No

[a] The Florida panther, red wolf, Eskimo curlew, and ivory-billed woodpecker are presumed to be extinct in the State.

[b] There has been no confirmed Bachman's warbler U.S. nesting ground sighting since the mid-1960s, however, several sightings of the species have occurred on wintering grounds during the last decade. This species may be extirpated in Louisiana.

[c] For law enforcement purposes, the alligator in Louisiana is classified as "Threatened due to Similarity of Appearance." They are biologically neither endangered nor threatened. Regulated harvest is permitted under State law.

[d] Candidate species are not protected under the ESA, but concerns about their status indicate that they may warrant listing in the future. Federal agencies and the public are encouraged to consider these species during project planning so that future listings may be avoided.

The only T&E marine mammal that might be encountered in the Project area is the Florida subspecies of the West Indian manatee (*Trichechus manatus latirostris*). Manatees are cold temperature-sensitive and tend to congregate in Florida during the winter, utilizing warm springs and power plant cooling water discharges, but they range widely in summer and have been reported from coastal Louisiana. They feed on submerged aquatic vegetation (SAV) which does not occur in the Project area, so their occurrence is unlikely.

Five (5) species of whales, all T&E, are known from the Northern Gulf of Mexico offshore of Louisiana, including both baleen and toothed whales. All occur well offshore, over the OCS, Continental Slope, and abyssal depths (USFWS, 2011a).

Five (5) species of marine turtle, all T&E, occur in the Northern Gulf of Mexico, including Louisiana waters. Kemp's Ridley Sea Turtle, *Lepidochelys kempii*, have been reported from the coastal shallows between Marsh Island, on the west side of Atchafalaya Bay, to the Mississippi River Birdfoot Delta. They have also been reported from estuarine areas (Fuller et al., 1987). Loggerhead Sea Turtle, *Caretta caretta*, are also common in Louisiana coastal waters, but not reported from the Isles Dernieres (ibid.). The third commonly observed marine turtle is the Green Sea Turtle, *Chelonia mydas*. All three (3) species nest on sand beaches and the hatchlings migrate offshore to spend lengthy periods as part of the *Sargassum* community, where they shelter in the floating vegetation and wrack, and feed on the community's varied infauna. As they grow the juveniles may be carried great distances by surface currents and their eddies, eventually abandoning the pelagic existence to become benthic foragers for crustaceans and other invertebrates over sandy, muddy, or reef-like substrates. Adult *C. mydas* feed on submerged vegetation, the others on crustaceans and other invertebrates. The remaining two (2) marine turtle species that have been reported from Louisiana are the Hawksbill Sea Turtle, *Eretmochelys imbricata*, and the Leatherback Sea Turtle, *Dermochelys coriacea*. The latter species lacks scales and a hard, horny shell; instead it has thick leathery skin. Leatherbacks primarily feed on jellyfish in the open ocean and do not appear to congregate in nearshore coastal Louisiana (ibid.). Hawksbills feed on sponges and other benthic invertebrates that inhabit reef and hard-bottom environments, which eliminates the Isles Dernieres and both Borrow Areas.

Marine turtle protection involves avoiding disturbances to nesting beaches and capturing turtles in advance of sediment dredging operations. Since none of the five (5) aforementioned species nest in Louisiana, nest disturbance is not a relevant issue (USFWS, 2011). The capture issue involves use of hopper dredges, which do take turtles that are feeding or resting on the sea floor. It is noted that the use of hydraulic cutterhead dredges has been determined to be unlikely to adversely affect any listed sea turtle species under the NMFS's purview (NMFS, 2003).

The only T&E bird species that occurs on the Isles Dernieres is the piping plover, *Charadrius melodus*, a diminutive migratory shorebird that winters in coastal Louisiana. In the Terrebonne-

Barataria area, piping plover are known from sparsely-vegetated beaches, overwash fans, accreting spits, and sand and mud flats (Doonan et al., 2006). The USFWS has designated the Isles Dernieres, from Raccoon Island to East Island, as critical habitat for Wintering piping plover. Critical habitat includes areas that support foraging and sheltering. Piping plover breeding occurs in late spring and summer elsewhere in North America and they migrate south in the fall (Nicholls & Balderassarre, 1990).

In September 2013, the USFWS proposed the red knot, *Calidris canutus rufa*, as a candidate for listing as a threatened species. Red Knot is a sandpiper that breeds in the Canadian Arctic and overwinters in the Northwestern Gulf of Mexico, the Southeastern U.S., and in South America as far south as Tierra del Fuego. Coastal Louisiana is both an overwintering area and a stopover area for birds migrating in fall and spring. Similar to piping plover, red knot forage on sandy beaches and tidal flats and roost on supratidal sandy shoreline and washover areas (USFWS, 2013).

In anticipation of the Project, the USGS has been routinely monitoring both piping plover and red knot presence and activity on Whiskey Island since the summer of 2012. Further, the USGS has conducted a benthic organism survey.

3.4 CULTURAL RESOURCES

3.4.1 Whiskey Island

As a component of the TBBSR study, a cultural resource assessment was conducted for six (6) areas of potential effect (APEs) encompassing the Isles Dernieres and the Timbalier Islands (Nowak et al., 2010a). The cultural resource assessment reviewed the geomorphology, prehistory, history and archaeology of the Isles Dernieres and Timbalier Islands to ascertain the probability for the presence of significant cultural resources, i.e., those archaeological sites and other historic properties possessing the qualities of significance and integrity defined by the National Register of Historic Places Criteria for Evaluation (36 CFR 60.4[a-d]).

Research included the review of archeological site files within ten (10) miles of the barrier island APEs, the results of previous investigations conducted within one (1) mile of the barrier island APEs, and databases (including the NOAA Automated Wreck and Obstruction Information System (AWOIS), MMS shipwreck database, and Louisiana shipwreck database) reporting the locations of shipwrecks and obstructions within ten (10) miles of the barrier island APEs. The geomorphology of Isles Dernieres and the Timbalier Islands was also reviewed as it relates to the potential for the existence of significant cultural resources. Historic maps and charts dating from 1853 to the present were reviewed along with the results of previously conducted geomorphologic studies that endeavored to reconstruct the historic shorelines of these island chains. Finally, historical research was conducted in order to ascertain the nature and extent of

historic navigation within the general vicinity of the study area. The review and correlation of the geomorphology of the study area with the regional prehistory and archaeological record of this part of south Louisiana indicate a low probability for significant prehistoric archaeological sites or prehistoric watercraft within the barrier island APEs. Additionally, any prehistoric archaeological remains that exist within these areas likely will consist of reworked and/or redeposited accumulations of cultural materials lacking integrity and having little research value (36 CFR 60.4[d]).

Consideration of the geomorphology and history of the study area also suggests that there is a low probability for significant historic archaeological sites or standing structures since the only historic structures on *terre firme* within the study area were the frame buildings of Village Bayou, on Last Island (Isles Dernieres), which were swept away by the hurricane of 1856. However, various probabilities for the discovery of historic shipwrecks exist within the barrier island APEs.

Ships could have grounded on nearby shoals as they attempted to navigate the natural channel behind Whiskey Island. Although no reported historic shipwrecks are recorded within the Whiskey Island APE, and while ships traveling to and from the village on Isle Dernieres probably did not pass within that APE, Confederate blockade runners probably did pass behind this reach of Isle Dernieres. As a result, the northwestern portion of the Whiskey Island APE has a moderate probability for historic shipwrecks. Areas within the APE south and west of this region were subaerially exposed until the mid-twentieth century; thus, they should be considered to have low potential for historic shipwrecks.

A Phase I submerged cultural resources remote sensing investigation was conducted by R. Christopher Goodwin and Associates, Inc. within the vicinity of Whiskey Island. Thirteen (13) targets exhibiting the potential to represent submerged cultural resources were identified, although none of the magnetic anomalies that compose those targets could be associated with sidescan sonar contacts, suggesting that all thirteen (13) targets are buried. No contacts were recorded by the subbottom profiler (Nowak et al, 2011b). Three (3) of the targets (07, 09, and 10) identified during the Phase I survey were determined to be in need of Phase II investigation prior to commencement of the Project. All of these targets consisted of groups of two (2) to four (4) magnetometer anomalies.

As part of the Project scope, a detailed Phase II cultural resource survey was conducted. Controlled archeological assessments (i.e., diver-conducted visual, tactile, and pneumatic probe survey) fully investigated each of the magnetic anomalies that comprised the target groupings and their surrounding areas. On Target 10, an iron fence post was discovered. All contacts with subbottom anomalies resulted in targeted close order pneumatic probe investigation. None of the anomalies were determined to be cultural resources. A determination of “No historic properties

affected" (36 CFR 800.4) was recommended for the three (3) targets investigated and concurrence with this recommendation has been received from the Louisiana State Historic Preservation Office (SHPO).

3.4.2 Ship Shoal Block 88 Borrow Area and Conveyance Corridor

In support of the TE-47 project design, a geophysical study and cultural resource assessment was undertaken at Ship Shoal in 2003 (C&C Technologies, 2003b) including bathymetry, magnetometer, sidescan sonar, and subbottom profiling at a 100-m line spacing. Analysis of the magnetic data identified 166 individual magnetic anomalies in the study area. More than 75% of the 166 magnetic anomalies identified are isolated with small magnetic signatures (less than fifteen (15) gammas). Analyses of sidescan sonar imagery identified 30 sonar targets. Three (3) sonar targets correlated with magnetic anomalies SS24/M43, SS25/M68, and SS29/M97 and none of these anomalies or targets were interpreted to be potential cultural resources. Two (2) clusters of anomalies were considered to have cultural resource potential and were recommended for avoidance. Both were greater than 500 ft from the Ship Shoal Block 88 study area.

A detailed submerged cultural resources and geo-hazard survey of Ship Shoal Block 88 was conducted as part of the Project scope (OSI, 2012 and Goodwin, 2012). The survey included acquisition of multi-sensor marine geophysical data including bathymetric soundings, sidescan sonar, marine magnetometer, and subbottom profiler data. The survey was performed to document current conditions on the shoal and provide data needed to perform an archaeological resource assessment of the sand body prior to any planned bottom disturbing activities. The surveys were undertaken in compliance with BOEM guidelines (NTL 2005-G07). The detailed survey plan was approved by both BOEM and SHPO. The primary track lines for all surveys were spaced 30 m (98 ft) apart and the data gathered consisted of vessel position, bathymetry, subbottom profiles, sidescan sonar imagery, and magnetic field contours and magnetic anomaly measurements. The cultural resources investigation did not identify any potential cultural resource targets within the survey area.

A detailed submerged cultural resources and geo-hazard survey of the conveyance corridor was conducted as part of the Project scope (OSI, 2012 and Goodwin, 2012). The survey area was over 980 ft in width and transects were surveyed at 30-m line spacing. The survey included collection of bathymetric soundings, sides scan sonar, marine magnetometer, and subbottom profiler data and followed the same methodology described above. The cultural resources investigation identified four (4) anomalies within the survey area and recommended avoidance buffers for those areas.

A review of NOAA Nautical Chart Nos. 11356 (38th Edition, June/08) and 11357 (41st Edition, May/11) shows that the conveyance corridor between the Ship Shoal Block 88 Borrow Area and

Whiskey Island will pass approximately 1,000 ft east of a charted wreck located approximately three (3) miles offshore (Goodwin, 2012).

3.4.3 Whiskey Island 3A Borrow Area and Conveyance Corridor

In support of the TE-50 project design, a geophysical survey conducted by OSI (2006) within the Whiskey 3A study area was conducted including bathymetry, magnetometer, sidescan sonar, and subbottom profiling at 50-m line spacing. Five (5) potential archaeological avoidance areas were identified by this investigation. The first two (2) avoidance areas are located in the northwest corner of Whiskey 3A and remaining avoidance areas are located in the northeast corner of Whiskey 3A. The avoidance areas have varying recommended avoidance/buffer area radii.

A more recent detailed submerged cultural resources and geo-hazard survey of the borrow area was conducted as part of the Project scope (OSI, 2012 and Goodwin, 2012). The survey included collection of bathymetric soundings, side scan sonar, marine magnetometer, and subbottom profiler data at 30-m line spacing and followed the same methodology described above. The cultural resources investigation identified 242 magnetic anomalies, the majority outside of the anticipated borrow area template, and nine (9) sidescan targets. One (1) of the latter appeared to be a pile of debris, while the remaining eight (8) were unidentifiable features. The closer line spacing for the current survey elaborated magnetic anomalies within four (4) of the five (5) previously defined avoidance areas; however none had correlative sidescan or subbottom features. Further investigation demonstrated that none of the "targets" were cultural resources.

A detailed submerged cultural resources and geo-hazard survey of the conveyance corridor was conducted as part of the Project scope (OSI, 2012 and Goodwin, 2012). The survey area was over 980 ft in width and transects were surveyed at 30-m line spacing. The survey included collection of bathymetric soundings, side scan sonar, marine magnetometer, and subbottom profiler data and followed the same methodology described above. The cultural resources investigation identified two (2) anomalies within the conveyance corridor and recommended avoidance buffers for those areas.

3.5 SOCIOECONOMIC AND HUMAN RESOURCES

Isle Derniere was the location of one (1) of the earliest coastal "summer resort" communities in Louisiana. By the late 1840s visitors from Brashear (now Morgan) City, New Orleans, and elsewhere would arrive by steamboat to take advantage of the sea breeze and various recreational opportunities, such as hunting, fishing, swimming, and socializing. The community, known as Village Bayou, had private homes and boarding establishments. A hurricane effectively scoured the island clear of structures on August 10th, 1856, killing about 140 people. The settlement was

not rebuilt and in the intervening years the island has been breached, with the resultant Isles Dernieres continuing to breach, diminish in dimension, and migrate north (Davis, 2010).

3.5.1 Commercial Fisheries

The Terrebonne-Barataria estuary is a nationally-important fishery resource. The closest reporting port to the Isles Dernieres is Dulac, Louisiana, on the Houma Navigation Canal (HNC). Closer still is Cocodrie, however it is used primarily by recreational and charter fishers.

The total U.S. commercial landings in 2010 were greater than 8.2 billion pounds valued at greater than $4.5 billion (NOAA Fisheries, 2012). Louisiana's total commercial landings in 2010 were over one (1) billion pounds valued at $248 million. The Port of Dulac-Chauvin on the HNC had 2010 landings of 32.8 million pounds valued at $45.1 million (*ibid.*). The most common target species for Louisiana commercial fishers are Gulf menhaden (locally known as pogie; processed for fish meal), white and brown shrimp, blue crab, black drum, eastern oyster (farmed and dredged), red snapper, and swordfish (NOAA Fisheries, 2011).

3.5.1.1 Whiskey Island

As part of the Isles Dernieres Wildlife Refuge human trespass is strictly limited. Commercial fishing activity can be undertaken on the surrounding open water, but nothing on the Island itself.

3.5.1.2 Ship Shoal Block 88 Borrow Area

Commercial fishing on Ship Shoal includes trawling for shrimp, purse-seining for pelagic species, such as Gulf menhaden and sardines, and angling for mackerel-like species. Popular species like amberjack, grouper, and snapper are most prevalent over rough or hard bottom areas and at structures, such as production platforms. Neither hard bottom nor platforms are present in Ship Shoal Lease Block 88. Trawlers must avoid submerged pipelines and wellheads in addition to emergent structures, which further restricts the available fishing grounds. While Ship Shoal is an important blue crab habitat, as discussed above, there is no crab fishery on the shoal: it remains an estuarine fishery.

3.5.1.3 Whiskey 3A Borrow Area

The lack of topographic features on this borrow area precludes its function as a haven for species such as amberjack, grouper, and snapper, but the above-referenced pelagic species may be found over it. Similarly, it may be habitat for shrimp and demersal fishes, such as summer flounder.

3.5.2 Recreational Resources

3.5.2.1 Whiskey Island

As part of the Isles Dernieres Wildlife Refuge human trespass is strictly limited. Recreational activity can be undertaken on the surrounding open water, but nothing on the Island itself.

3.5.2.2 Borrow Areas

Both borrow areas afford opportunity for recreational angling. Neither provide attractions for recreational snorkeling or SCUBA diving.

3.5.3 Waterborne Commerce, Navigation, and Public Safety

None of these socioeconomic features is relevant. As part of the Isles Dernieres Wildlife Refuge, trespass is forbidden on Whiskey Island. The right of free passage permits vessels to transit around the Island and the petroleum transmission facility off the east end of the Island is actively maintained and routinely visited by various service vessels. In a like manner, both borrow areas are located in navigable waters and free passage is not prohibited.

3.5.4 Infrastructure, Oil, Gas, and Other Minerals

There is no public infrastructure on Whiskey Island – it is an uninhabited barrier island. As mentioned herein, there is an oil production facility located in open water east of the Island and there are a number of pipelines leading to and away from it. None are laid across the Island itself.

The Ship Shoal Lease Block 88 sand body and the mixed sediment resource within the Whiskey 3 study area are intersected by numerous pipelines and structures serving the oil and gas industry. The conveyance corridors cross multiple oil and gas pipelines.

3.5.5 Environmental Justice

Whiskey Island is undeveloped and uninhabited, and the conveyance corridors and borrow areas are under water. The nearest populated area is Cocodrie, Louisiana which is approximately fifteen (15) miles northeast of Whiskey Island. Demographically, Terrebonne Parish supports an estimated population of 111,860 (U.S. Census Bureau, 2012). The median income of households in Terrebonne Parish in the 2006-2010 date range was $48,437. As of the 2010 census update, approximately 73 percent of parish residents held high school diplomas with fourteen (14) percent holding bachelor’s or higher education degrees. Parish-wide, 28 percent of the

population is a race other than white (U.S. Census Bureau, 2012). Less than seventeen (17) percent of residents in Terrebonne Parish live below the poverty line.

3.6 HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE (HTRW)

During preparation of the TBBSR study, a Phase I Environmental Site Assessment (ESA) was prepared for the entire study area, including Whiskey Island, for the purpose of elaborating past and/or present evidence of the presence of any hazardous, toxic, or radioactive substances or petroleum products. The ESA report included site inspections and historical research. It found no "Recognized Environmental Conditions" (RECs) indicative of current HTRW releases. Six (6) past RECs had been reported from East Timbalier Island and all had been properly addressed. Nothing has been reported from the Isles Dernieres (USACE, 2010).

The primary concern for HTRW in Louisiana coastal waters is hydrocarbons from natural and anthropogenic sources. The most recent of the latter was the April 20, 2010 explosion, fire, and subsequent sinking of *Deepwater Horizon*, a semi-submersible offshore mobile drilling unit used to drill a well for BP Exploration and Production, Inc. in the Macondo prospect, Mississippi Canyon 252 – MC252. This incident resulted in discharges of oil and other substances from the rig and the submerged wellhead into the Gulf of Mexico. An estimated 4.9 million barrels of oil were subsequently released from the well over a period of approximately three (3) months (Lubchenco, et al., 2010).

The magnitude of the oil spill and response was unprecedented, causing impacts to coastal and oceanic ecosystems ranging from the deep ocean floor, through the oceanic water column, to the highly productive coastal habitats of the northern Gulf of Mexico, including estuaries, shorelines, and coastal marsh. According to the Shoreline Inspection Reports, the shoreline of Whiskey Island became heavily oiled within three (3) months of the Deepwater Horizon sinking and it was cleaned up within another two (2) months. Examination of the Nearshore Surface Oil Forecast Deepwater Horizon MC 252 and the spill trajectory projection maps show oil offshore from the Isles Dernieres and potential beached oil periodically from May through July 2010 which was subsequently cleaned. Tar balls appeared on the Whiskey Island beach in August 2011 and were cleaned up within one (1) month. None have been reported subsequently (NOAA, 2010).

4.0 ENVIRONMENTAL CONSEQUENCES

4.1 IMPACT-PRODUCING FACTORS

4.1.1 Dredging Operation Characteristics

Dredging at both borrow areas will be carried out by hydraulic cutterhead dredge(s), and conveyance of the sediment will be supported by auxiliary booster pumps. The bit or cutter is located on the end of an arm (the ladder) that is hinged off the forward end of the dredge. The ladder can be maneuvered vertically to control its depth and the dredge and ladder maneuvered laterally and fore/aft using anchors deployed off the forward quarters in combination with vertical spuds. The loosened slurry is pumped up the ladder by a large suction pump in the dredge hull, which also pumps it ashore through a submerged pipeline, aided by the booster pump.

The total estimated construction time is 480 days. Project scheduling assumes dredging will be continuous, twenty-four (24) hours per day, seven (7) days per week. Dredge down time is assumed to be twenty (20) percent: fifteen (15) percent for maintenance and five (5) percent for weather contingencies. The distance from Ship Shoal Block 88 Borrow Area to Whiskey Island through the conveyance corridor is approximately 8.9 miles. The distance from the Whiskey 3A Borrow Area to Whiskey Island through the Conveyance Corridor is approximately 4.5 miles.

4.1.2 Effluent Discharge at Sea

Effluent discharges are not expected at either borrow area. Temporarily elevated turbidity is limited to the immediate vicinity of the cutterhead and the majority of it is entrained in the slurry that is pumped ashore.

4.1.3 Total Depth of Cut Within the Borrow Areas

The dredge cut at the Ship Shoal Block 88 Borrow Area will be stepped downward progressively towards the center of the cut template to follow the thickness of the beach-compatible sediment. The design depth ranges from -27 ft NAVD88 to -34 ft NAVD88 with a 2.0 ft allowable overdredge ranging from -29 ft NAVD88 to -36 ft NAVD88. Because the bottom topography of Ship Shoal is sloping, the actual cut thickness varies from ten (10) to seventeen (17) ft.

The dredge cut at Whiskey 3A Borrow Area has a uniform depth of -37 ft NAVD8 with a 2.0 ft allowable overdredge to -39 ft NAVD88. Because the bottom topography at Whiskey 3A Borrow Area is also uneven, the actual cut thickness varies from fifteen (15) to eighteen (18) ft. The side slopes at both cuts shall be one (1) ft vertical for every ten (10) ft horizontal.

Several studies have addressed questions on the effects of sand mining at Ship Shoal on wave dynamics both over the shoal and on the adjacent nearshore areas. Stone and Xu (1996) used the STWAVE model to assess wave height variations associated with normal and storm conditions following removal of the shoal. The model results indicated that removal of the shoal would not have significant impact on the adjacent shorelines (Stone, 2004). Stone et al. (2009) subsequently modeled several different mining scenarios, using the projected volume calculations for different restoration "targets," (Caminada Headland, Isles Dernieres, Whiskey & Trinity Islands, etc.). They concluded that mining Ship Shoal on these scales would not have adverse impacts on hydrodynamics or sediment transport. They did recommend against complete removal of the shoal, which would be impossible because of the extensive petroleum extraction and distribution infrastructure on much of it.

4.1.4 Emplacement on Beach, Dune, and Marsh Habitats

For the Recommended Component of Construction within the NER Plan for Whiskey Island, the fill template for the beach and dune was designed to avoid impacting the existing mangrove wetland habitats on Whiskey Island (USACE, 2010). The only habitats that will be impacted are the open sandy beach and the nearshore inter- and sub-tidal sandy areas. As measured from the beach separation dike to the toe of fill, the beach and dune will cover approximately 900 acres. The sandy sediment from Ship Shoal is compatible with the existing sandy beach soil. The marsh platform will cover approximately 35 acres of unvegetated sandy sediment and another 345 acres of unvegetated water bottom utilizing mixed sediments that are compatible with marsh establishment.

Sediment placement affects the terrestrial and benthic fauna in both the beach and intertidal zones by covering them with a layer of sediment. The most obvious organisms on or in the beach are the burrowing ghost crabs (*Ocypode quadrata*) and the amphipods, spiders, and insects that inhabit the wrack line. Some terrestrial and benthic species can burrow through a modest layer (from fifteen (15) to thirty-five (35) inches for different species) of added sediment since they are adapted to the rapidly shifting environment of the beach and intertidal zone; however, thicker layers (greater than forty (40) inches) of sediment are likely to smother the benthic fauna (Greene, 2002). After sediment placement, benthic fauna can take anywhere from six (6) months to two (2) years to recover (Peterson et al., 2000; 2006).

The marsh fill template covers both unvegetated beach and nearshore intertidal bay bottom. Sediment placement impact will be comparable to the impact on the beach. The marsh fill sediment will be allowed to settle and dewater. Marsh vegetation planting will occur during the next few growing seasons following completion of marsh construction. Marsh fauna will recolonize the area as tidal inundation is naturally reestablished. This may take several years, however it is understood that for a restored marsh to persist successfully over time, its initial

elevation cannot start so low that it is intertidal at every tidal cycle. Rather, it is built higher to account for the compaction and settlement over time, with the goal of having the marsh platform elevation enter the tidal range between Mean Higher High Water and Mean Lower Low Water in approximately three (3) years.

Additional impacts in the Conveyance Corridors can result from laying sediment pipeline from the Borrow Areas to the Restoration Area. These effects would be minor and short-term; these benthic resources would reestablish from adjacent undisturbed areas.

The benefits of additional acreage of beach, dune, and marsh as new habitat and protection of the adjacent estuary were weighed in the TBBSR study and considered to outweigh the unavoidable loss of habitat that accompanies fill placement (USACE, 2010).

4.2 PHYSICAL RESOURCES

4.2.1 Oceanographic and Coastal Processes

No-Action Alternative – Whiskey Island

The continuing trend of erosion and overwash would result in loss of beach area to the point where the recently constructed CWPPRA Whiskey Island Back Barrier Marsh Creation project (TE-50) marsh and the adjacent mangrove wetland areas would be unprotected from storm wave damage, which would accelerate their loss. Whiskey Island derives minimal benefit from overwash because Caillou Boca, the channel to its north, has tidal currents that carry overwashed sediment to the east and west, away from the Island. Without added sediment the western spit will diminish in length, which will allow waves and storm surge from the open Gulf to impact the wetlands to the north. The eventual fate of the Island will be its reworking into a subtidal shoal lacking GEFF, which results in loss of the important barrier island services of salinity and tidal current moderation, wave attenuation, and provision of estuarine habitat. In addition, normal sediment transport across Raccoon Pass will diminish and ultimately cease.

No-Action Alternative – Borrow Areas

This Alternative will have no impacts on the oceanographic and coastal processes at either Borrow Area.

Restoration Alternative - Whiskey Island

The Project will restore Whiskey Island's GEFF through construction of the beach and dune fill template over the existing beach and Gulf-facing intertidal and subtidal habitats with compatible

sand in order to create approximately 900 acres of new beach and dune habitats; and creating additional marsh habitats, on the order of 380 acres, on the western end. Advancing the shoreline will provide additional protection for the two (2) existing mangrove wetlands, the TE-50 marsh between them, and the newly-created marsh. Restoring GEFF will enable the Island to absorb wave energy during storms and fair-weather conditions and provide storm surge protection for the interior marshes within Terrebonne Basin, which would decrease land loss erosion rates. The additional benefits provided by functioning barrier islands include maintenance of estuarine conditions by moderation of salinity and tidal hydraulic fluctuations plus the habitat services provided to the wide range of resident and transient fish and wildlife species known to inhabit the Louisiana coast for at least part of their life cycles.

Restoration Alternative – Borrow Areas

Ship Shoal Block 88

Impacts of sand mining on wave transformation over Ship Shoal and resultant impacts on the Terrebonne Basin barrier shorelines was investigated by Stone and Xu (1996) and Stone (2000). Stone and Xu (1996) conducted a wave modeling analysis to evaluate the effects of large-scale removal of sand from various portions of Ship Shoal. The approach centered on the removal of the entire shoal complex. The total volume of sand extracted from the shoal for the modeling analysis was over 1.4 billion CY which included up to a six (6) meter thick section of sand being removed from the western portion of the shoal. The analysis conducted indicated spatial differences in the magnitude of wave heights across Ship Shoal. The magnitude in wave heights due to shoal removal were less on the east side of the shoal compared to the west side. Wave height changes on the east side of the shoal were reported to be insignificant during severe storms and even less noticeable under fair weather conditions. Overall, the model results indicated the entire removal of the shoal would not have a significant impact on wave energy conditions along the nearshore zone (USACE, 2010).

Stone et al. (2009) investigated the impacts of sand mining on hydrodynamics and sediment transport on Ship Shoal using two (2) case studies. Case study A compared the hydrodynamics of the region under two (2) bathymetric configurations: one (1) with the shoal and the other with the shoal completely removed. Case study B utilized four (4) different sand mining scenarios which mimicked proposed Project Borrow Area configurations. Wave, current variability, and sediment transport over the shoal under different barrier island restoration/mining scenarios under a winter storm and tropical cyclone event were analyzed. The researchers looked at mining at three (3) areas of Ship Shoal including Lease Block 88. The modeling results indicated that Ship Shoal has significant influence on wave dissipation but suggested that neither large-scale nor small-scale sand mining should result in abrupt changes in current patterns. The

results indicated that small-scale sand mining was not expected to profoundly impact hydrodynamics or sediment transport over Ship Shoal (USACE, 2010).

Whiskey 3A

As part of the TE-50 project, numerical modeling was used to assess the impact that dredging a borrow area will have on nearshore wave conditions for Whiskey Island Area 3. The selected wave conditions were developed from previous work and also used in the TE-47 project to study the impacts on wave conditions from dredging the borrow area. The model results indicated that dredging Whiskey Island Area 3 to -40 ft NAVD 88 will not produce a significant change in the wave conditions. Simulated impacts decreased with decreasing depth, such that they were almost negligible at the -10 ft contour, indicating that impacts to sediment transport at the nearby barrier shorelines should be minimal (USACE, 2010).

4.2.2 Geology

No-Action Alternative – Whiskey Island

Under the No-Action Alternative, the historic land loss and erosion rates will continue and the barrier shoreline will eventually convert to shallow open water bottoms. Sand resources within the beach and dune system will be overwashed into Caillou Boca and lost, or lost offshore during significant storm events. The Island will lose its geomorphologic form and function.

No-Action Alternative – Borrow Areas

Not implementing the Project will have no impact on the geology of either borrow area.

Restoration Alternative – Whiskey Island

Placing approximately 8.9 MCY of beach and dune compatible sand on Whiskey Island will improve the ability of the island to resist shoreline erosion, wave overtopping, and breach formation. Sand fencing and dune vegetation shall be installed providing a mechanism for future aeolian sand transport and dune enhancement for additional shoreline protection. Placement of approximately 0.8 MCY of mixed sediments to create new marsh provides a platform to capture overwashed sediments and reduce Island migration. Primary settlement and compaction of the placed sediments will occur during the first one (1) to two (2) years. Adverse direct impacts of placing borrow area sediments into the dynamic high-energy barrier system would generally be minimized by placement of compatible sediments in this sediment-starved barrier system. An indirect impact on the geology includes a benefit of deposition and natural redistribution of sediments along the Island and to the adjacent sediment deprived barrier shoreline.

Restoration Alternative – Borrow Areas

The Project entails excavation of almost 12 MCY of sand from approximately 651 acres in Ship Shoal Lease Block 88. The volume of the shoal has been estimated to be greater than 900 MCY (Stone et al., 2004), with an estimated 74 MCY contained in Lease Block 88. The Project represents approximately 1.0 percent of the total volume. The sand body encompasses approximately 100,000 acres. The Project represents approximately 0.7 percent of the total surface area of the sand body. The order of magnitude of the Project is considered small-scale mining in the context of the various Ship Shoal wave dynamics and sediment transport modeling studies (Stone, 2000; Stone et al. 2004, 2009), and thus utilization of the Ship Shoal Block 88 Borrow Area will not have a measurable impact on the geology of Ship Shoal.

The Project entails excavation of approximately 1.3 MCY of mixed sediments from approximately 77 acres in the nearshore zone. The volume of available sediments within the Whiskey 3A study area has been estimated to be greater than 12.6 MCY (OSI, 2006). The Project represents approximately 8.0 percent of the total volume. The sediment body encompasses approximately 1,160 acres. The Project represents approximately 6.6 percent of the total surface area of the sediment body. Dredging this sediment source was shown to have minimal impacts on coastal processes (LDNR, 2007; USACE 2010), and thus utilization of the Borrow Area will not have a measurable impact on the geology of the nearshore zone.

4.2.3 Air Quality

No-Action Alternative – Whiskey Island

Not implementing restoration of Whiskey Island will have no impact on air quality.

No-Action Alternative – Borrow Areas

Not implementing the Project will have no impact on air quality at either borrow area.

Restoration Alternative – Whiskey Island

If restoration is undertaken air quality will be temporarily negatively affected by exhaust discharges from the internal combustion engines on construction machinery, work boats and crewboats, quarters barge generators, and miscellaneous vehicles. This level of activity will persist throughout the duration of the Project and return to pre-construction conditions shortly after completion of construction activities.

Restoration Alternative – Borrow Areas

If restoration is undertaken air quality will be temporarily negatively affected by exhaust discharges from the internal combustion engines on the cutterhead dredge, booster pump(s), and the associated tugboats, crewboats, and survey boats. This level of activity will persist throughout the duration of the Project and return to pre-construction conditions shortly after completion of construction activities.

4.2.4 Water Quality

No-Action Alternative

Water quality in the Terrebonne Basin has been affected by numerous factors for many years. Most obvious is the loss of freshwater and estuarine marsh from subsidence, relative sea level rise, canal excavation, coastal development, and storm damage. Marsh loss translates into loss of plants that previously filtered particulates and absorbed nutrients from stormwater runoff. Various state and federal pollution control efforts, including both point-source- and non-point-source pollutant regulation address stormwater and wastewater discharges into coastal waters, however none deal with the subsidence/sea level rise portion of the problem.

The seasonally-changing hypoxic zone created by nutrient discharges from the Mississippi and Atchafalaya Rivers periodically extends westward to the Texas coast. It apparently surrounds Ship Shoal but does not cover it, thus the shoal may serve as a source for infauna to repopulate the adjacent area following hypoxic events (Stone et al., 2009).

Not implementing restoration will have no impact on ambient water quality at Whiskey Island and the borrow areas.

Restoration Alternative

If restoration is undertaken nearshore water quality will be impacted by access channel dredging, containment dike construction, and dredged material discharge across the beach and into the marsh fill template. The nature of this impact will be in the form of turbidity at excavation and placement sites and turbidity plumes at the locations where dewatering effluent is released. This may be one (1) or more points along the marsh containment dike and a combination of undirected sheet flow across the beach and flow directed by training dikes on the beach.

Hydraulic cutterhead dredging activities will create areas of localized turbidity as excavation progresses. The high quality sediment in the Ship Shoal Block 88 Borrow Area will result in

minimal turbidity offshore. Elevated turbidity levels within the borrow areas will be temporary and will not have a permanent impact on water quality at either borrow area.

Best management practices shall be required in the contract documents of the construction contractor to control turbidity and minimize impacts to water quality at the Island and the borrow areas.

An indirect impact of restoring Whiskey Island is a minor benefit for improvements to water quality as the newly created and existing wetlands would serve as natural filters for improving water quality (Day et al., 1989). Another indirect impact is the minor benefit that restoration of the Island would provide through its more robust marine-estuarine geomorphologic boundary contributing to restricting higher salinity Gulf of Mexico waters from entering the fresher interior estuarine areas north of the Project area.

4.2.5 Noise

No-Action Alternative

There would be no impacts of the No-Action Alternative on noise specific to Whiskey Island and the borrow areas.

Restoration Alternative

Construction activities would result in temporary and localized increases to noise levels at the dredge and associated booster pump(s) and from the equipment employed on the Island. The level of noise that is generated by construction equipment can be controlled. During the construction period, localized and temporary noise impacts would likely result in noise-sensitive wildlife and fishery resources being temporarily displaced from the Project area during construction activities. In some instances, noise impacts may directly impact fish and wildlife species. Depth sounding and other submerged acoustic devices use a range of frequencies that may be detected by marine organisms. If disturbed, these organisms would generally avoid the construction area. However, tolerance of unnatural disturbance varies among wildlife. Best management practices shall be detailed in the Project Technical Specifications requiring the construction contractor to control noise and minimize the temporary impacts.

4.2.6 Water Resources

Neither Whiskey Island nor the two (2) borrow areas provide water resources. The former because it is remote and the groundwater beneath it is salty; the latter because they are submerged in the Gulf of Mexico.

4.2.7 Climate

Neither the No-Action Alternative nor the Restoration Alternative would impact the local climate at Whiskey Island or the two (2) borrow areas.

4.3 BIO-PHYSICAL ENVIRONMENT

4.3.1 Vegetation Resources

No-Action Alternative - Whiskey Island

The continuing trend of erosion and overwash would result in loss of beach area to the point where the TE-50 marsh and the adjacent mangrove wetlands would be unprotected from storm wave damage, which would accelerate their loss. The TBBSR study (USACE, 2010) projected Whiskey Island's upland area would disappear early on in the period of analysis. The impacts listed included loss of over 400 acres of EFH and over 370 acres of supratidal habitat, loss of critical piping plover habitat, and loss of storm surge protection for the adjacent marsh and riparian forested wetlands. The latter impact would result in increased wave energy eroding the nearby north shoreline of Caillou Boca, with ultimate conversion of that estuarine area to open water.

No-Action Alternative – Borrow Areas

There are no submerged aquatic vegetation resources on the borrow areas.

Restoration Alternative – Whiskey Island

Restoration of Whiskey Island's GEFF would create approximately 900 acres of beach and dune and approximately 380 acres of intertidal marsh. The newly created dune and marsh platforms will both be planted with native vegetation. In addition to the new marsh, the two (2) existing areas that contain mangrove marsh and the TE-50 marsh platform would be protected from storm damage by the width of beach and dune developed for the Project, thus enhancing their existing value as fish and wildlife habitat. This added protection will facilitate the gradual maturation of that environment, including its vegetation succession and the natural development of its internal tidal circulation pattern. As the vegetation in the marshes expands in area and continues to grow it produces more leaf litter, which in turn produces more detritus, which is a major energy source for both the planktonic and benthic communities of the estuarine and nearshore habitats.

An indirect impact is the minor benefit that restoration of the Island would provide through its more robust marine-estuarine geomorphologic boundary contributing to protecting the interior vegetated resource areas north of the Project area.

Restoration Alternative – Borrow Areas

There are no submerged aquatic vegetation resources on the borrow areas.

4.3.2 Aquatic Resources

4.3.2.1 Planktonic Resources

No-Action Alternative – Whiskey Island

Not implementing the restoration of Whiskey Island would have no immediate impact on planktonic resources. Eventual loss of the Island and its wetland habitats would reduce and ultimately eliminate the ecological benefits it provides to the estuarine faunal community, which includes organic detritus and dissolved organic compounds that are nutrient sources for both estuarine and oceanic phyto- and zooplankton. The same holds true for the adjacent wetlands to the north of Caillou Boca, which will also eventually suffer a reduction in the ecological benefits they provide to the resources of the Terrebonne Basin. This loss of the barrier habitats and estuarine habitats could lead to the conversion of primarily estuarine-dependent plankton species assemblages to more marine-dominant and open water plankton species assemblages. This conversion may alter the predator-prey balance by changing the makeup of the community of planktivorous fishes in coastal waters.

No-Action Alternative – Borrow Areas

The No-Action Alternative will not have a direct impact on plankton resources at the borrow areas.

Restoration Alternative – Whiskey Island

Direct impacts to plankton resources would be localized and short-term adverse impacts, including mortality of some plankton populations, due to placement of the borrow area sediments for barrier island restoration. Water bottoms and fragmented barrier habitat will be converted to beach, dune, and marsh barrier habitats. During sediment placement, there would be a localized and short-term decrease in available dissolved oxygen; and an increase in turbidity, temperature, and biological oxygen demand (BOD) because of the release of nutrients from the re-suspended

sediment. Following fill operations, the Project area would return to ambient conditions and be re-colonized by plankton populations.

Once restoration is completed the newly created and existing marsh areas will be better protected which will benefit planktonic resources. Further, once the new marsh has become established, the added export of detritus and other nutrients will enhance estuarine and marine productivity and nutrient transformation.

Restoration Alternative – Borrow Areas

Direct impacts to plankton resources would be localized and short-term. Adverse impacts, including mortality of some plankton populations, would be due to excavation of the borrow areas. During dredging, there would be a localized and short-term decrease in available dissolved oxygen and an increase in turbidity, temperature, and biological oxygen demand (BOD) because of the release of nutrients from the re-suspended sediment. Following dredging operations, the Borrow Areas would return to ambient conditions and be re-colonized by plankton populations.

4.3.2.2 Benthic Resources

No-Action Alternative – Whiskey Island

Not implementing the restoration of Whiskey Island would have no immediate impact on benthic resources. Eventual loss of the Island and its wetland habitats would reduce and ultimately eliminate the ecological benefits it provides to the estuarine faunal community, which includes available nutrients and detritus. The same holds true for the adjacent wetlands to the north of Caillou Boca, which will also eventually suffer a reduction in the ecological benefits they provide to the resources of the Terrebonne Basin. This loss of the barrier habitats and estuarine habitats could lead to the conversion of primarily estuarine-dependent benthic species assemblages to more marine-dominated (in the case of the barrier island) and open water benthic species assemblages.

No-Action Alternative – Borrow Areas

The No-Action Alternative will not have a direct impact on benthic resources at the borrow areas.

Restoration Alternative – Whiskey Island

Direct impacts to benthic resources would be localized and short-term adverse impacts, including mortality of some benthic populations, due to placement of the Borrow Area sediments for barrier island restoration. Water bottoms and fragmented barrier habitat will be converted to beach, dune, and marsh barrier habitats. During sediment placement, there would be a localized and short-term decrease in available dissolved oxygen; and an increase in turbidity, temperature, and biological oxygen demand (BOD). Following fill operations the Project area would return to ambient conditions and be re-colonized by benthic populations within one (1) to two (2) years following construction (USACE, 2010). Pre- and post-construction benthic organism sampling and analyses are a component of the monitoring associated with protection of the threatened piping plover and candidate red knot, with results reported to the USFWS.

Once restoration is completed the newly created and existing marsh areas will be better protected which will benefit benthic resources. Further, once the new marsh has become established, the added export of detritus and other nutrients will enhance estuarine and marine productivity and nutrient transformation.

Restoration Alternative – Borrow Areas

General

Borrow area mining could destroy any slow-moving or sessile benthic organisms found within the borrow areas. However, more mobile benthic species would likely be displaced to more suitable habitats.

Ship Shoal Block 88 Borrow Area

Potential impacts to benthic communities from mining Ship Shoal were reported in Stone et al. (2009) with findings later published in Dubois et al. (2009) and Grippo et al. (2009). Summaries of their findings are presented herein, while a detailed description is contained within the TBBSR study (USACE, 2010). Dubois et al. (2009) predicted that the benthic macrofauna at Ship Shoal would be "strongly affected and slow to recover" from sand mining. Sand mining would cause a shift in species dominance to "disturbance specialists" that are fast-growing, small, have rapid reproduction rates and body growth which enables them to colonize disturbed habitats. This could lead to a reduction in biomass which would indirectly impact higher trophic levels. Grippo et al. (2009) suggested that benthic microalgae may have higher biomass than phytoplankton on Ship Shoal and contribute significantly to the shoal's food web. Changes in primary production and particle size could reduce the benthic community biomass and alter the species composition which could affect higher trophic levels. As stated above, the Project

represents approximately 1.0 percent of the total volume and 0.7 percent of the total surface area of the Ship Shoal sand body. Small scale mining on this order of magnitude is not likely to adversely affect the benthic resources of Ship Shoal. The borrow area is bordered by the Ship Shoal sand body. Significant acres will be undisturbed by the Project and serve as "*seed sand* or *seed source*" for harbor native organisms that would furnish larvae for recolonization and/or provide a source of recruits for benthic faunal recovery. Overall, research suggests that recovery of benthos occurs relatively soon after impact. Documented recovery times of benthos range from between 45 and 156 days to two (2) years (Brooks et al, 2004).

Whiskey 3A Borrow Area

There have not been specific studies of the benthic resources on the Whiskey 3A Borrow Area. Small scale mining on the order of 1 MCY for this sediment resource is not likely to adversely affect the benthic resources; which should return to ambient conditions and be re-colonized within one (1) to two (2) years following construction (USACE, 2010).

4.3.2.3 Pelagic Fishes

No-Action Alternative – Whiskey Island.

Not implementing the restoration of Whiskey Island will have no immediate impact on the fish and fisheries. However, as the island continues to erode and degrade, important habitat, including marsh and marsh edge, shallow sand and mud flats, and mangrove stands will be lost, thus removing nursery and forage resources for a wide range of fish and wildlife.

No-Action Alternative – Borrow Areas

The No-Action Alternative will not have a direct impact on fish and fisheries at the borrow areas.

Restoration Alternative – Whiskey Island

Because of the magnitude of the Project at Whiskey Island, between beach renourishment and dune and marsh creation, the turbidity plumes will displace both fishes and their motile prey organisms. The expanded beach fill template will result in burial of benthic prey for fishes that forage in the sandy intertidal and subtidal zones. Those prey organisms will recolonize the area, but not immediately. Restoration of Whiskey Island, as previously discussed, will afford protection to the existing productive intertidal marshes as well as the new marsh acreage. The shelter and nursery area provided will benefit estuary-dependent fish, as well as the detritus and other marsh-derived nutrients that are an essential part of the food chain for many commercial and recreational fishes and invertebrates.

Restoration Alternative – Borrow Areas

Implementing the Project would disturb the surface of Ship Shoal Block 88 by removal of almost 12 MCY of sand. The direct impact of this on oceanic resources would be to those organisms whose life cycles include some utilization of Ship Shoal, such as various migratory drum and croaker species and the mackerel-like Scombridae listed in Section 3.2.2.3, above. Considering the modest area disturbed, this should not interfere with overall macrofaunal utilization of Ship Shoal. The effect on oceanic macrofauna at the Whiskey 3A Borrow Area is unknown, assuming those species are present.

4.3.3 Wildlife Resources

No-Action Alternative – Whiskey Island

Not implementing the Project would create no immediate impact to the wildlife groups described in Section 3.2.2.4, above. However, the eventual disappearance of the Island would eliminate it as habitat for terrestrial and avian fauna, with the exception of wading birds, should emergent marsh persist temporarily without the protection afforded by any adjacent upland.

No-Action Alternative – Borrow Areas

The No-Action Alternative will not have a direct impact on wildlife resources at the borrow areas.

Restoration Alternative – Whiskey Island

Implementing the Project will temporarily displace and disturb some of the terrestrial wildlife; however the two (2) existing mangrove/marsh areas and the TE-50 marsh will be protected by the beach separation dike and can function as refuge, if necessary. The restored beach and the created dune and marsh areas will provide additional habitat for the listed wildlife species. Regarding marine mammals, the healthy marsh areas will contribute to improving the stocks of forage fishes, such as mullet, that are preyed upon by bottlenose dolphin.

Restoration Alternative – Borrow Areas

Implementing the Project would disturb the surface of Ship Shoal Block 88 by removal of almost 12 MCY of sand. The direct impact on non-terrestrial listed species would be to those organisms whose life cycles include some utilization of Ship Shoal and are prey species for the bottlenose and Atlantic spotted dolphins, marine mammals that may occur at both Borrow Areas.

Considering the modest areas disturbed, this should not interfere with the forage species productivity across the whole of Ship Shoal or over the Whiskey 3A Borrow Area.

4.3.4 Avian Communities

No-Action Alternative – Whiskey Island

Not implementing the Project would create no immediate impact to the avian groups described in Section 3.2.2.5, above. The eventual disappearance of the Island would eliminate it as habitat for most avian fauna, with the exception of wading birds, since emergent marsh may persist briefly without the protection afforded by any adjacent upland.

No-Action Alternative – Borrow Areas

The No-Action Alternative will not have a direct impact on avian species at the borrow areas.

Restoration Alternative – Whiskey Island

Implementing the restoration would create approximately 900 acres of sandy beach and dune and approximately 380 acres of marsh. The beach/dune restoration template requires covering approximately 80 acres of existing beach. The marsh creation template requires covering 35 acres of back-barrier beach and 345 acres of unvegetated intertidal and subtidal water bottoms. A migratory bird abatement program, developed cooperatively by the CPRA and USFWS, will be established to avoid or minimize impacts to the avifauna that uses Whiskey Island. This effort will be in place prior to start of any construction activity on the Island and it will be in effect throughout construction. The construction activities and associated noise will result in disturbance to the avifauna that utilizes the Project footprint areas for nesting, roosting, and foraging, until the work is completed. Depending on the pace of construction, some species may be displaced to the remaining undisturbed marsh, but it is likely that some of the species that inhabit the undisturbed marsh areas will also be displaced to one of the neighboring islands during the construction process. As observed on similar dredging projects, an increase in avian presence by certain species could be expected during the discharge of the slurry. After Project completion, as the vegetation efforts take root, the new shoreline adjusts to the natural wave and tide regime, and their infaunal assemblages are reestablished, the avifauna will gradually become reestablished and its population numbers will increase because of the increase in available habitat. Reestablishing the forage base of beach, intertidal, and subtidal invertebrates that support many of the shorebirds may take several years. Reestablishing the population of forage fishes associated with the beach and marsh environment is often dependent on reduction in nearshore turbidity and associated increases in zooplankton population.

Restoration Alternative – Borrow Areas

Implementing the restoration should not have any impact on avifauna in reference to the borrow areas.

4.4 CRITICAL BIOLOGICAL RESOURCES

4.4.1 Essential Fish Habitat

No-Action Alternative – Whiskey Island

Not implementing the restoration would result in EFH impacts as the gradual disappearance of Whiskey Island would reduce the productivity of its marshes and the service they provide as shelter and forage areas for numerous species of estuary-dependent fishes. The same holds true for those species that forage in the shallow foreshore, back shore, and adjacent passes. The ultimate value of Whiskey Island as EFH would be reduced to the background value of the open water of Terrebonne Bay. The adjacent island and headland wetlands that are presently protected by Whiskey Island would lose that protection, and their shorelines would degrade in a similar fashion, thus magnifying the impact on the ecology of the Terrebonne Basin.

No-Action Alternative – Borrow Areas

The No-Action Alternative will not have a direct impact on EFH at the borrow areas.

Restoration Alternative – Whiskey Island

Implementation of restoration would result in temporary loss of prey and foraging habitat around Whiskey Island because of the turbidity from fill placement and burial of nearshore habitat. Slow moving fish and benthic prey may be entrapped and smothered in the intertidal areas during sediment deposition. These impacts, however, are anticipated to be minor and would be limited to the immediate vicinity of the Project area on Whiskey Island and for the duration of construction of the Project features. The additional area of marsh, once vegetation proceeds, will add to the productivity of the existing marsh areas and provide additional ecosystem benefits, and positively impact EFH.

Restoration Alternative – Borrow Areas

Implementing the Project would disturb a small portion (<1%) of the surface topography of Ship Shoal by removal of almost 12 MCY of sand. The impact of this on EFH resources would be to those pelagic and benthic organisms whose life cycles include some utilization of Ship Shoal for forage and/or reproduction, including blue crab. As stated above, the Project represents approximately 1.0 percent of the total volume and 0.7 percent of the total surface area of the Ship Shoal sand body. Small scale mining on this order of magnitude is not likely to adversely affect the EFH resources of Ship Shoal. The borrow area is bordered by the Ship Shoal sand body. Significant acres will be undisturbed by the Project and continue to provide EFH. The same analogy is true for the Whiskey 3A Borrow Area, which is bordered by Borrow Area 2 and surrounded by Borrow Area 3.

4.4.2 Threatened and Endangered Species

No-Action Alternative – Whiskey Island

As described in Section 3.3.2, the only T&E species that may occur on Whiskey Island is the piping plover and the Isles Dernieres are designated critical habitat for it. As the Island degrades the preferred piping plover habitat, sparsely-vegetated sand (supratidal beach and dune and overwash fans, and their foraging areas, intertidal beach, sand- and mud-flats) will gradually disappear, and the plover habitat along with it.

No-Action Alternative – Borrow Areas

The No-Action Alternative will not have a direct impact on T&E species at the borrow areas.

Restoration Alternative- Whiskey Island

Restoration of Whiskey Island will displace piping plover and red knot during construction. Employment of a cooperatively-developed shorebird protection plan (CPRA and USFWS) will address measures to minimize disturbance during construction. The recommendations developed by USFWS for their TBBSR LCA project Biological Opinion will be adapted for the Caillou Lake Headlands Project. Following Project completion, the available habitat for wintering piping plover and red knot sheltering and foraging will be increased significantly, to the direct benefit of both species. Recent research (Schupp et al., 2012) has reinforced the importance of long-term maintenance of overwash features to support the piping plover population.

Restoration Alternative – Borrow Areas

This restoration effort proposes use of cutterhead dredges at both borrow areas, which poses minimal threat to marine turtles compared to use of hopper dredges. There is also a slight risk of collision with service vessels (tugs, crew boats) operating around the dredge. This risk also applies to the West Indian manatee. These risks are addressed through the Project Technical Specifications that require the construction contractor to adhere to the federal manatee protection conditions such as use of spotters and warning signage on the dredge and service vessels.

4.5 CULTURAL RESOURCES

No-Action Alternative – Whiskey Island

Based on the Phase I and Phase II investigations described herein, there are no identified cultural resources at Whiskey Island, thus the No-Action Alternative will not have any effect on cultural resources.

No-Action Alternative – Borrow Areas

The No-Action Alternative will not have a direct impact on cultural resources at the borrow areas.

Restoration Alternative

Summary

No previously reported prehistoric or historic archeological sites, historic standing structures, or significant traditional cultural properties are located within 1.0 mi (1.6 km) of the survey areas at both borrow areas and their respective conveyance corridors. Analyses of historic databases identified two (2) named shipwrecks, two (2) unknown vessels, and two (2) obstructions within 1.0 mi (1.6 km) of the survey area and concluded that there was low potential for additional discovery within the Project area. A determination of "No historic properties affected" (36CFR 800.4) was recommended by Goodwin (2012), provided the six (6) identified potential cultural resource targets are avoided by an appropriate distance determined through consultation. The Louisiana SHPO concurred with the Goodwin recommendation (SHPO, 2012).

Recent cultural resources field investigations identified two (2) targets described as "Potential Cultural Resource" within the Whiskey 3A Conveyance Corridor. Four (4) more were identified within the Ship Shoal Block 88 Conveyance Corridor. A determination of "No historic properties affected" (36 CFR 800.4) was recommended by Goodwin (2012). Consultation was

carried out with BOEM and SHPO to establish buffers or avoidance protocols. SHPO concurred with the findings of the Phase I investigation in September 2012.

Disturbance of the seafloor has the potential to cause adverse impacts to unidentified submerged cultural resources. Although detailed remote sensing surveys as conducted for this Project are expected to be highly effective at recognizing submerged cultural resources, the possibility of encountering an unanticipated submerged cultural resource is always present during dredging activities. As a result, implementation of an unanticipated discoveries plan shall be required of the construction contractor by the Project Technical Specifications.

Whiskey Island

Based on the Phase I and Phase II investigations described herein, there are no identified cultural resources at Whiskey Island, thus no historic properties will be affected by the Project, as proposed. The Louisiana SHPO has concurred that no historic properties will be impacted by the Project (SHPO, 2012).

Borrow Areas and Conveyance Corridors

The borrow areas and conveyance corridors have been designed to provide the recommended avoidance buffers developed from the Phase I surveys during the design process for the Project (Goodwin, 2012), thus no historic properties will be affected within the Borrow Areas or within the conveyance corridors, as proposed.

4.6 SOCIOECONOMICS AND HUMAN RESOURCES

4.6.1 Commercial Fisheries

No-Action Alternative – Whiskey Island

Not implementing the Project would have no short-term effect on fisheries. As the Island degrades and ultimately becomes subtidal, as discussed in Section 4.4.1 above, EFH will diminish and revert to the baseline for open water unvegetated estuarine conditions.

No-Action Alternative- Borrow Areas

The No-Action Alternative will not have a direct impact on commercial fisheries at the Borrow Areas.

Restoration Alternative – Whiskey Island

As described in Section 4.4.1, implementing the Project will disrupt its function as a nursery area for estuary-dependent fishes, their forage species, and as a foraging area for transient species. Following restoration completion, EFH will be enhanced at Whiskey Island, which should reflect positively on the commercially-exploited species that occur there, even briefly.

Restoration Alternative – Borrow Areas

Removal of the proposed volumes of sand and mud from the two (2) Borrow Areas will affect their topography, but it should not have a negative effect on pelagic commercial fishing, such as purse-seining. Commercial trawling may prove unproductive until the Borrow Areas attain an equilibrium shape and their infauna is reestablished.

4.6.2 Recreational Resources

No-Action Alternative – Whiskey Island

Not implementing the Project would result in the gradual decline of the fishery resource thus reducing and eventually eliminating recreational fishing opportunities.

No-Action Alternative – Borrow Areas

The No-Action Alternative will not have a direct impact on recreational opportunities at the borrow areas.

Restoration Alternative – Whiskey Island

Implementing the Project would temporarily disrupt recreational fishing around Whiskey Island while construction is under way and for a period after construction ceased. Once the additional marsh has become established, forage and detritus productivity should increase and with it, so should the populations of the recreational target species (fish and shellfish).

Restoration Alternative – Borrow Areas

Removal of the proposed volumes of sand and mud from the two (2) borrow areas will affect their topography, but it should not have a negative effect on recreational fishing for pelagic or demersal species. Fishing in the exact locations of the borrow areas may prove unproductive until the borrow areas attain an equilibrium shape and their infauna is reestablished, but the large adjacent undisturbed areas should still be available.

4.6.3 Waterborne Commerce, Navigation, and Public Safety

No-Action Alternative – Whiskey Island and Borrow Areas

The No-Action Alternative would not have any impact on waterborne commerce, navigation, and public safety.

Restoration Alternative – Whiskey Island and Borrow Areas

During dredging operations, it may be necessary to restrict watercraft access to the construction area in the interest of public safety. These restrictions would be temporary and are expected to be minor to boat operators. During dredging and placement, the use of the area immediately surrounding the borrow areas and Whiskey Island in the vicinity of the restoration would be temporarily restricted due to public safety. All U.S. Coast Guard regulations will be adhered to during construction.

4.6.4 Infrastructure, Oil, Gas, and Other Minerals

No-Action Alternative – Whiskey Island and Borrow Areas

The No-Action Alternative would not have any direct impacts on Infrastructure, Oil, Gas, and Other Minerals.

Restoration Alternative – Whiskey Island and Borrow Areas

The Project restoration features have been designed to avoid the existing oil production facility located in open water east of the Island and existing oil and gas pipelines leading to and away from it. None are laid across the Island itself.

The borrow area footprints have been designed to avoid the buried pipelines and structures in their general vicinity.

In the conveyance corridors, the Project Technical Specifications will require best management practices for sediment pipeline installation, maintenance, and removal to avoid impacts when the sediment pipeline crosses buried oil and gas pipelines.

4.6.5 Environmental Justice

Federal agencies are directed by Executive Order 12898 to assess whether their actions would have a disproportionate and negative effect on the environment and health of people of ethnic or

racial minorities or those with low income. No disproportionate impacts on ethnic or racial minorities or low income individuals would result from the Project.

4.7 HAZARDOUS, TOXIC AND RADIOACTIVE WASTE (HTRW) IMPACTS

No-Action Alternative – Whiskey Island and Borrow Areas

The No-Action Alternative would not have any impacts on HTRW.

Restoration Alternative – Whiskey Island and Borrow Areas

A sediment sample assessment of the South Pelto portion of Ship Shoal was conducted for the Caminada Headland Beach and Dune Restoration project (BA-45) to evaluate for the presence of toxic metals and petroleum-impacted sediment that could be associated with the Deepwater Horizon Oil Spill. The results for sample locations within the South Pelto portion of Ship Shoal for all parameters analyzed were below established toxicity benchmarks for aquatic life (BEM, 2011a). The South Pelto portion of Ship Shoal is located closer to the source of the Deepwater Horizon Oil Spill than either the Ship Shoal Block 88 or Whiskey 3A Borrow Areas. A similar sediment assessment was carried out for the marsh and beach borrow areas for the West Belle Pass Barrier Headland Restoration project (TE-52), located respectively offshore from East Timbalier Island and Cat Island Pass, and the results were the same (BEM, 2011b) as the South Pelto sediment assessment results. The West Belle Pass Barrier Headland Restoration project borrow areas are closer to the source of the Deepwater Horizon Oil Spill than either the Ship Shoal Block 88 or Whiskey 3A Borrow Areas.

During construction, accidental spills and releases of hazardous or toxic wastes are possible. The Project Technical Specifications will require the Contractor to implement best management practices to prevent oil, fuel, or other hazardous substances from entering the air or water; and also for the Contractor to have a spill contingency plan for hazardous, toxic, or petroleum products in place, to be implemented in the unlikely event of an occurrence.

4.8 CUMULATIVE IMPACTS

No-Action Alternative – Whiskey Island

The cumulative impact of allowing the Island to continue to degrade will be its ultimate disappearance and loss to the ecosystem of the benefits it provides. Individual benefits have been described in the preceding sections of Chapter 4. These benefits accrue to the Terrebonne Basin in the broad sense, so their decline and disappearance will be felt across the basin, not just at the Isles Dernieres. Ultimately, as the other islands of the Terrebonne Basin deteriorate, the

socioeconomic fabric of the area will be jeopardized. Servicing the oil and gas infrastructure offshore and within the Basin will remain as an economic foundation, as will some commercial and recreational fishing, but sea level rise will undoubtedly negatively affect communities such as Cocodrie and others along the bayous that intersect the Basin.

No-Action Alternative – Borrow Areas

Not implementing the Project will have no cumulative impacts on either borrow area.

Restoration Alternative – Whiskey Island

Implementing the Project will restore Whiskey Island's GEFF. The cumulative benefit will be seen as the Island retains its form and all of the ecological benefits (pelagic and benthic estuarine productivity, wildlife habitat, EFH, habitat for migratory birds, habitat for T&E Species, and protection of adjacent wetland shores, *etc*.) into the future. The proposed restoration of the barrier shoreline and creation of new marsh will bolster the Island's ability to resist beach erosion, storm surge overwash, and breach formation. Should neighboring islands be similarly restored as was contemplated in the NER Plan (USACE, 2010), the synergy should be a cumulative benefit to the entire basin. The total restored and created areas for the remaining NER Plan islands (Raccoon, Trinity, and Timbalier) would be 4,568 acres, in addition to the 1,040 acres constructed for Whiskey Island.

Restoration Alternative – Borrow Areas

Implementing the restoration will result in elevation changes to both borrow areas from sediment excavation. Modeling studies have indicated that the effort at Ship Shoal will not have adverse impacts on nearby shorelines and other studies have suggested that the Ship Shoal Block 88 Borrow Area will recover gradually as storms and tides affect the shoal crest sediment (Stone et al., 2009; Nairn et al., 2004). Similar modeling studies were undertaken for the Whiskey Island 3A Borrow Area and they concluded that excavating sediment from the borrow area would not produce changes in wave conditions that would create impacts to the nearby shorelines (T. Baker Smith and Moffat & Nichol, 2007).

The estimated volume of Ship Shoal is over 900 MCY of very fine- to medium-grained sand, occupying an area of 100,000 acres. Should both the Barataria Basin Barrier Shoreline Restoration (BBBSR) and TBBSR projects be undertaken, the total fill volume required from Ship Shoal would be 48 MCY equal to 5.3 percent of the total volume available. This cumulative impact is considered minor.

5.0 CONSULTATION AND COORDINATION

5.1 USACE ENVIRONMENTAL IMPACT STATEMENT, SECTION 10/SECTION 404 PERMIT, AND COASTAL USE PERMIT

As part of the LCA TBBSR study, a Notice of Intent (NOI) to prepare a draft Environmental Impact Statement (EIS) was published in the *Federal Register* (volume 73, number 246) on December 22, 2008. The purpose of the NOI was to formally announce the intent to prepare an EIS for the LCA TBBSR study, identified in the 2004 LCA Ecosystem Restoration Plan as a near-term critical project.

A public scoping meeting was held on February 10, 2009 in Houma, Louisiana. A total of 45 participants signed in for the scoping meeting. A total of nine (9) individuals expressed comments at the scoping meeting. A total of thirteen (13) comments were received during the comment period including two (2) scoping comment cards, five (5) scoping comment letters, six (6) scoping comments received via email; and no comments were received via the web site for this study (USACE, 2010).

The draft EIS was publicly released in June 2010 for review and comment during a 45-day period. A public meeting soliciting comments on the proposed action was held during this time. Comments from the review were incorporated into the Final EIS, which was released for a 30-day public review in October 2010. The Final EIS, combined with the Integrated Feasibility Study, accompanied a December 30th, 2010 report from the Chief of Engineers to the Secretary of the Army, fulfilling the requirements of WRDA, 2007 (See § 1.2). On February 11, 2013 the New Orleans District, USACE, the Louisiana Department of Environmental Quality (LDEQ), the Louisiana Department of Natural Resources (LDNR), and the Bureau of Ocean Energy Management (BOEM), New Orleans, issued a Joint Public Notice following receipt of the Coastal Use Permit application from CPRA. The Joint Public Notice initiated the public comment process for the State/Federal CUP, the LDEQ Water Quality Certification, and the Essential Fish Habitat review under the Magnuson-Stevens Fishery Conservation and Management Act (NOAA Fisheries). In addition, submission of the CUP and the Joint Public Notice, followed by this Environmental Assessment facilitated completion of the USACE Environmental Assessment and Finding of No Significant Impact (FONSI), signed on June 07, 2014. The USACE EA details compliance with the broad range of issues that must be addressed for satisfactory adherence to the National Environmental Policy Act (NEPA), including reviews and consultations by the U.S. Fish and Wildlife Service and NOAA Fisheries for issues associated with threatened and endangered species and migratory birds. Also facilitated was BOEM's development of its NEPA compliance documentation, FONSI, and the Negotiated Noncompetitive Lease agreement for use of Outer Continental Shelf sediment resources.

5.2 LANDOWNER INVOLVEMENT

The LDWF currently owns Whiskey Island and manages it as a component of the Isles Dernieres Barrier Island Refuge. As land manager, LDWF has permitted entry on the island for survey, geotechnical, and environmental data acquisition efforts. The LDWF has provided significant insight and support to the Project, participated fully in all public meetings and site visits, and provided input throughout the Coastal Use Permitting process (CUP) and the USACE Section 404/Section 10 permitting process, as required by §404 of the Clean Water Act and §10 of the Rivers and Harbors Act of 1899.

5.3 NON-GOVERNMENTAL ORGANIZATION INVOLVEMENT

Restore or Retreat (ROR) is a non-profit coastal advocacy group whose mission is to identify and expedite the implementation of aggressive, large-scale projects in the Barataria and Terrebonne basins. ROR attended the LCA Scoping meetings, stakeholder meetings, and the Terrebonne Parish CZM meeting and commented on the Study area and supported implementation of the Project.

5.4 PARISH INVOLVEMENT

Terrebonne Parish Consolidated Government has been a leader in barrier island restoration since the early 1980s, having funded the first barrier island project in Louisiana in 1985. The Terrebonne Coastal Zone Management Committee (CZM) attended the LCA Scoping meetings and hosted presentations at their CZM meeting in December 2009. Terrebonne Parish has commented on the Project during the TBBSR Study and supports implementation of the Project features. A Project update presentation was given to the Terrebonne Parish CZM at their October 2012 monthly meeting.

5.5 GOVERNMENTAL ORGANIZATION INVOLVEMENT

The Barataria-Terrebonne National Estuary Program (BTNEP) was established by Congress in 1987. The program charter of BTNEP led to the development of a coalition of government, private and commercial interests for the preservation of the Barataria and Terrebonne basins. These diverse stakeholders collaborated and conducted research that led to the development of a Comprehensive Conservation Management Plan (CCMP) that guides BTNEP in the preservation, protection, and restoration of the Barataria-Terrebonne estuarine complex. One of the management actions in the BTNEP CCMP, Action Plan EM-5 is the preservation and restoration of barrier islands, which includes the proposed restoration actions on Whiskey Island.

When the engineering and design phase for the Project began in February 2012, the PDT held a kickoff meeting and began bi-weekly conference calls which continue through the present.

Stakeholders from BOEM, USFWS, USACE, and LDWF participated in the kick-off meeting and some of the agency staff routinely attends the conference calls. Representatives of NOAA and the Louisiana Oil Spill Coordinator's Office have been informed of Project progress through participation in the biweekly meetings/conference calls.

In December 2012 a permit pre-application meeting was held at the USACE New Orleans District Headquarters to disseminate information and solicit comments on the preliminary designs of the island beach, dune, and marsh fill templates as well as the sediment borrow areas and their conveyance corridors. The meeting was attended by representatives of CPRA and their consultants, LDWF, LDEQ, LDNR, USACE, BOEM, and USFWS. In addition to updating all of the agencies on project progress the meeting ensured team coordination regarding the information needed to complete the CUP and Section 10/Section 404 Permit applications and other relevant permits, such as BOEM's permits for geotechnical and geophysical exploration and the LDWF permit for mining sediment from state water bottoms.

6.0 PERMITS AND COMMITMENTS

6.1 PERMITS

The following is a list of permits that are required to implement the proposed Project:

- LDNR Office of Coastal Management Division Coastal Use Permit and Coastal Zone Consistency Determination
- USACE Section 10/404 Permit including an independent Environmental Assessment
- LDEQ 401 Water Quality Certification
- LDWF Special Use Permit

All of the requisite permits were obtained in conjunction with the submission of the Joint Coastal Use and Section 10/Section 404 Permit Application that was filed in January 2013. The USACE completed an independent project-specific EA prior to issuance of the 10/404 permit. As part of the review process USACE received comments from LDWF, USFWS, NOAA Fisheries, and LDEQ. The permits and associated documents are included in Appendix A.

6.2 ENVIRONMENTAL IMPACT STATEMENT DOCUMENTATION

As part of the development of the TBBSR EIS, the USACE and CPRA coordinated with state and federal agencies and received a variety of regulatory consultation documents associated with the NER Plan (USACE, 2010). Similarly, development of the USACE EA for the Caillou Lake Headlands project resulted in receipt of comments and formal consultation documents from the agencies listed in §6.1, above. A summary of the documentation is presented below. The documentation is included in Appendix A.

6.2.1 Protection of Fish and Wildlife Resources

The USFWS prepared a Biological Assessment and a Biological Opinion for TBBSR in August 2010. On September 17, 2010, the USFWS issued the Final Fish and Wildlife Coordination Act Report for the LCA TBBSR Study. The report provided thirteen (13) recommendations for the proposed LCA TBBSR restoration measures, many of which are not applicable to the proposed restoration actions on Whiskey Island. The USFWS correspondence responding to the USACE Section 10/404 permit public notice is included in Appendix A.

On March 18, 2013 the USFWS recommended re-initiation of consultation regarding piping plover. This was followed by a June 7, 2013 re-initiation request from CPRA regarding piping plover, West Indian manatee, and five species of marine turtle that could be impacted by the Caillou Lake Headlands Restoration project. The request pointed out that the beach/dune and marsh sediment would be mined using cutterhead dredge(s) and that NMFS held that formal

consultation was unnecessary because their previous biological opinion that cutterhead dredges present "…discountable risks to motile species under their purview" have not changed (Hawk, 2012).

The USFWS prepared a Supplemental Biological Opinion for the Caillou Lake Headlands TE-100 Project on August 12, 2013. The document referred to the 2010 BO and addressed monitoring to ensure compliance with a 25% proportional sub-portion of the original incidental take for piping plover. The USFWS correspondence responding to the USACE Section 10/404 permit public notice is included in Appendix A.

It should be noted that the initial USACE 10/404 permit that was proffered in March 2014 was objected to by the CPRA in order to clarify the bird monitoring and abatement conditions required by the USFWS. The CPRA coordinated closely with the USFWS and both agreed upon a revised Bird Monitoring and Abatement Plan which was included in the USACE 10/404 permit dated June 18, 2014.

The USFWS prepared a Draft Conference Opinion for the Caillou lake Headlands restoration project covering conservation recommendations concerning the red knot (*Calidris canutus rufa*), which has been proposed for listing in accordance with the Endangered Species Act of 1973. The draft opinion, No. 04EL1000-2014-FC-0579, was dated August 25, 2014 and is included in Appendix A.

The NOAA/NMFS prepared a February 2009 coordination letter report addressing management of EFH during implementation of TBBSR. The NOAA/NMFS correspondence responding to the USACE Section 10/404 permit public notice is included in Appendix A.

6.2.2 Water Quality

In August, 2010, the USACE submitted an application for a Water Quality Certification (WQC) to the LDEQ for the implementation of the TBBSR NER Plan. A WQC letter was received in September, 2012. A subsequent request from CPRA for the Project resulted in the USACE receiving a WQC letter from LDEQ dated March 11, 2013 that the requirements for a Water Quality Certification (WQC130206-01/AI 185950/CER 21030001) for permit MVN-2013-0266-WOO had been met and that the placement of fill material would not violate water quality standards in Louisiana in accordance with Section 404(b)(1) of the Clean Water Act. The Water Quality Certification is included in Appendix A.

6.2.3 Coastal Use Permit and Coastal Zone Consistency Determination

In accordance with Section 307 of the Coastal Zone Management Act the Louisiana Department on Natural Resources, Coastal Management Division (CMD) reviewed the TBBSR NER Plan for

consistency with the Louisiana Coastal Resources Program. The LDNR CMD issued a letter of consistency (C20100188) dated August 6th, 2010. A modification to the Coastal Zone Determination was obtained on April 2, 2012 for the collection of ten (10) soil borings required for the design of this Project. It was determined that the modification request was consistent with the Louisiana Coastal Resources Program. Following receipt of the CUP application for the Caillou Lake Headlands Project CMD issued Coastal Use Permit/Coastal Use Consistency Determination no. P20121652/no. C20130224 on October 29, 2013, included in Appendix A.

6.2.4 Cultural Resources

As part of the TBBSR study and in accordance with Section 106 of the National Historic Preservation Act a programmatic agreement was developed among the USACE, CPRA, SHPO, and Advisory Council on Historic Preservation in July 2010. The programmatic agreement documented that the USACE in cooperation with the CPRA has been working to reverse the current trend of coastal degradation and had taken into account the effects of the undertakings in the LCA Plan, including TBBSR, upon historic properties and has afforded the SHPO and the ACHP an opportunity to comment. The programmatic agreement stipulates how agencies implementing projects should conduct consultation with Indian tribes; coordinate with the public; coordinate with other consulting parties; identify, evaluate and assess effects determination; coordinate effects determinations; resolve adverse effects; deal with unanticipated discoveries and effects; treat human remains; and resolve disputes. BOEM initiated and completed Section 106 coordination with the Louisiana SHPO for the project-specific cultural resource investigations associated with the proposed Project. Both the terrestrial and marine cultural resource surveys determined that the propose actions would not negatively affect any known scientific, cultural, or historic resources in the Area of Potential Effect. Four potential cultural resource targets were located in proximity to the proposed activities and SHPO and BOEM-agreed-upon buffers have been designated around each. The SHPO coordination letters regarding both the Phase I and Phase II Cultural Resource Surveys, dated May 23, 2013 and September 26, 2012, are included in Appendix A.

6.2.5 Commitments

The CPRA commits to avoiding, minimizing, or mitigating for adverse effects during construction activities for the Project. The CPRA will comply with the Endangered Species Act requirements elaborated in the consultation documents and permits associated with this Project provided by BOEM, USACE, USFWS, NMFS, LDNR, LDEQ, and LDWF. Specific attention will be directed to the requirements of the Section 10/Section 404 and Coastal Use permits and BOEM's OCS Lease. General Provisions 36, 37, and 38 in the Project Contract Specifications address contractor compliance with the maritime Rules of the Road and the U.S. Coast Guard regulations regarding vessel operation and obstruction to navigation.

The CPRA will ensure that all construction activities will be kept under surveillance, management, and control to minimize interference with, disturbance to, and damage to fish and wildlife. The CPRA commits to having a Bird Monitoring and Abatement Plan implemented by the construction contractor during the Project, the contents of which will be developed in consultation with the USFWS and LDWF. The CPRA also commits to surveys and monitoring for the piping plover and red knot including a benthic survey; details of which will be developed in consultation with the USFWS and LDWF.

The CPRA commits to construction monitoring which will begin with a pre-construction meeting and continue with bi-weekly meetings through the duration of construction. Pre-construction hazard surveys will be conducted to verify and mark the location of hazards prior to construction. Pre- and post-construction and dredging progress bathymetric and topographic surveys will be conducted to monitor the Borrow Areas, Conveyance Corridors, and fill areas. Construction activities will be monitored to ensure that the activities stay within the Project footprint and all activities are completed in accordance with all permit conditions and stipulations. Emphasis will be placed on the several cultural resource avoidance buffers along the corridors, including pipeline crossings, and in the borrow areas. Upon completion of construction, the CPRA will document construction activities in a construction completion report.

6.3 NATURAL RESOURCE DAMAGE ASSESSMENT (NRDA) DOCUMENTS

6.3.1 Deepwater Horizon Oil Spill

Deepwater Horizon Oil Spill Natural Resource Damage Assessment Programmatic and Phase III Early Restoration Plan and Early Restoration Programmatic Environmental Impact Statement, June 26, 2014. Developed in accordance with the Oil Pollution Act of 1990 and the National Environmental Policy Act by the Federal and State natural resource trustee agencies, this multi-chapter document describes and evaluates restoration alternatives and projects, including the Caillou Lake Headlands Project.

6.3.2 Record of Decision

Record of Decision (ROD): not yet promulgated.

7.0 LIST OF PREPARERS

Name	Organization	Role in Preparation
Michael Miner, Ph.D.	BOEM	Document Review
Kenneth Ashworth, Ph.D.	BOEM	Document Review
Chad Chauvin, PE	CPRA	Project Management
Elizabeth Davoli, R.P.A.	CPRA	Document Review
Clayton Breland, Ph.D., CPG	CPRA	Document Review
Devyani Kar, Ph.D., CFM	CPRA	CFM Project Management
Jon Staiger, Ph.D.	CEC, Inc.	Document Preparation
Michael Poff, PE	CEC, Inc.	Document Preparation
Michael Stephen, Ph.D., PG	CEC, Inc.	Document Preparation
Greg Grandy, ASLA	CEC, Inc.	Document Preparation
R. Christopher Goodwin, Ph.D.	R. Christopher Goodwin & Associates, Inc.	Marine and Terrestrial Archaeology
David McCullough, Ph.D.	R. Christopher Goodwin & Associates, Inc.	Marine and Terrestrial Archaeology
John Sullivan, P.G.	OSI, Inc.	Geophysical Survey

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