BARRIER ISLAND STATUS REPORT
Draft Fiscal Year 2016 Annual Plan
February 2015

1.0 Introduction

The Coastal Protection and Restoration Authority (CPRA) provides this barrier island status report as part of the Annual Plan document to be submitted to each member of the Louisiana Legislature in compliance with Act 297 of the 2006 Regular Legislative Session. The Act requires that the report: 1) indicate the condition of all barrier islands; 2) provide the status of all barrier island stabilization and preservation projects under construction; and 3) outline future plans for restoration and maintenance of the barrier islands and coastal passes. Because the Annual Plan provides information about all coastal restoration projects in Louisiana (including location, status, features, acres benefited, cost, and funding source), it is appropriate to include a report on the status of the barrier islands.

2.0 Overview of Barrier Islands

The coastline of the modern Mississippi River delta plain is bordered by numerous barrier islands related to several historic major deltaic headlands. For the sake of convenience these islands and headlands can be organized into four distinct barrier systems, each tied to an abandoned Mississippi River delta complex: from west to east they are the Teche, Lafourche, Modern, and St. Bernard delta systems (Figure 1). The back-barrier bays and lagoons are connected to the Gulf of Mexico by numerous tidal inlets, which allow the exchange of diurnal

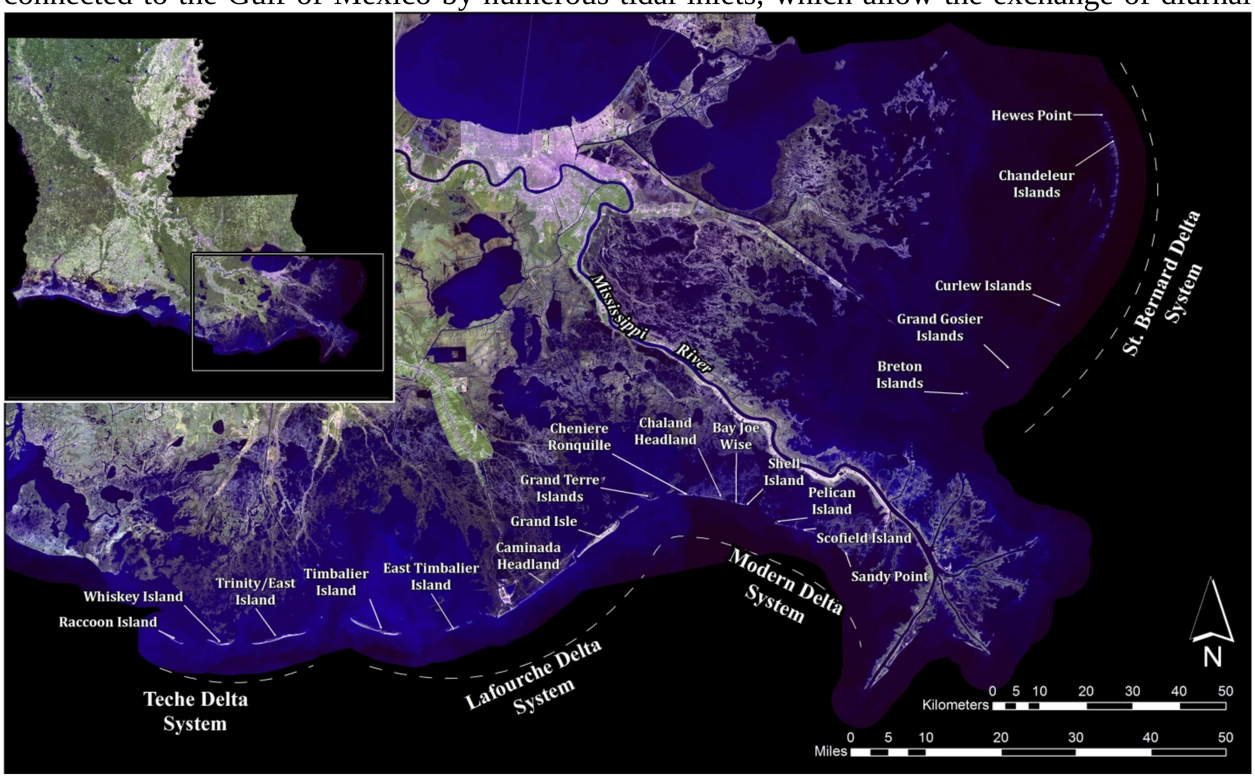


Figure 1. Location of Teche, Lafourche, Modern, and St. Bernard barrier island systems in Louisiana.

tides and separates these barrier islands from each other. The morphology of the barrier islands along the Louisiana coast is related to the sediment supply and physical processes acting in the region (Georgiou et al., 2005). Because barrier islands migrate and deteriorate over time (McBride and Byrnes, 1997), restoration of these habitats requires periodic replenishment of sediment/sand to counteract the losses due to erosion. Numerous hurricanes and the *Deepwater Horizon* oil spill have clearly demonstrated the advantage of robust barrier islands and a well-managed coastline in terms of shoreline resilience and hurricane damage reduction. These events have also highlighted the ecological concerns related to the massive loss of coastal wetland and barrier island systems (Ewing and Pope, 2006). Coastal landscapes created by these barriers can provide a significant and potentially sustainable buffer from wind and wave action as well as storm surges generated by tropical storms and hurricanes. In addition, barrier shorelines are unique habitats that represent the foundation for complex and productive coastal ecosystems.

The restoration of Louisiana's barrier islands has been a priority for a number of programs over the past several decades. In the 1990s, barrier island restoration was a priority for the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) program, which funded construction of a number of barrier island restoration projects. More recently, the CPRA has constructed or is planning to construct a large number of additional projects (see below) to restore barrier islands and headlands in coastal Louisiana. The constructed projects have been studied and their performance has been assessed to adaptively improve resilience and persistence of these projects.

More than 20 barrier island projects have been implemented in Louisiana over the past two decades. These projects are described below geographically from west to east, and are grouped by barrier island system.

2.1 <u>Teche Delta System (Raccoon Island to Wine Island)</u>

2.1.1 Constructed Projects

1. Raccoon Island Breakwaters Demonstration (TE-29; CWPPRA; 1997) – The goal of this project was to reduce shoreline erosion and increase land coverage. Eight segmented breakwaters were constructed along the eastern end of the island to reduce the rate of shoreline retreat, promote sediment deposition along the beach, and protect seabird habitat. Project effectiveness was determined by monitoring changes in the shoreline, wave energy, and elevations along the beach, and by surveys of the gulf floor between the shoreline and the breakwaters.
2. Raccoon Island Shoreline Protection/ Marsh Creation (TE-48; CWPPRA; 2007, 2013) – The goal of this project was to protect the Raccoon Island rookery and seabird colonies from an encroaching shoreline by reducing the rate of erosion along the western end of the island and creating more land along the northern shoreline. This goal was accomplished through the construction of eight additional breakwaters west of the existing (TE-29) breakwaters and a terminal groin at the eastern of the island (Phase A). In addition, mixed sediment from an offshore borrow site in federal waters was dredged to create 60 acres of back barrier marsh platform with an average elevation of 3.5 feet (Phase B). The shoreline protection (Phase A)

component of this project was constructed in 2007; construction of the back barrier marsh platform component (Phase B) was completed in April 2013.

3. Whiskey Island Restoration (TE-27; CWPPRA; 1999) – The objective of this project was to create and restore beaches and back barrier marsh platform on Whiskey Island. About 4.6 miles of the Gulfside shoreline with beach/dune component of variable width (700-800 feet) was restored using about 2.9 million cubic yards (MCY) of sand. The dune height was 4 feet with crest varying from 300-500 feet. The project consisted of creating 523 acres of back barrier marsh platform and filling in the breach at Coupe Nouvelle. The initial vegetation planting of smooth cordgrass (*Spartina alterniflora*) on the bayside shore was completed in July 1998 and additional vegetation seeding and planting was carried out in spring 2000.
4. Whiskey Island Back Barrier Marsh Creation (TE-50; CWPPRA; 2009) – The goal of the TE-50 project was to increase the longevity of the previously restored and natural portions of the island by increasing the island's width which helped retain sand volume and elevation. Approximately 316 acres of back barrier intertidal marsh habitat, 5,800 linear feet of tidal creeks, three 1-acre tidal ponds and 13,000 linear feet of protective sand dune were created by semiconfined disposal and placement of dredged material. About 2.76 MCY of mixed sediment was dredged from an offshore borrow area in Gulf of Mexico near the island. After removal of the mixed sediment overburden, about 0.36 MCY of underlying sand was used to create the dune fronting the marsh platform. The vegetative planting with native marsh vegetation to colonize and protect the newly-placed marsh soil was undertaken.
5. Isles Dernieres Restoration Trinity Island (TE-24; CWPPRA; 1999) – The project objectives included the restoration of the dunes and back barrier marshes of Trinity Island. Approximately 4.85 MCY of sand/sediment were dredged from a borrow area in Lake Pelto to build approximately 4.3 miles of 8-feet high dune with crest width of about 300 feet along with an elevated marsh platform at the bay side of the island. A total of about 353 acres of supratidal and intratidal habitats were created. About 22,500 feet of sand fences were installed in various orientations along with vegetative planting to stabilize the sand and minimize wind-driven transport.
6. New Cut Dune and Marsh Restoration Project (TE-37; CWPPRA; 2007) – The purpose of this project was to close the breach between Trinity and East Islands through the creation of beach, dune, and marsh habitats in order to increase the structural integrity of eastern Isles Dernieres by restoring the littoral drift and adding sediment into the nearshore system. New Cut was closed through the construction of about 8,000 feet of dune platform (by placing approximately 0.85 MCY of sand dredged from an offshore borrow area) matching the dune elevations on the east and west, strengthening the connection between East and Trinity Islands. Nine species of native barrier island vegetation were planted along with over 17,000 linear feet of sand fence.
7. Isles Dernieres Restoration East Island (TE-20; CWPPRA; 1999) – The project objective was to restore the coastal dunes and wetlands of the Eastern Isles Dernieres. Approximately 3.9 MCY of sand were dredged from Lake Pelto to build about 353 acres of beach and dune with target elevations of 2 feet and 8 feet, respectively. The dune crest width ranges from 300 to 500 feet. Sand fences and vegetation were also installed to stabilize the sand and minimize wind-driven transport.
8. Enhancement of Barrier Island Vegetation Demonstration (TE-53; CWPPRA; 2010) – The goal of this project was to test several technologies or products to enhance the establishment and growth of key barrier island and salt marsh vegetation. The project focuses specifically

on enhancing the establishment and growth of transplants of both dune vegetation (*Panicum amarum* and *Uniola paniculata*) and marsh vegetation (*Spartina alterniflora* and *Avicennia germinans*). Planting took place on Whiskey Island and New Cut in 2010, and monitoring of vegetation began in 2011.

2.1.2 Projects under Construction

None.

2.1.3 Future Projects

1. NRDA Caillou Lake Headlands Restoration Project (TE-100; NRDA): This project includes the project area as envisaged by previous CWPPRA project entitled "Ship Shoal: Whiskey West Flank Restoration (TE-47)". The design template of this project is same as that suggested under the Louisiana Coastal Area (LCA)- Terrebonne Basin Barrier Shoreline (TBBS) Restoration Project, which includes the entire island footprint. This project will provide a barrier to reduce wave and tidal energy, thereby protecting the mainland shoreline from continued erosion. The objective of this project is to rebuild dunes and a marsh platform on the Whiskey Island through the emplacement of about 8.9 MCY of sand transported from Ship Shoal Block 88. About 4.26 miles of shoreline will be nourished with a 6.4 feet high and 100 feet wide dune crest and 4.2 feet high and 464 feet wide beach on Gulf side and 100 feet wide on Bay side, covering around 1,063 acres. About 0.82 MCY of sediment would be used to construct 178 acres of marsh platform. NRDA funds will be used for construction of this project.

2.2 Lafourche Delta System (Timbalier Island to Grand Isle)

2.2.1 Constructed Projects

1. Timbalier Island Planting Demonstration (TE-18; CWPPRA; 1996) – For this project, sand fences were installed and vegetation suited to the salinity and habitat type of Timbalier Island was planted in several areas on the island to trap sand and buffer wind and wave energy.
2. Timbalier Island Dune and Marsh Creation (TE-40; CWPPRA; 2004) – Timbalier Island is migrating rapidly to the west/northwest; therefore, the western end of Timbalier Island is undergoing lateral migration by spit-building processes at the expense of erosion along the eastern end. The objective of this project was to restore the eastern end of Timbalier Island by restoring beach, dunes, and marsh. An 8-foot high dune with average crest width of about 400 feet was built using about 4.6 MCY of sand/sediment dredged from offshore borrow area which created a total fill area of about 273 acres, including about 196 acres of marsh platform.
3. East Timbalier Island Sediment Restoration, Phase 1 (TE-25; CWPPRA; 2000) – The objective of this project was to strengthen and thus increase the longevity of East Timbalier Island. The project included the placement of dredged sediment in three embayments along the landward shoreline of East Timbalier Island, along with aerial seeding of the dune platform, installation of about 13,000 linear feet of sand fencing, and dune vegetation plantings. About 2.8 MCY of sediment was dredged from an offshore borrow area to create a total of about 217 acres of supratidal and intratidal habitats which included a 5-foot high

dune with crest width of about 200 feet and a 2-foot high and 500-foot wide marsh platform. This project was funded over two funding cycles, PPL 3 and 4, from 1999 and 2000, respectively.

4. East Timbalier Island Sediment Restoration, Phase 2 (TE-30; CWPPRA; 2000) – The project goals and objectives were the same as that of Phase 1. While Phase 2 of the project along the western half of the island did not reconnect the western and eastern portions of the island, it did create 99% of the targeted acreage. It has helped to protect thousands of acres of existing fringing marsh to the north. Construction funds from this phase of the project were also used for 7,000 feet of rubble mound revetment created to protect the newly created habitats.
5. West Belle Pass Barrier Headland Restoration (TE-52; CWPPRA; 2012) – The goals of this project were to re-establish the eroded West Belle Pass headland via dune and marsh creation and to prevent increased erosion along the adjacent bay shoreline, protect the interior marshes and the Port Fourchon area. The project created a continuous headland approximately 10,660 feet in length, creating about 93 acres of dune habitat using nearly 1.74 MCY of dredged sand, and about 227 acres of marsh habitat using 3.05 MCY of dredged mixed sediment. Construction began in May 2011 and completed in 2012.
6. Bayside Segmented Breakwaters at Grand Isle (BA-50; CIAP; 2012) – The purpose of this project was to reduce erosion on the bay side of Grand Isle. Twenty-four 300 foot breakwaters (approximately 1.5 miles) were constructed on the back-bay side of Grand Isle. This project was constructed with Jefferson Parish CIAP funds in September 2012.

2.2.2 Projects under Construction

1. Caminada Headland Beach and Dune Restoration (BA-45; CIAP; Surplus) – The Caminada Headland Beach and Dune Restoration project will restore and maintain the headland through the creation of dunes and beach habitat and will protect unique coastal habitats, continue littoral sand transport to Grand Isle, and protect Port Fourchon and the only hurricane evacuation route available to the region. This reach of the Barataria shoreline also supports the only land-based access to the barrier shoreline in the Deltaic Plain. Construction of portions of the Caminada Headland component of the LCA-BBBS Restoration Project template began in early 2013 using CIAP 2007 and Surplus 2008 funds. Approximately 3.3 MCY of sand from South Pelto Blocks 12 and 13 borrow area (eastern portion of Ship Shoal Complex) was placed to restore approximately 6 miles of shoreline by constructing a 7-foot high and about 290-foot wide dune and a 4.5-foot high and 65-foot wide beach over a surface area of about 303 acres. This restoration project is unique in that it is the first time that sand from the Ship Shoal complex was dredged for coastal restoration purposes and was transported a distance of almost 22 miles.
2. Caminada Headland Beach and Dune Restoration Increment II (BA-143, NFWF) – In order to achieve the goals of this project approximately 5.39 MCY of sand will be dredged from the South Pelto Block in Ship Shoal and construct a 7-foot high dune with a 290 foot width along with a 4.5-foot high and 65-foot wide beach over a project length of 39,000 linear feet thereby restoring the headland on the same template as BA-45. This project will start approximately in the middle of the headland, where the BA-45 project ended and continue east to Caminada Pass. It is expected to create a surface area of about 489 acres. Construction of the project is anticipated to begin in the spring of 2015 and be complete by the end of 2016. When complete the BA-45 and BA-143 projects will have pumped over 8.5 million cubic yards onto the headland to restore over 13 miles of beach and dune habitat.

2.2.3 *Future Projects*

1. East Timbalier Island Restoration Project (TE-118; NFWF) – East Timbalier Island is part of a barrier island chain that separates Terrebonne and Timbalier Bays from the Gulf of Mexico. The island is currently comprised of two severely degraded segments. This project is for engineering and design to develop a final design package consisting of permitting, WVA assessment, and construction plans and specifications – with probable construction cost and schedule, all sufficient to re-establish the historic island footprint, reconnecting the two segments, with restoration of dune, supratidal, and intertidal habitat. Estimated Benefits (East Timbalier Plan B) include in TY1 Beach/Dune Minimum Template – 241 acres and Intertidal Marsh – 279 acres.
2. Caminada Headlands Back Barrier Marsh Creation Project (BA-171; CWPPRA) – This project would create 300 acres of back barrier intertidal marsh and nourish 130 acres of emergent marsh behind 3.5 miles of Caminada Beach using 2.7 MCY of mixed sediment dredged/ pumped from delineated borrow area in the Gulf of Mexico. The marsh creation and nourishment cells are designed to minimize impacts on existing marsh and mangroves. Assuming some natural vegetative recruitment, vegetative plantings are planned at a 50% density, with half planned at Target Year 1 (TY1) and half planned at TY3. This project (BA-171) will be designed to create and nourish marsh habitat behind BA-45 to further decrease the likelihood of breaches and improve the longevity of the shoreline. BA-171 is a CWPPRA project which is funded for E&D (Phase 1).
3. Barataria Basin Barrier Shoreline (BBBS) Restoration (LA-10; LCA) – Initially this project included the Caminada Headland Beach and Dune Restoration and Shell Island Restoration Projects. Portions of Caminada Headland were constructed with CIAP and Surplus funds. The eastern beach/dune portion will be constructed with NFWF funds, and a portion of the back barrier marsh platform is being designed through CWPPRA. Shell Island East was constructed with Berm to Barrier Funds, and Shell Island West will be constructed with NRDA funding. Construction of the remainder of the BBBS template features will be decided at a later date.

2.3 Modern Delta System (Cheniere Ronquille to Scofield Island)

2.3.1 *Constructed Projects*

1. Vegetative Plantings of a Dredged Material Disposal Site on Grand Terre Island (BA-28; CWPPRA; 2001) – The goal of this project was to stabilize dredged material sites on West Grand Terre Island. This objective was achieved through vegetation plantings and by purchasing grazing rights on the island for the 20-year life of the project.
2. East Grand Terre Island Restoration (BA-30; CIAP; 2010) – The goal of this project was to stabilize and benefit 1,575 acres of barrier island habitat and extend the island's life expectancy by filling breaches and tidal inlets in the shoreline, and reinforce the existing shoreline with sand. For this about 621 acres of barrier island were created by restoring 2.8 miles of barrier shoreline through construction of a 6-foot high dune along with 165 acres of beach habitat and construction of about 456 acres of marsh platform using about 3 MCY of sand and 1.6 MCY of mixed sediment from two offshore borrow areas. Although the CPRA

constructed this projects using CIAP 2007 funds, this project was engineered, designed, permitted, and received the necessary land rights for construction, through the CWPPRA program, in partnership with the NOAA Fisheries.

3. Barataria Barrier Island Complex Project: Pelican Island and Pass La Mer to Chaland Pass Restoration (BA-38; CWPPRA; 2007, 2012) – The objectives of this project were to create barrier island habitat, enhance storm-related surge and wave protection, prevent overtopping during storms, and increase the volume of sand within the active barrier system. This project includes restoration of two barrier islands viz. the Chaland Headland portion of this project, which was constructed in 2007, and the Pelican Island segment, which began construction in May 2011 and was completed in 2012. Additionally in June 2010, the state began construction of a barrier berm in response to the *Deepwater Horizon* oil spill from Shell Island to Scofield Island west of the river to safeguard its coast from the effects of the oil. The construction of the berm introduced a significant amount of sand into the barrier island system.
   a. Pass La Mer to Chaland Pass Restoration (BA-38-1; CWPPRA; 2007) – A total fill area of 484 acres was created which included about 254 acres of back barrier marsh platform with an average elevation of 2.5 feet. Back barrier marsh platform was constructed using about 1.0 MCY of overburden mixed sediment from an offshore borrow area. About 2.4 MCY of sand was placed to build about 230 acres of beach-dune habitat with a dune height of 6 feet and crest width of 400 feet over a project length of 2.7 miles.
   b. Pelican Island Restoration Project (BA-38-2; CWPPRA; 2012) – Pelican Island was restored using about 6.4 MCY of mixed sediment and sand from 4 different borrow areas in state and federal waters ranging in distance from 2 to 12 miles. About 2.1 MCY (in-place volume) of sand were utilized to create 192 acres of beach-dune habitats. About 398 acres of marsh platform, with an average elevation of about 2.6 feet, was constructed using 1.6 MCY of sediment. Average dune elevation was about 7.5 feet extending to a length of 2.5 miles. It may be noted that Emergency Berm W9 was built in front of this island using about 1.24 MCY of sand.
4. Pass Chaland to Grand Bayou Pass Barrier Shoreline Restoration (BA-35; CWPPRA; 2009) – Also known as Bay Joe Wise, this project includes the emplacement of mixed sediment to create marsh along with tidal creeks and ponds, followed by vegetation plantings. The project's objectives were to: 1) prevent the breaching of the Bay Joe Wise shoreline by increasing barrier shoreline width; 2) increase back-barrier, emergent marsh area by approximately 220 acres to maintain the barrier shoreline; and 3) create emergent marsh suitable for tidal aquatic habitats. These features act as a buffer against wave and tidal energy, thereby protecting the mainland shoreline from breaching and continued erosion. About 350 acres of total fill area was created which included a marsh platform approximately 1,000 feet wide contiguous with the northern side of the gulf shoreline of Bay Joe Wise. The dune was built to an elevation of 6 feet with a dune crest width of about 110 feet. Approximately 3 MCY of sediment was dredged from the Pas la Mer Ebb-Tide Delta, Pass Chaland Ebb-Tide Delta, and Grand Pass Ebb-Tide Delta. The project also included the construction of approximately 10,000 feet of 4-foot wide, 2-foot deep tidal creeks or water exchange channels. In addition, immediate post-construction aerial seeding with Japanese millet (*Echinochloa frumentacea*) or brown top millet (*Panicum ramosum*) followed by smooth cordgrass (*Spartina alterniflora*) and black mangrove (*Avicennia germinans*) vegetative plantings were undertaken.

5. Riverine Sand Mining/Scofield Island Restoration (BA-40; Berm Funds; 2013) – The goals of this project were to mitigate breaches and tidal inlets in the shoreline, reinforce the existing shoreline with sand, increase the width of the island with back barrier marsh to increase island longevity, and to re-establish a sandy dune along the length of the shoreline to protect the back barrier marsh platform from sea level rise and storm damage. The beach-dune habitats were constructed by the sand dredged from a borrow area in the Lower Mississippi River via a 22-mile long pipeline and the marsh platform was constructed from an offshore borrow source of mixed sediment. Although this project was designed under CWPPRA, construction began in December 2012 using Berm Funds. This created approximately 2.16 miles of beach and dune fill to close the breach areas and restore/protect the eroding beach. The dune component included a 50-foot wide crest width at +6 feet NAVD88. The beach fill template included a 100-foot wide construction berm at +4 feet NAVD88. The surface area of the beach platform was approximately 223 acres measured at +4 feet NAVD88. The required fill volume was approximately 2.03 MCY (required excavation (cut) volume was approximately 2.64 MCY). An approximately 2.23-mile long back barrier marsh platform on the bay side of Scofield Island was constructed. The surface area of the proposed marsh platform is approximately 375 acres with target marsh platform elevation of +3.0 feet NAVD88. The required fill volume was approximately 1.74 MCY (the required excavation (cut) volume is approximately 2.79 MCY). It may be noted that Emergency Berm W-10 was built in front of this island using about 0.964 MCY of sand.
6. Western Berm Reaches (West of Mississippi River along Shell, Pelican and Scofield Islands) In response to the *Deepwater Horizon* oil spill which began on April 20, 2010, the State of Louisiana constructed approximately 16 miles of sand berms along several sections of the state's barrier islands both east and west of the Mississippi River. The objective of these projects was to provide a barrier to oil and minimize the potential impact of the oil spill to thousands of acres of fragile barrier islands and wetlands in coastal Louisiana.
    a. Berm Reach W8 (Shell Island): The initial template of berm reach W8 was located within the footprint of the Shell Island restoration project which was proposed under the Barataria Basin Barrier Shoreline LCA project. However, pre-construction surveys indicated that the island had receded, so the profile was shifted approximately 750 feet north. The construction template for the W8 berm reach was identical to the templates used on the other berm reaches: a 20-foot crest width, +5 feet, NAVD 88 crest elevation, 1V:25H side slopes above -2.0 feet, NAVD88 and 1V:50H below -2.0 feet, NAVD 88. Construction of approximately 9,000 linear feet of berm on Shell Island started on October 9, 2010 and was completed by November 23, 2010. Approximately 777,000 cubic yards of sand was placed along the island.
    b. Berm Reach W9 (Pelican Island): Construction of berm reach W9 along Pelican Island started on July 18, 2010 and was completed by October 2, 2010. Sand was placed within the construction template, which was identical to the template used for the other berm reaches. The template was superimposed on the existing island and within the footprint of the proposed CWPPRA Pelican Island Restoration Project (BA-38-1). A total length of 12,700 feet of berm was constructed and approximately 1,294,000 cubic yards of sand was emplaced within the berm along Pelican Island.
    c. Berm Reach W10 (Scofield Island): Construction of berm reach W10 on Scofield Island started on September 13, 2010. Approximately 935,000 cubic yards of sand was placed between September 13 and November 23, 2010 for constructing approximately 14,755

feet of berm. The construction template for berm reach W10 was identical to the other berm reaches. The berm was constructed within the footprint of the proposed CWPPRA Scofield Island Restoration Project (BA-40).

7. Shell Island Restoration – Shell Island is a critical component of the Barataria shoreline which has been breached into two islands – east and west. Restoration of these two islands was initially included in the LCA-BBBS Project. The Shell Island Restoration project would restore this barrier island through the creation of dune and marsh habitat. The overall goals of this project are to prevent intrusion of the Gulf of Mexico into interior bays and marshes, restore natural sand transport along this reach of the coast, and protect oil and gas facilities. This segment of the shoreline has been nearly lost. It may be noted that Emergency Berm Reach W8 was built using about 0.777 MCY of sand on the eastern portion of the Shell East island. This project has been split into two projects: Shell Island East-Berm (BA-110) and Shell Island West NRDA (BA-111). Shell Island East (Berm) has been constructed, whereas Shell Island West NRDA is funded through the Louisiana Outer Coast Restoration project using NRDA Early Restoration Funds.
    a. Shell Island East Berm (BA-110) was constructed between April 2013 and August 2013. About 2.29 MCY of sand from a Lower Mississippi River Borrow Area (the same borrow area used for the Scofield Restoration Project [BA-40]) was utilized to construct an 8-foot NAVD 88 dune with a crest width of 340 feet between station 76+79 and station 144+00 creating a dune area of about 87 acres as well as a beach area of approximately 54 acres. About 136 acres of marsh platform was constructed using about 0.286 MCY from the same borrow area as the dune sediment.

2.3.2 Projects under Construction

None.

2.3.3 Future Projects

1. Cheniere Ronquille Barrier Island Restoration (BA-76; NRDA) – This project would expand the Cheniere Ronquille's gulf shoreline structural integrity by tying into two recently constructed projects to the east and address one of the remaining reaches of the Barataria/ Plaquemines shoreline. The design includes fill for a beach and dune plus 20 years of advanced maintenance fill, as well as fill for marsh creation/nourishment. Approximately 127 acres of beach/dune fill would be constructed and approximately 259 acres of back barrier marsh platform would be constructed using the sand/sediment from the borrow areas identified for earlier projects. Once restored, this island will provide critical habitat, and help reconnect the barrier island chain that provides defense to inland communities. Dune plantings would be conducted by seeding and installing approved nursery stock. About half of the marsh platform would be planted with cordgrass and portions of the dune, swale, and marsh would be planted with appropriate woody species. This project will be built by the National Marine Fisheries Services and is funded through the Louisiana Outer Coast Restoration project using NRDA Early Restoration Funds.
2. Shell Island West (BA-111: NRDA): This project is in the final design phase. The template of this project includes 16,100 feet of shoreline with an 8-foot high and 340-foot wide dune on the western portion of the east island, and a 380-foot wide dune on the western island,

creating an area of about 231 acres with 4.8 MCY of sand. About 285 acres of barrier marsh platform will be constructed using about 1.1 MCY of mixed sediment from an offshore borrow area. This project is funded through the Louisiana Outer Coast Restoration project using NRDA Early Restoration Funds.

2.4 St. Bernard Delta System

2.4.1 Constructed Projects

1. Chandeleur Islands Marsh Restoration (PO-27; CWPPRA; 2001) – This project is intended to accelerate the recovery period of barrier island areas overwashed by Hurricane Georges in 1998 through vegetation plantings. The overwash areas, which encompass 364 acres, are located at 22 sites along the Chandeleur Sound side of the island chain and were planted with smooth cordgrass (Spartina alterniflora).
2. Eastern Berm Reach E4 (East of Mississippi River along Chandeleur Islands): In response to the *Deepwater Horizon* oil spill which began on April 20, 2010, the State of Louisiana constructed approximately 16 miles of sand berms along several sections of the state's barrier islands both east and west of the Mississippi River. The objective of this project was to provide a barrier to oil and minimize the potential impact of the oil spill to thousands of acres of fragile barrier islands and wetlands in coastal Louisiana. A total of 47,000 feet (8.9 miles) of berm were constructed along the Chandeleur Islands. It was estimated that a total of 5.85 MCY of sand was dredged from Hewes Point.

2.4.2 Projects under Construction

None.

2.4.3 Future Projects

1. Louisiana Outer Coast Restoration Project: North Breton Island (NRDA) – Funded as an Early NRDA Restoration Project, the Louisiana Outer Coast Restoration project comprises four island segments including Breton Island. The goals of this project are to restore beach, dune, and back-barrier marsh habitats, as well as habitat for brown pelicans, terns, skimmers, and gulls to help compensate the public for spill-related injuries and losses to these resources. The restoration work involves placement of appropriately sized sediments to create beach, dune, and back-barrier marsh areas; installation of sand fencing to trap and retain windblown sediments and foster dune development; and revegetation of appropriate native species in dune and back-barrier marsh habitat.

3.0 Monitoring and Maintenance

Louisiana's barrier islands are part of a complex system controlled by many overlapping and interrelated processes. The four primary barrier island systems have been monitored and evaluated by recent efforts, such as the Barrier Island Comprehensive Monitoring (BICM) program (Section 3.1) and the monitoring of the Emergency Berms (Section 3.2). In addition to the monitoring, the Barrier Island Maintenance Program (BIMP; Section 3.3) provides a framework for prioritizing planning, design, and construction of barrier island maintenance projects when needs are identified. These programs have provided information to the CPRA regarding the current condition and stability of Louisiana's barrier islands. To minimize the acceleration of island disintegration that commonly occurs after islands breach, a barrier island Breach Management Program is currently being developed to address both breach prevention and response to breaches when they occur (Section 3.4). This program will drastically improve the state's ability to repair storm-induced damages and extend the life-expectancy and integrity of Louisiana's barrier shorelines. Finally, to ensure the efficient and effective use of limited sediment resources in Louisiana, a Borrow Area Monitoring and Maintenance (BAMM) project has been initiated to provide information to understand the evolution of the borrow pits (inland, riverine, and offshore) over time, especially the infilling characteristics (rate and types of sediment) and gradient of the pit-slopes (Section 3.5).

3.1 Barrier Island Comprehensive Monitoring (BICM) program

The development of a comprehensive program to evaluate the state's barrier shoreline was initiated by a Louisiana Department of Natural Resources (LDNR) workgroup (now headed by the CPRA) in 2002-03. This workgroup developed a monitoring framework to assess shoreline processes and resulting habitats, and the changes in these ecosystems over time. The initial plan was then reviewed in 2004 by the Louisiana Shoreline Science Restoration Team (SSRT) working under the LCA program. The LCA study recommended the establishment of a coordinated System-wide Assessment and Monitoring Program (SWAMP), which would integrate the environmental monitoring of wetlands (Coastwide Reference Monitoring System, or CRMS-*Wetlands*), rivers and inshore waters (CRMS-*Waters*), near-shore waters, and barrier islands (BICM). The initiation of the BICM program in 2005 was conducted through the CPRA and was funded by the LCA Science and Technology (S&T) office and through a partnership between the University of New Orleans (UNO) and the U.S. Geological Survey (USGS). Initial goals of the BICM program were to establish baseline conditions for the state's barrier shoreline after hurricanes Katrina and Rita, as well as to refine the methods and products for use in programs other than LCA (e.g., CWPPRA; CIAP; BIMP).

The advantage of BICM over CWPPRA project-specific monitoring alone, is the ability to provide integrated long-term data on all of Louisiana's barrier shorelines, instead of only those areas with constructed projects. As a result, a greater amount of long-term data are now available to evaluate constructed projects, facilitate planning and design of future barrier island projects, assist operations and maintenance activities, and determine storm impacts. Because data were collected for the entire barrier island system concurrently, BICM data are more consistent and complete than previous barrier island data collection efforts.

Initial BICM datasets collected include 1) post-storm damage assessment photography and videography, 2) shoreline position, 3) land/water analysis, 4) topography, 5) bathymetry, 6) habitat composition, and 7) surficial sediment composition. Additionally, these datasets have been compared to historic datasets (where available) that have been standardized, thereby providing digital datasets to user groups for their use in multiple restoration efforts. Data collection for all seven BICM components initiated in 2005 was completed in 2008. Final datasets and reports are currently available through the CPRA web site.

Post-storm assessment products included an aerial video survey of the entire coastline and photographs of the majority of the shoreline. Photography of particular shoreline locations were then matched with historic photographs to provide time-series datasets for shoreline evaluations and comparisons (Figure 2).

These datasets have already proven invaluable in assessment of the impacts of Hurricanes Gustav and Ike in 2008, in the planning of LCA projects currently in the feasibility stage, and in the *Deepwater Horizon* oil spill of 2010. These photos have also allowed assessment of impacts for documentation of damage claims to FEMA.

A combination of CRMS-*Wetlands*, UNO photography, and Quickbird satellite imagery was collected for the entire Louisiana coast. Shoreline positions using post-storm photography have been developed along with complete 1880s, 1930s, 1990s, and 2004 shorelines. The imagery has been analyzed, and datasets for historic, long-term, short-term, and near-term erosion rates for the entire coastline are available (Figure 3). Additionally, land/water change maps and tables have been developed with the shoreline changes (Figures 4 and 5).

Figure 2. Photo comparison of Elmer's Island shoreline in Lafourche Parish, LA immediately after Hurricanes Katrina and Rita in 2005, and approximately 2 years later.

LiDAR data have been collected for all three portions of the sandy coast; the Chandeleur Islands, from Raccoon Island to Sandy Point, and the Chenier Plain from Sabine Pass to the Mermentau River Outlet. Data, grid models, and change models for all coastal areas are complete (Figure 6). USGS has continued to fly LiDAR for the Chandeleur region and has provided an additional four surveys of the area (Figure 7). Additionally, LiDAR was flown by USGS for the Teche and Lafourche Deltaic Regions in early 2008 and plans are underway to bring these data into the BICM program for use. LiDAR data were acquired from the Caminada Headland to Sandy Point in March, 2013 as part of a lower Barataria basin LiDAR update through a partnership with USGS. The processed data is scheduled for delivery from USGS in early 2014.

Bathymetric surveys were conducted during 2006 and 2007. The Chenier plain area and the southern Chandeleur Islands were surveyed to complete the coast-wide coverage areas begun in 2006. Surveys covered from five kilometers (km) offshore to two km bayward of the shoreline. In addition to bathymetry data, USGS collected sonar and seismic data along all the offshore lines and did a complete sidescan sonar mosaic of the gulf side of the Chandeleur Islands. Data, grid models, and change models from all field work are finalized (Figures 8, 9, and 10).

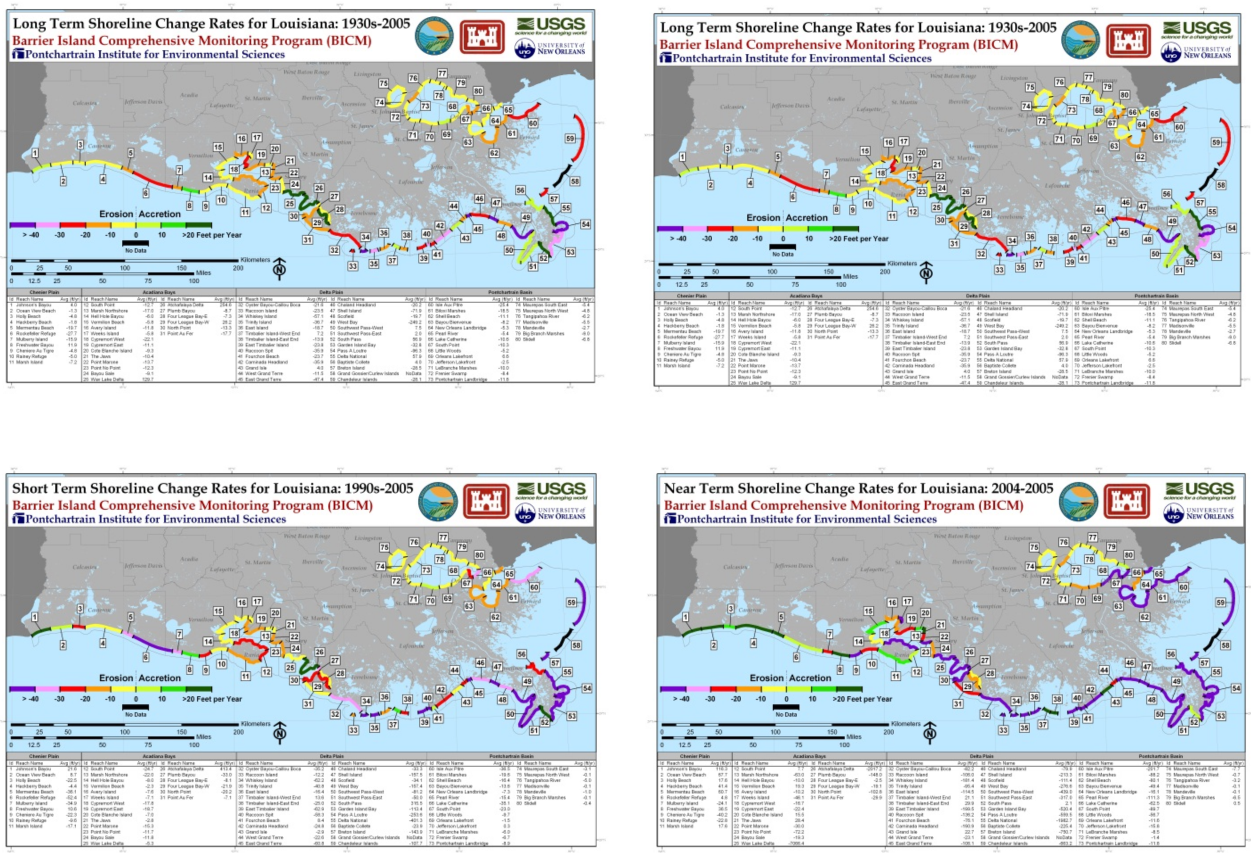


Figure 3. Shoreline erosion rates for sections of the Louisiana coast. A) Historic (1850s-2005), B) Long-term (1920s–2005), C) Short-term (1996-2005), and D) Near-term (2004-2005) (Martinez et al., 2009).

Habitat analysis based on the aerial photography is complete. Detailed habitat data for all BICM shoreline areas are available for 1996/98, 2002, 2004, and 2005 along with change maps showing habitat differences for all time periods (Figures 11 and 12).

Collection of surficial sediments for sediment characterization was conducted in 2008 and analysis is complete. Sediment characterization analysis, reports, and distribution maps are available (Figure 13).

A final report entitled "Louisiana Barrier Island Comprehensive Monitoring (BICM) Program Summary Report: Data and Analyses 2006 through 2010: U.S. Geological Survey Open-File Report 2013–1083" was published as a USGS open file and can be accessed online at http://pubs.usgs.gov/of/2013/1083/ (Kindinger et al., 2013). The BICM program used both historical and newly acquired (2006 - 2010) data to assess and monitor changes in the aerial and subaqueous extent of islands, habitat types, sediment texture and geotechnical properties, environmental processes, and vegetation composition. BICM datasets included aerial still and video photography (multiple time series) for shoreline positions, habitat mapping, and land loss; LiDAR surveys for topographic elevations; single-beam and swath bathymetry; and sediment

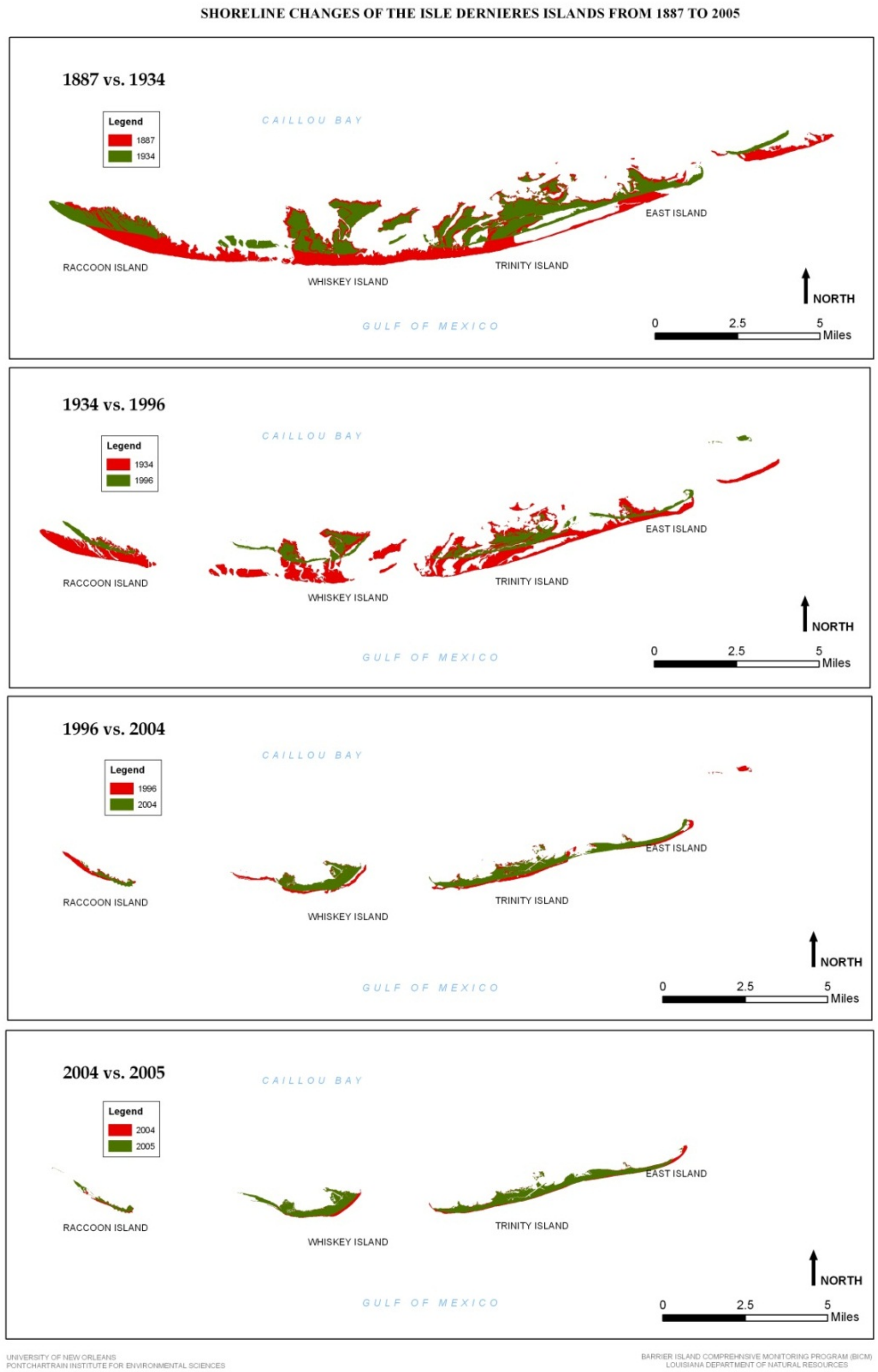


Figure 4. Historical overlays for the Isle Dernieres for 1887 – 2005. (Martinez et al., 2009).

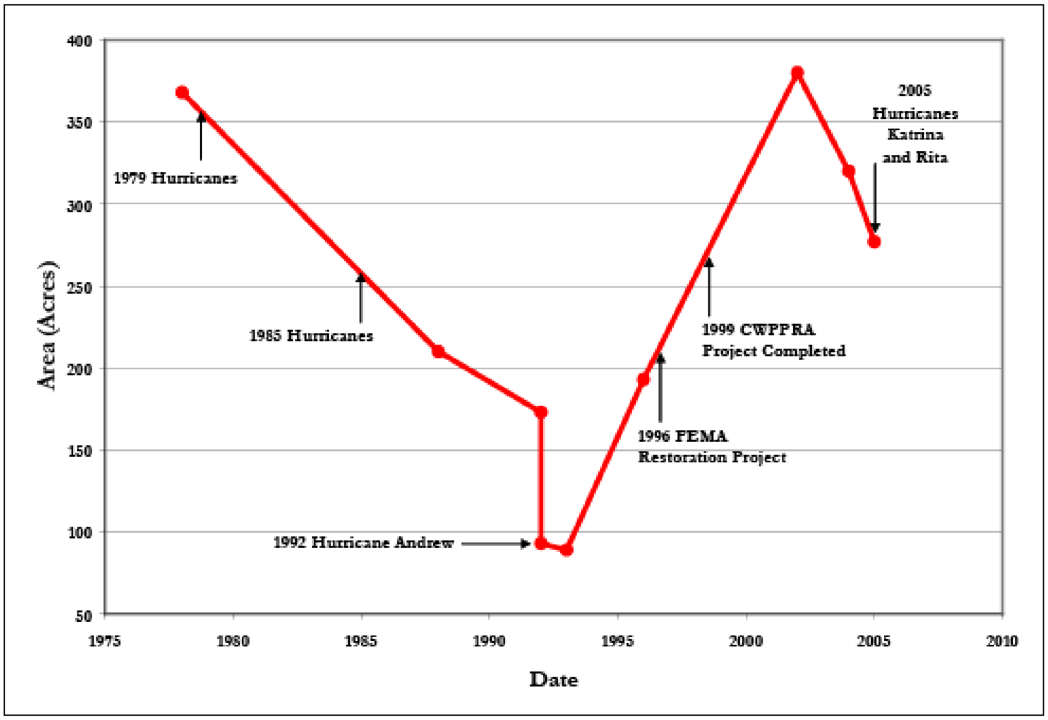


Figure 5. A time-series documenting the historical area changes in East Island (TE-20) between 1978 and 2005. Significant shoreline events are illustrated along the time-series line (Martinez et al., 2009).

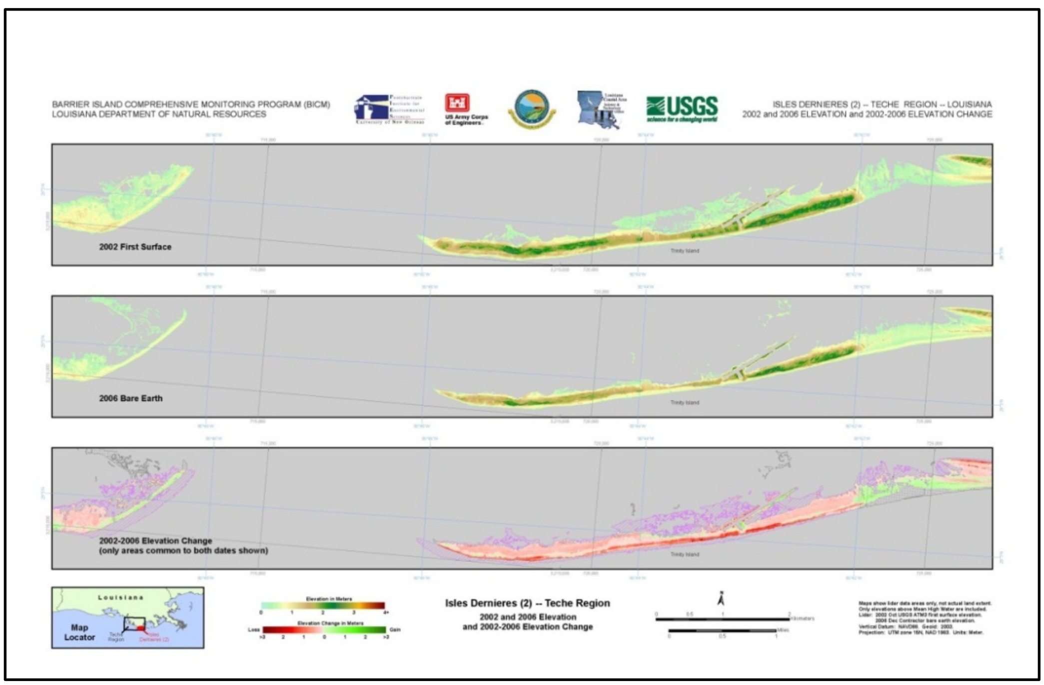


Figure 6. LiDAR topography of a portion of the Isle Derniers in Terrebonne parish in 2002 and 2006, as well as analysis of elevation changes within common areas of the data.

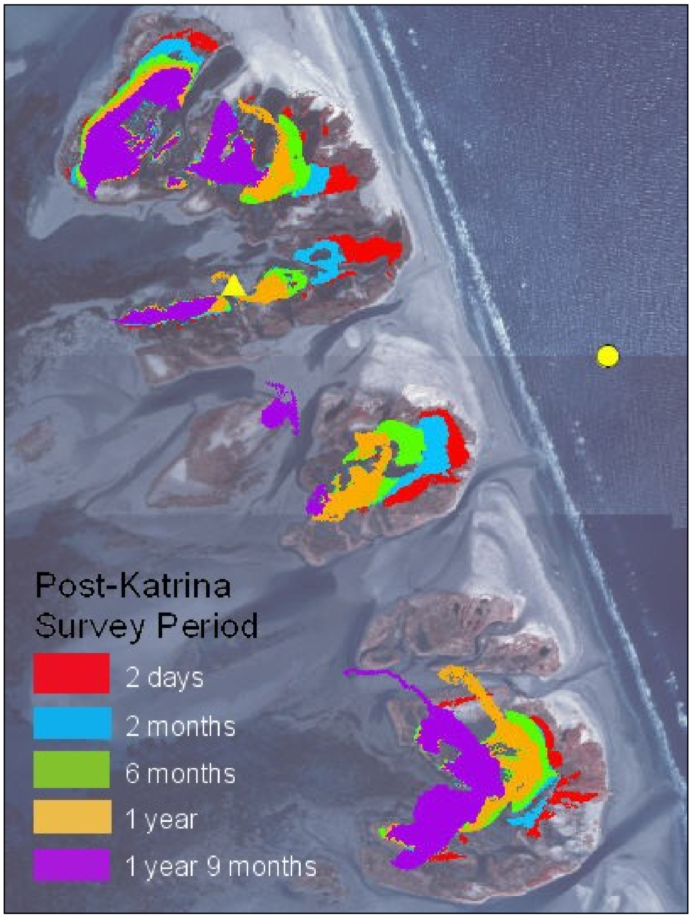


Figure 7. Draft LiDAR surveys of a portion of the Northern Chandeleur Islands. Colored portions are the land areas above MHW.

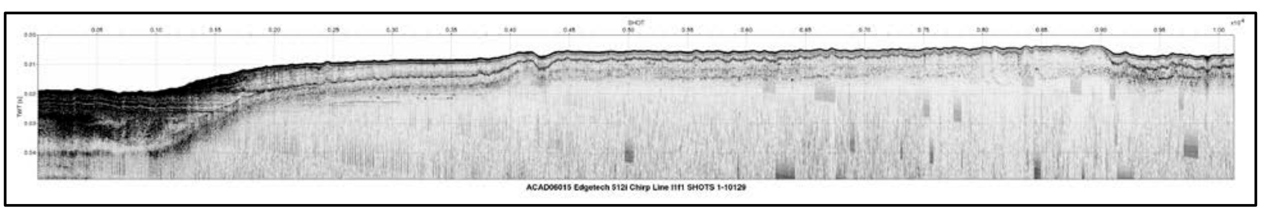
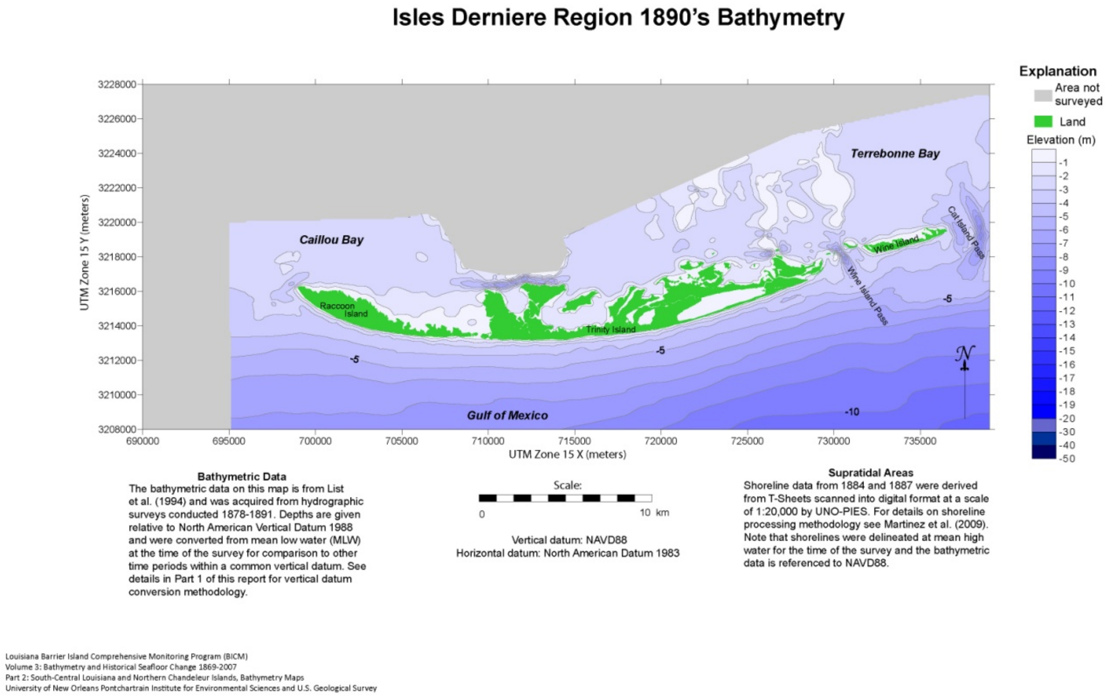


Figure 8. Example of chirp seismic–reflection profile data provided by USGS surveys of the Chandeleur Islands. Data is available from Baldwin et al., 2009.



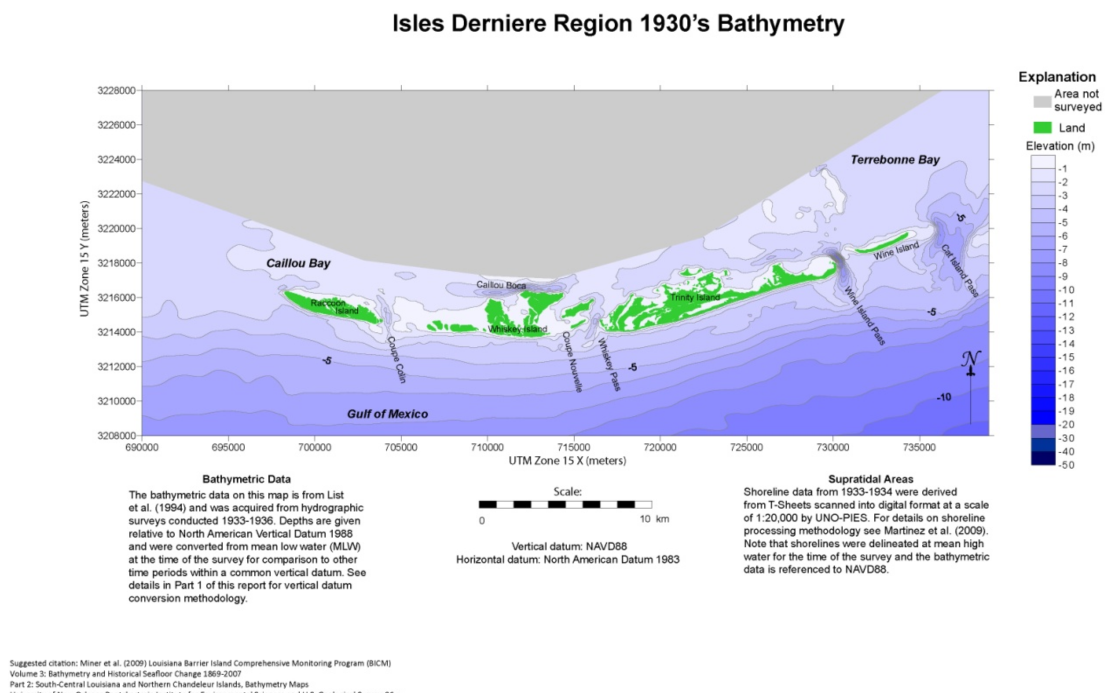


Figure 9. Bathymetric maps for the Isle Dernieres - 1890s and 1930s.

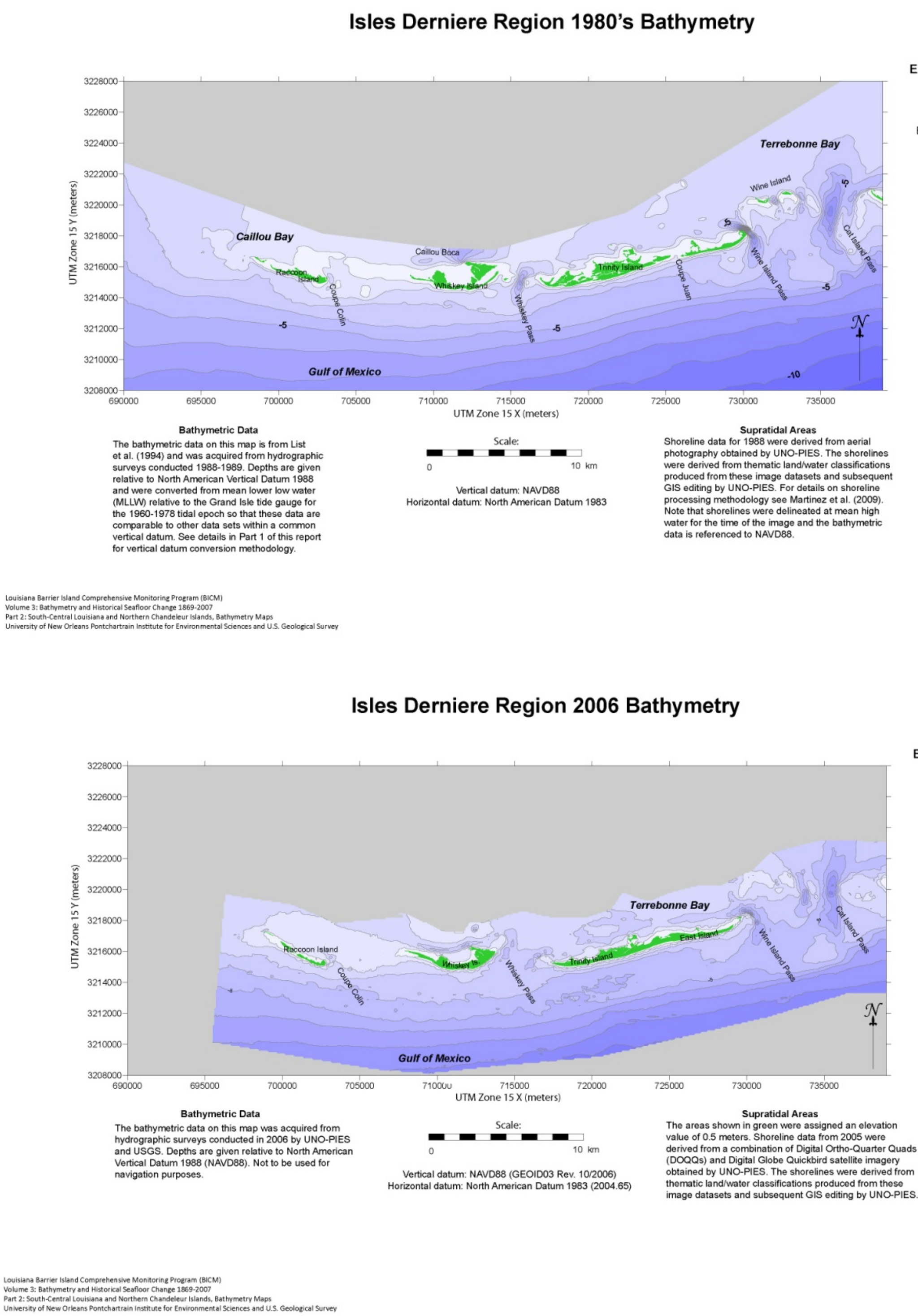
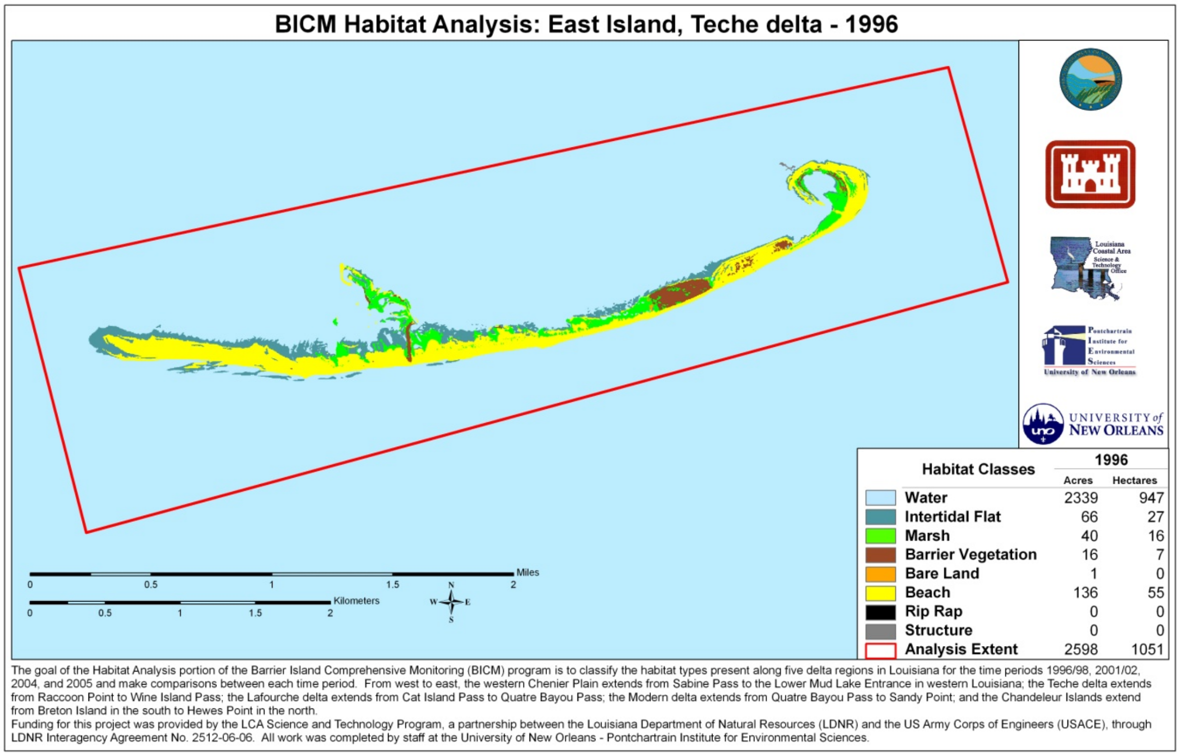


Figure 10. Bathymetric maps for the Isle Dernieres - 1980s and 2006.



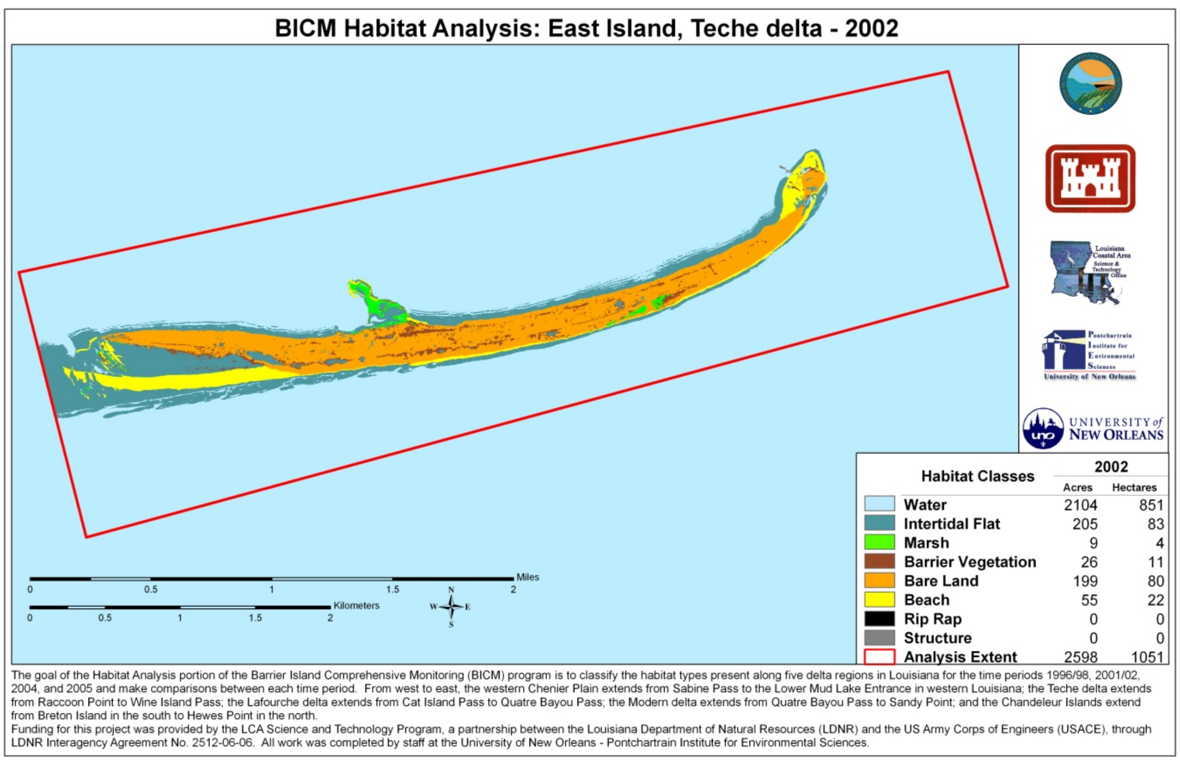
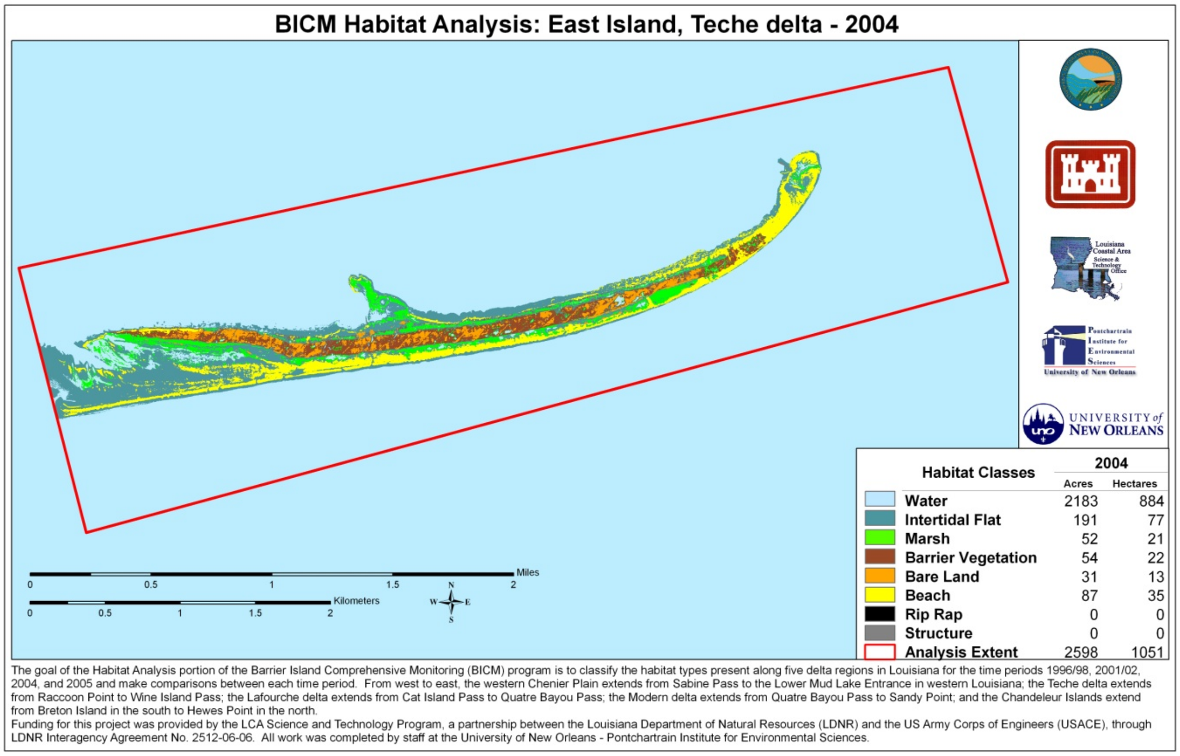


Figure 11. Habitat classification maps of East Island (TE-20), Isle Dernieres, Terrebonne Parish, LA for 1996 and 2002.



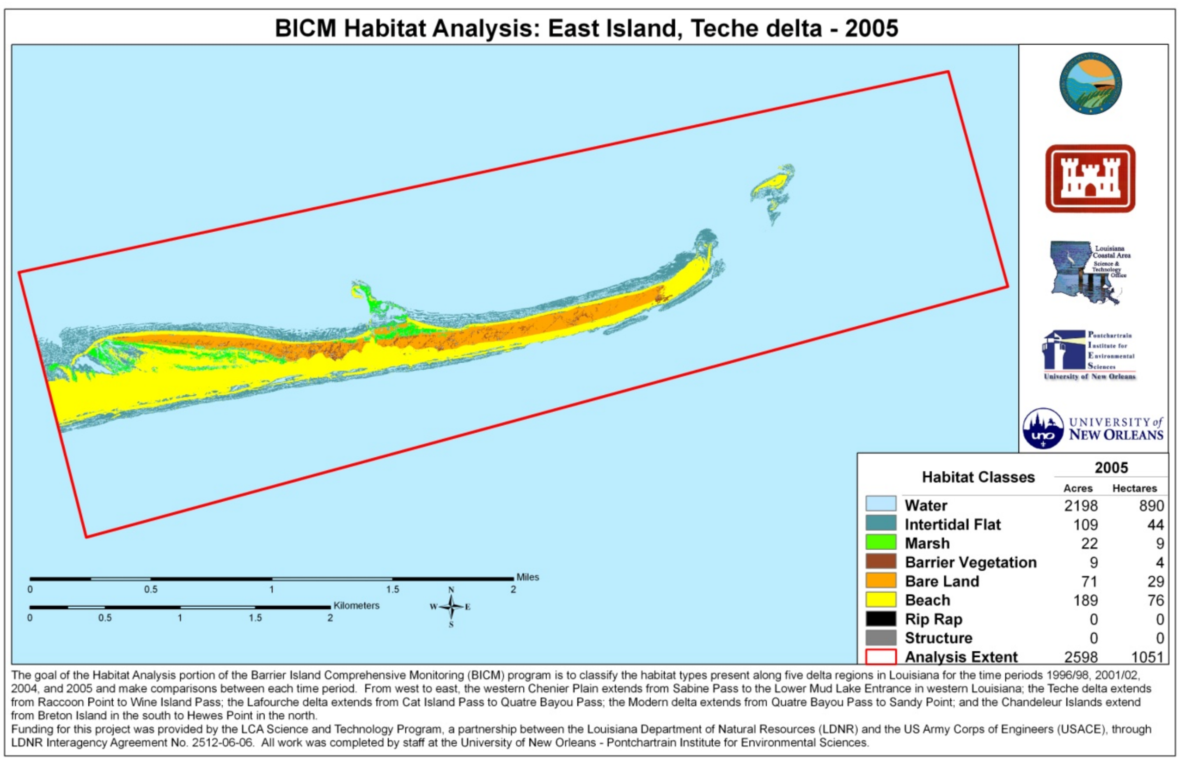


Figure 12. Habitat classification maps of East Island (TE-20), Isle Dernieres, Terrebonne Parish, LA for 2004 and 2005.

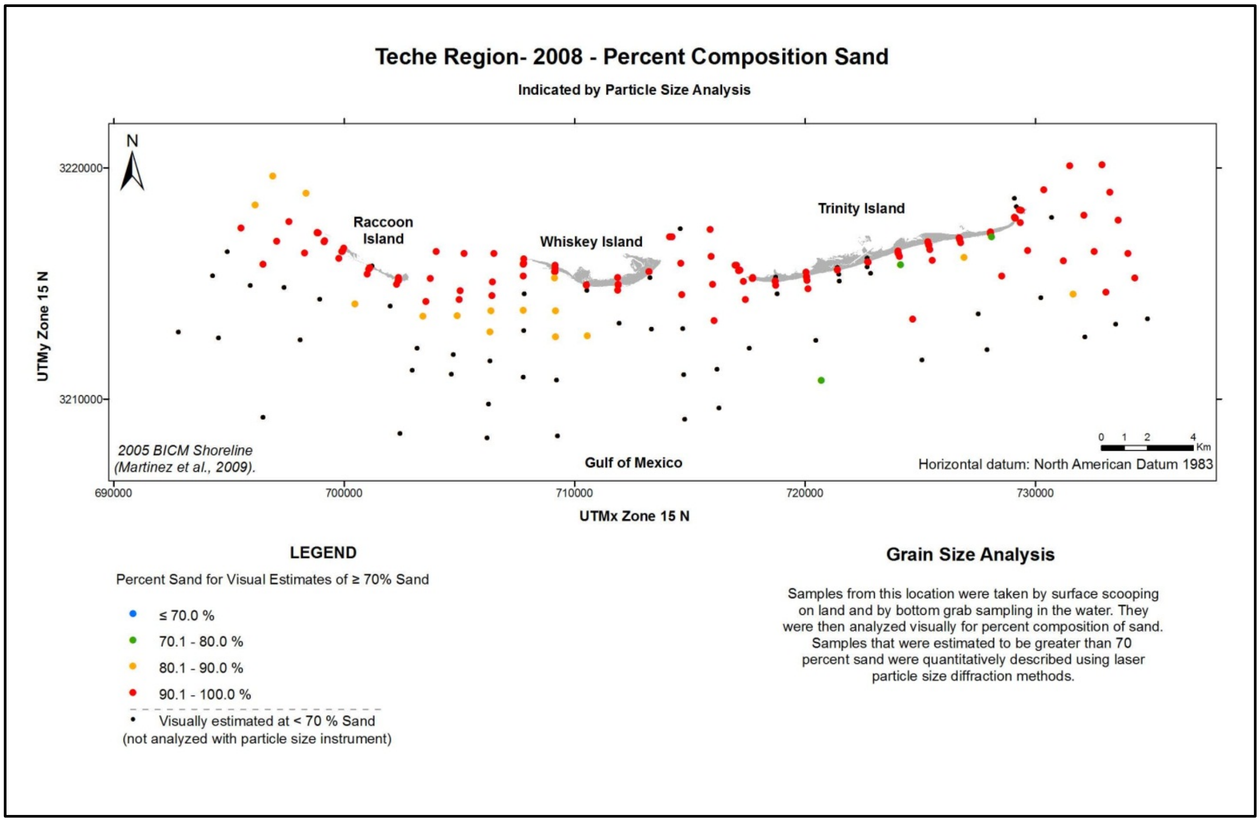


Figure 13. Surficial sediment characterization of the 2008 Isle Dernieres area in Terrebonne Parish, LA.

grab samples. Planning and design of the program will continue to refine future data collection, analysis, products, tools, and timelines for future programmatic monitoring.

CIAP funded monitoring of vegetation on some barrier island projects will be used to refine vegetative sampling procedures proposed in the original 2003 BICM proposal document. These vegetative sampling procedures will be conducted and analyzed to determine the added value of vegetative sampling within the BICM program, and potential costs of full-scale implementation. Once this analysis is completed, decisions will be made whether to incorporate this additional BICM component as originally recommended.

The USGS Coastal and Marine Science Center (St. Petersburg, FL) completed a final BICM report in 2013 (Kindinger et al., 2013) synthesizing the findings covering all aspects of the initial BICM program and held a workshop to report findings and discuss future efforts. Stakeholders participated in discussions of results and identified additional future needs such as overwash, subsidence, and storm impacts, within the context of a long-term monitoring program. The report is available digitally via the CPRA or USGS websites and presents the data collection efforts, as well as discusses several broad scale issues synthesizing the BICM data as a basis for assessments. Various themes discussed include shoreline change within the context of sea-level rise, hurricane impacts and island response, tidal inlet management, habitat changes, and future BICM goals. The report provides not only an overview of the data collection efforts, but also provides an initial overview of issues addressed by the data, as well as additional stakeholder needs.

The next BICM data collection cycle (2013-2017) has been initiated with the revisions and development of shoreline position data and the addition of shorelines for the 1950s, 2008, and 2012. These data will be available within the next six months and provide updated shoreline erosion data, including added time periods to better evaluate changes in shoreline position. BICM is currently moving to capture other data sets in the Teche, Lafourche, and Modern Deltas, and Chandeleurs in 2015, and then move through data collection efforts in the Chenier Plain (2016), with data synthesis and delivery in 2017.

Data collection activities for the other BICM datasets are being planned with USGS and other contractors to reoccupy the original BICM data locations for comparisons, as well as provide some added coverage areas based on stakeholder needs (Western Chenier Plain). Efforts are continuing to contract USGS for topographic LiDAR surveys of the Teche Delta region in early 2015. USGS has already conducted LiDAR surveys of the Lafourche and Modern Delta BICM areas in 2013 through other efforts of the CPRA. Bathymetric surveys are being scoped for the Teche, Lafourche, and Modern Deltas for the 2015 time frame and USGS and the CPRA are in contracting for bathymetric surveys in the vicinity of the Chandeleur Islands in 2015. Other variables such as habitat mapping and surficial sediment sampling are under negotiation as well and will be conducted during the appropriate time frames for data comparisons. Currently, historic datasets are also being considered for those areas not already covered under the initial BICM effort.

Additional data collections such as subsidence, overwash incidents, and annual shoreline survey profiles are being proposed and budgeted based on user input and needs identified for the 2017 Master Plan update, as well as storm damage assessments and other programs (Figure 14).

3.2 Monitoring of the Emergency Berms

In response to the *Deepwater Horizon* oil spill which began on April 20, 2010, the State of Louisiana constructed approximately 16 miles of sand berms along several sections of the state's barrier islands both east and west of the Mississippi River. The objective of this project was to provide a barrier to oil and minimize the potential impact of the oil spill to thousands of acres of fragile barrier islands and wetlands in coastal Louisiana. These berms are man-made features, were constructed for a specific purpose, as stated above, and are different geomorphologically than native barrier islands. However, significant insight into coastal processes which affect barrier islands can be gained by monitoring their changes over time. On May 27, 2010, a NOD-20 emergency permit (MVN 2010-1066-ETT) was issued by the U.S. Army Corps of Engineers (USACE), New Orleans District (CEMVN). The emergency permit allowed the construction of sand berms in specified areas or "reaches". Specifically, reaches E3 and E4 to the east of the Mississippi River, and reaches W8, W9, W10, and W11 to the west of the Mississippi River, were authorized for a total of approximately 38 miles of barrier berm. These areas were identified by USACE staff as critical locations where greater immediate benefit was likely to be achieved with minimal adverse disruption of the coastal environment. Only reaches E4, W8, W9

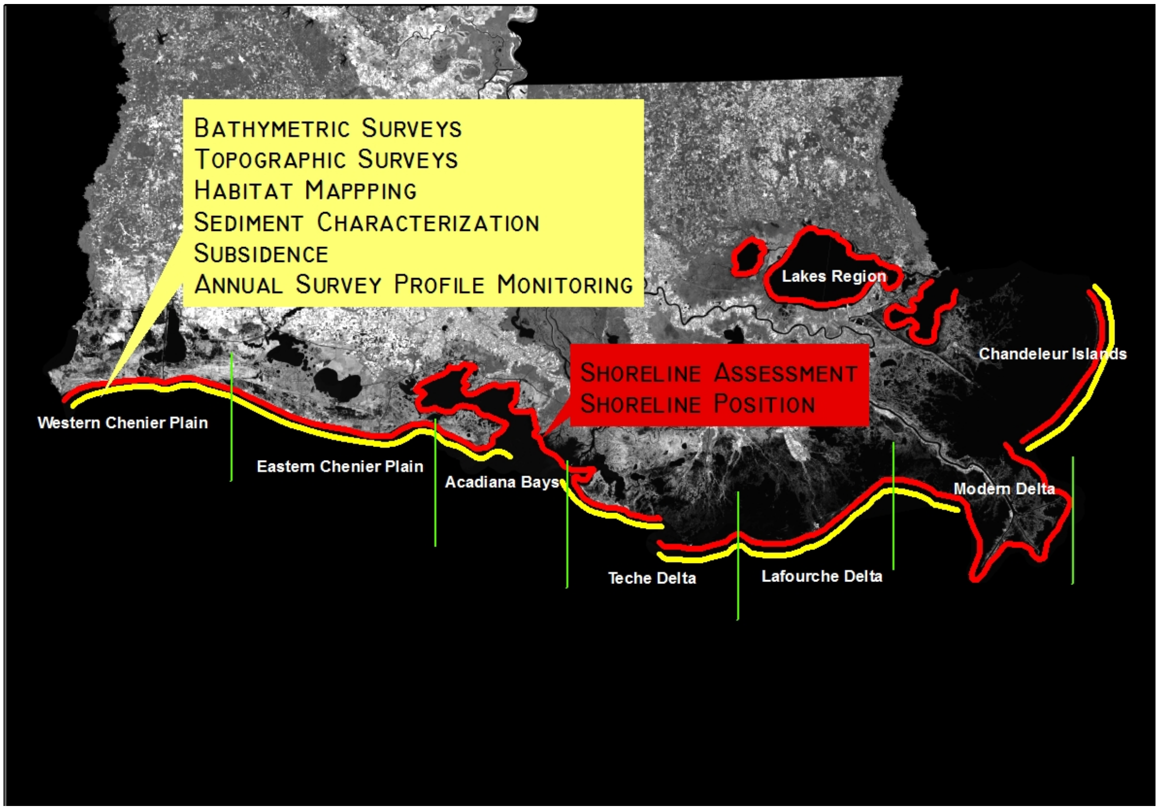


Figure 14. Proposed BICM data collection structure for the 2013 through 2017 work effort. Note the additional areas of effort in the Eastern Chenier Plain and Teche Delta regions.

and W10 (over 83,000 linear feet; approximately 16 miles of sand berm) were constructed under the NOD-20 emergency permit (Figures 15 and 16). Reaches W11 and E3 were not constructed.

Monitoring was required as a part of the emergency permit. Transects were established perpendicular to the shoreline, beginning at a point 1,000 feet landward from the inside toe of the berm and ending at the -20 foot NAVD 88 isobath. The constructed berms were surveyed along these transects at five time-intervals: after construction (as-built), and at 30-, 90-, 180- and 360-days post-construction to estimate sand-volume-changes (Table 1).

The monitoring data suggest that for berm reach E4, 77% of the fill had been retained at the 360-day monitoring survey; for berm reach W8, 83% of the fill had been retained at the 360-day monitoring survey; for berm reach W9, 79% of the total volume placed appears to be retained at 360-days post-construction and for berm reach W10, approximately 91% of the volume placed in the berm had been retained at the 360-day monitoring survey. It should be noted that the direct causes of the changes in sand volumes discussed above are difficult to determine at this time. However, these changes are undoubtedly attributed to a combination of factors, such as longshore transport, overwash, settlement, and subsidence that have all been experienced along Louisiana’s barrier island system.

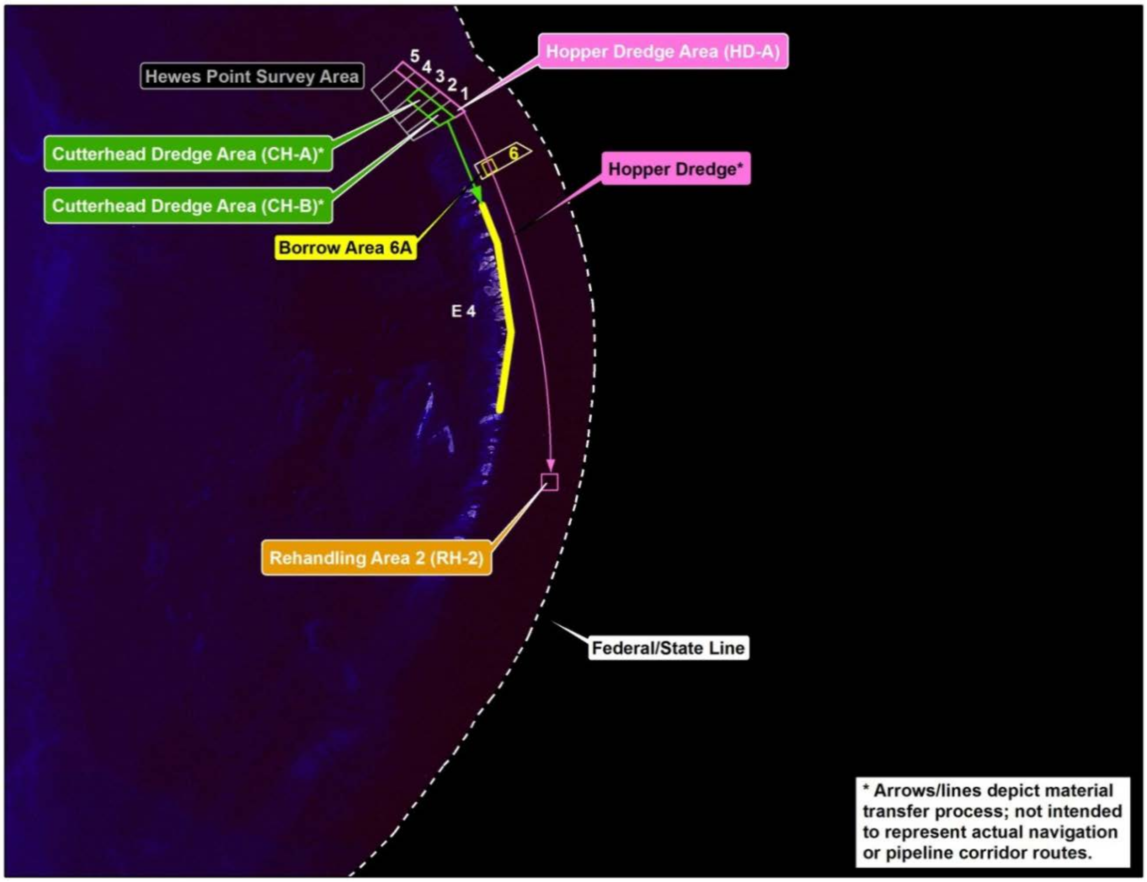


Figure 15. Borrow Area and Sand Berm (E4) locations on the eastern side of the Mississippi River. Sand for E4 was mined from Hewes Point to the north and either placed directly into the berm, or transported to a rehandling area (RH-2) using a hopper dredge (from borrow area HD-A). Borrow Area 6A was used as a temporary borrow site to begin work on the northernmost 2,000 linear feet of Reach E4 of the sand berm and was backfilled with sand from Borrow Area CH-B.

The data collected as part of the monitoring programs are extremely valuable to increase the understanding of coastal processes on Louisiana's barrier islands. Data sets collected at such frequent intervals and relatively tight spacing are rare.

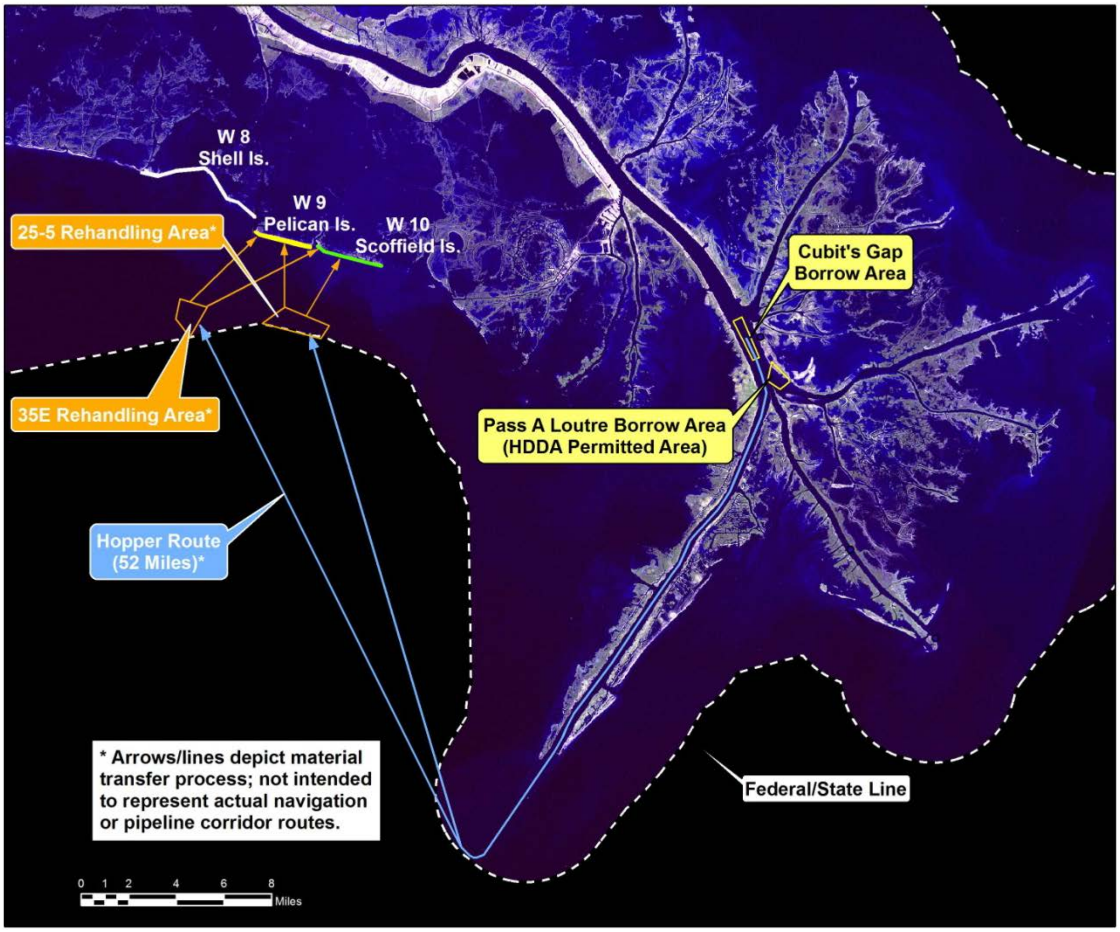


Figure 16. Sand Berm (W8, W9 and W10) and Borrow Area locations on the western side of the Mississippi River. Reaches W8, W9, and W10 were constructed by dredging sand from approved borrow sites in Lower Mississippi River to pre-approved rehandling areas 35E and 25-5.

Table 1. Summary of sand volumes from as-built and monitoring surveys for Emergency Berm reaches.

	Volumes (cy)				
Reach No.	As-built	30-day Monitoring	90-day Monitoring	180-day Monitoring	360-day Monitoring
E4	3,166,600	3,117,400	3,857,400	3,493,000	2,451,700
W8	777,300	722,600	685,100	625,100	642,600
W9	1,242,500	1,194,000	979,800	1,004,300	977,500
W10	964,200	817,100	863,900	931,800	875,200

3.3 Barrier Island Maintenance Program (BIMP)

Several legislative programs have been established on both the state and federal levels that call for the implementation of a program to stabilize and preserve Louisiana's barrier islands and shorelines. House Bill No. 429, Act No. 407, authored by Representative Gordon Dove during the 2004 Regular Session, outlined the process by which the CPRA would annually develop a list of priority projects to be submitted to the House and Senate Committees on Natural Resources. These projects would be funded by the Barrier Island Stabilization and Preservation Fund, which was established by House Bill No. 1034, Act No. 786 of the 2004 Session to provide appropriations, donations, grants and other monies for the program. The legislation requires this fund to be used exclusively by the CPRA to support the Barrier Island Stabilization and Preservation Program, with all interest earnings and unencumbered monies remaining in the fund at the end of the fiscal year.

In accordance with this legislation, and with the understanding that maintenance is an integral part of stabilization, preservation, and restoration of any barrier island or shoreline, BIMP was conceptualized by the CPRA. BIMP provides the framework for categorizing, prioritizing, selecting, and funding state barrier island maintenance projects, while coordinating with CWPPRA and other existing restoration mechanisms.

3.3.1 Rationale

The BIMP program is necessary to quickly coordinate and fund the maintenance of previously constructed barrier shoreline restoration projects in Louisiana. This program can act as a comprehensive management approach to prioritizing rehabilitation efforts in coordination with other restoration initiatives (e.g., CWPPRA, LCA).

During the past decade, numerous barrier islands and headlands in Louisiana have been or are currently being restored by the state and its federal partners through CWPPRA and other sources. CWPPRA projects have a design life of 20 years; however, scheduled maintenance of these projects has not been incorporated into their funding or design. Design of these projects relies heavily on numerical models for predicting their longevity and ultimate success. Inherent in these models are certain assumptions and the realization that there are significant uncertainties about the physical processes that affect the stability of these land masses. If the project is impacted by more events than assumed in the model, the condition of the barrier island or headland deteriorates considerably, thereby reducing the life of the project. The project then requires maintenance to sustain the predicted design template. Maintenance costs can increase exponentially when not performed in a timely manner. Therefore, BIMP is a tool that can be used to formulate a much needed component of maintenance planning for existing projects without maintenance funds. This strategy will address the need for timely and cost-effective maintenance of barrier shoreline projects to ensure their long-term success.

3.3.2 Program Area

BIMP encompasses all barrier islands, headlands, and sandy shorelines, restored or otherwise (Figure 17). Based on the geographic and geologic setting, the domain of the BIMP program includes the eight coastal segments identified below (Campbell et al., 2005).

1. Chandeleur Islands – Northern Chandeleur Islands (Freemason Islands, North Islands, and New Harbor Islands) and Southern Chandeleur Islands (Breton Island, Grand Gosier Island, and Curlew Islands).
2. Plaquemines – Sandy Point, Pelican Island, Shell Island, Chaland Headland (Pass La Mer area), Cheniere Ronquille, and East and West Grand Terre Islands.
3. Lafourche – Grand Isle and Caminada- Moreau Headland.
4. Timbalier Islands – Timbalier and East Timbalier Islands.
5. Isle Dernieres – Raccoon, Whiskey, Trinity, East, and Wine Islands.
6. Freshwater Bayou to Point Au Fer – Point Au Fer, Marsh Island, and Chenier au Tigre.
7. Eastern Chenier Plain – Freshwater Bayou to Calcasieu Pass.
8. Western Chenier Plain – Calcasieu Pass to Sabine Pass.

Grouping these apparently disparate and disjointed units of barrier islands, headlands, and sandy shorelines into coastal segments will facilitate the development of a regional long-term strategy for shoreline maintenance, including project prioritization and development. It should be noted that any alteration to an area within a segment will affect the remainder of the segment due to coastal processes and morphodynamics, and, consequently, the sediment budget.

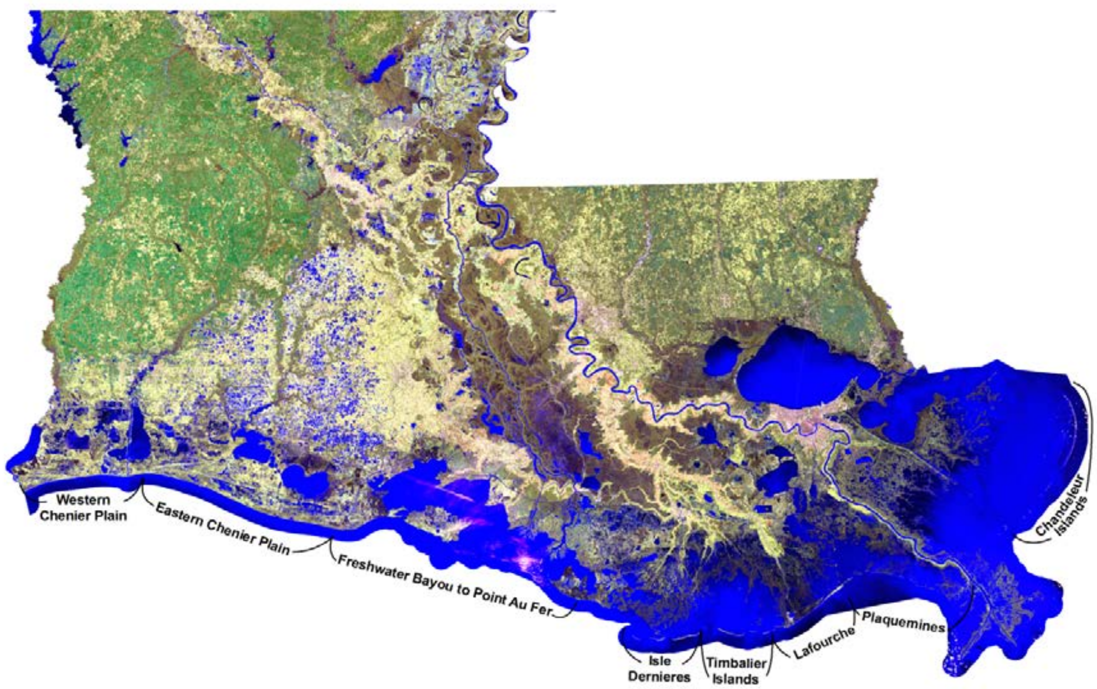


Figure 17. Various coastal segments including sandy shorelines, headlands, and barrier islands.

3.3.3 Funding and Timeline

As part of BIMP, the CPRA will formulate an annual list of potential projects based on inspections of previously constructed projects, post-storm assessments, BICM data, and existing project maintenance schedules. Data from these sources will be used to identify existing projects with an immediate need for repairs. All projects will be compiled and ranked by December 1 of each year. This list, along with recommended funding levels, will be provided to both the House and Senate Committees on Natural Resources for approval and funding. Funding will come from the Barrier Island Stabilization and Preservation Fund as set forth in House Bill No. 1034, Act No. 786 of the 2004 Session.

3.3.4 BIMP Projects

1. The 2006-2007 BIMP projects approved for implementation were the Bay Champagne Marsh Creation and Bay Champagne Sand Fencing projects. Bay Champagne is a 250-acre body of water just east of Port Fourchon in Lafourche Parish. Currently, only a narrow dune feature separates the bay from the Gulf, and a breach of this dune would expose interior marsh to increased erosion. These restoration projects would create 70 acres of marsh in the bay, as well as utilize sand fencing to stabilize the fore and back dune areas. The total combined cost of the projects was estimated at $2,820,000. These projects were discontinued due to a lack of sediment sources in close proximity. Additionally, the Caminada Headland project currently funded for construction should address the Bay Champagne area of need when it is constructed.
2. The 2007-2008 BIMP selections were the Sediment Bypassing at the Mermentau Jetties and the East Grand Terre Vegetative Plantings projects. The former project planned to add $1,387,688 in Cameron Parish CIAP funds with $2,750,000 in BIMP funds to hydraulically dredge sediment adjacent to the east Mermentau Jetty and move it to the west side. This would allow the littoral drift to disperse the sediment on the beach front. The goal of this project was to rebuild approximately 75-100 acres of gulf shoreline at Hackberry Beach. However, this project was deemed unfeasible because a preliminary investigation found there was insufficient sand to justify this project, and preliminary modeling showed that removing sediment adjacent to the east jetty could cause accelerated erosion and possible breaching of the shoreline at the north end of the jetty. The East Grand Terre Vegetative Plantings project will be implemented in the project area of the East Grand Terre Island Restoration (BA-30) CIAP project that was constructed in 2010. The total cost of the BIMP planting project is approximately $750,000.
3. The BIMP project approved for implementation in the 2008-2009 cycle was the 2009 Sand Fencing Project, which consisted of installation of 34,000 linear feet of sand fencing within the project areas of five constructed barrier island restoration projects in Terrebonne and Plaquemines Parishes. The construction contract amount was $198,200. The proposed sand fencing was installed on Trinity/East Islands in the eastern Isles Dernieres (TE-20 East Island, TE-24 Trinity Island, and TE-37 New Cut project areas); Timbalier Island (TE-40 Timbalier Island project area); and near Chaland Pass (BA-38 Chaland Headland project area). Installation of the sand fencing will facilitate the capturing of wind-blown sand and building of additional sand dunes on the islands. The work was completed in May 2010. No additional projects were selected this cycle, as the Sediment Bypassing at the Mermentau

Jetties and East Grand Terre Vegetative Plantings projects were expected to use funds from this funding cycle.

4. There were no new BIMP projects selected in the 2009-2010 cycle, because the Mermentau Jetties project's preliminary feasibility investigations continued through early 2010, and it was expected that the Jetties project would use funding from this cycle. When this project was deemed infeasible, it was hoped that another suitable project could be developed within Cameron Parish, so the funds from this BIMP funding cycle were set aside for this potential new project. However, another suitable project was not identified for this funding cycle in Cameron Parish.

3.4 Breach Management Program

A Breach Management Program is in development to identify, classify, and prioritize methodologies and recommendations for breach prevention (proactive) and response (reactive) measures. A detailed analysis of coastal restoration projects completed in 2014 quantified the effects of breaching on barrier islands and headland beaches, specifically computing the significant increases in shoreline erosion rates. The Breach Management Program has developed a methodology to classify breach potential along the Louisiana coastline between Raccoon Island to the west and Scofield Island to the east. Barrier islands classified as having the potential to breach within four years are classified as severe and breach prevention measures are being developed for those areas. Opportunities are being explored to strategically partner breach prevention measures with other barrier island projects scheduled in the near-term within the Coastal Master Plan or as Beneficial Use Projects for disposal of maintenance dredged sediments from federal navigation channels.

3.5 Borrow Area Monitoring and Maintenance (BAMM)

To ensure the efficient and effective use of limited sediment resources in Louisiana, a Borrow Area Monitoring and Maintenance (BAMM) project was initiated and funded through CIAP as a part of the Performance Evaluation and Science Monitoring Project. The BAMM project provides information to understand the evolution of the borrow pits (inland, riverine, and offshore) over time, especially the infilling characteristics (rate and types of sediment) and gradient and depth (depending upon hypoxic condition development) of the pit-slopes. Also a numerical modeling effort was undertaken to analyze and evaluate potential adverse impacts to wave climate and hydrodynamics if large inland borrow areas are dredged to mine about 50 MCY of sediment.

The goals of BAMM are to develop general guidelines for developing criteria for location, delineation, and design of potential borrow areas in inland, riverine and offshore environments for coastal restoration projects in Louisiana in a cost effective manner which will have minimal adverse impact on the adjoining coastal system. This included review of potential dredge impacts, existing wave analysis work and other related studies. Geophysical, geotechnical and water quality data were collected from several borrow areas. The combined information gathered during these efforts was analyzed and used to provide recommendations on borrow area location, depth of dredging, and design.

Additionally many of the current marsh creation and restoration projects in Louisiana specify that fill material be obtained from borrow areas designed within interior lakes and bays. The use of "inland" borrow areas is governed by numerous restrictions and/or regulations. Most of these regulations focus on vertical and horizontal dredging limits. The impacts of these aspects of borrow area design on wave heights and energies as well as on the surrounding marsh environment are not clearly understood. Therefore, the scientific basis of these restrictions and/or regulations needs to be investigated to determine whether these borrow area design constraints are justified.

The BAMM project is divided into four tasks and a cumulative final report. As of November 2014, the second draft Project Inventory and Literature Search (Task 1) has been submitted along with Draft Final Report. Task 2, the Bathymetric and Geophysical Collection and Analysis, was completed in May of 2013. The maps created from this data collection were analyzed/processed to assist in the calculation of infilling rates of the borrow areas and general bathymetric changes in elevation. The Hypoxia Monitoring (Task 3) involved the deployment of gauges that measure dissolved oxygen, salinity and temperature in six borrow area locations. One gauge was placed within each chosen borrow area and another was placed approximately 0.5 miles outside of the borrow area and acted as a control. The gauges were deployed for four consecutive months (June-October) with data collection occurring once a month. The gauges were collected for a final time in the last week of October 2013. Task 4's calibration report on Model Development was authored in October 2013. The Task 4 interim report was submitted and reviewed. The final report, currently being reviewed, includes recommendations on borrow area location, depth of dredging and design developed through analysis of the four subsequent tasks.

3.6 The Caminada – Moreau Subsidence Study (CMSS)

Marsh and barrier island restoration rely on placement of large quantities of sediment on existing substrate that is often highly compressible. Engineering design of restoration projects requires knowledge of background subsidence rates, the relationship between surface loading and subsurface compaction, and settlement of the fill after placement. The Caminada – Moreau Subsidence Study (CMSS) was conceptualized, planned, developed and undertaken to evaluate the existing geological profile of deltaic deposits at foreshore, dune, and backshore locations along the Caminada Moreau; evaluate subsidence in these areas; and monitor subsidence before (for baseline measurement) and after loading sediment for the restoration of Caminada Headland. This is a first-of-its-kind study as no direct measurement of subsidence and its partitioning has been previously attempted. Several challenges arose during the study, requiring changes to the scope and approach.

This study was funded by CIAP and formed a part of the Performance Evaluation and Science Monitoring Project. The study was conducted under three sequential major phases (Phase 1, 2, and 3) which included the evaluation of the existing geological profile, an evaluation of subsidence, and the installation of 10 subsurface monuments at three different stations. Anchors were placed at various depths in three locations along the Caminada headland to monitor variability in compactional subsidence associated with loading from the fill, including settlement plates. In addition, a primary benchmark was established outside the influence of the fill to record background subsidence for this region. These monuments are being monitored via 10 different surveys spread over next two years during Phase 4 to document subsidence trends throughout the period. High-accuracy leveling surveys were conducted for each anchor location relative to the control benchmark to an accuracy of ±0.03 feet. Preliminary results for the first 14 months of surveys document subsidence at all depths in the sediment column for sites where fill placement is complete. Although the first anchor below the surface recorded the greatest amount of subsidence (0.25 to 0.3 feet at about 20 feet deep), anchors at 60 to 80 feet deep recorded 0.09 feet of compactional subsidence as well. This quantity of settlement at depth is more than expected, and requires further evaluation of deeper sediment layers to identify the depth at which compactional subsidence due to loading from beach restoration is within measurement uncertainty. Background subsidence calculations from control benchmark measurements indicate a subsidence rate of about 0.03 ft/yr (9.2 mm/yr), very consistent with National Geodetic Survey relative sea level rise measurements at Grand Isle of 9.1 mm/yr. The final survey is scheduled to be completed by mid-July 2015 and the final deliverable will be submitted by 31 August 2015.

Further the final data in the spreadsheets will be invaluable for calibrating/validating compactional subsidence model (developed by Dr. Julie Rosati, ERDC) for use with future beach restoration projects along the barrier island shorelines of south Louisiana.

A copy of the report entitled "Caminada-Moreau Subsidence Study (Phases 1-3)" can be found in the CPRA Document Database at the following link:
http://sonris-www.dnr.state.la.us/dnrservices/redirectUrl.jsp?dID=4715311

4.0 Barrier Island Performance Assessment

4.1 Overall Barrier Shoreline Condition

Louisiana's barrier shoreline is one of the fastest eroding shorelines in the world. Due to the geologic setting and the predicted changes in sea level during coming decades, these shoreline habitats and the services they provide are some of the most vulnerable features of our coastal landscape. The CPRA's BICM Program has been established to assess and report on the changes of the coastal shoreline to help develop programmatic approaches to restoration and maintenance. In addition, the CPRA funded an interim study (CEC, 2012) to look at barrier island performance in the five years since BICM data were collected.

Current shoreline erosion data from BICM (Martinez et al., 2009) indicate that most of Louisiana's shoreline is eroding faster than ever before, with some short-term (1996 – 2005) erosion rates more than double the historic (1890s – 2005) averages (Figures 18 and 19). However, recent information from the post-BICM studies elucidate the benefits of recent restoration projects. This section presents the overall findings from BICM and then a more detailed discussion by geomorphologic delta complex follows.

The Chandeleur Islands have exhibited the largest changes in erosion rates. Historic erosion rates of approximately 27 ft/yr have increased within the past decade to over 125 ft/yr, predominantly due to storm activities. This has led to a decrease in the overall size of Breton Island by approximately 776 acres, or 95 percent (Table 2). Additionally, over 66 percent (85.1 acres) of the land area remaining in 2004 was removed by Hurricanes Katrina and Rita in 2005. When compared to the fact that only 18 percent (150.7 acres) of the land mass was lost between

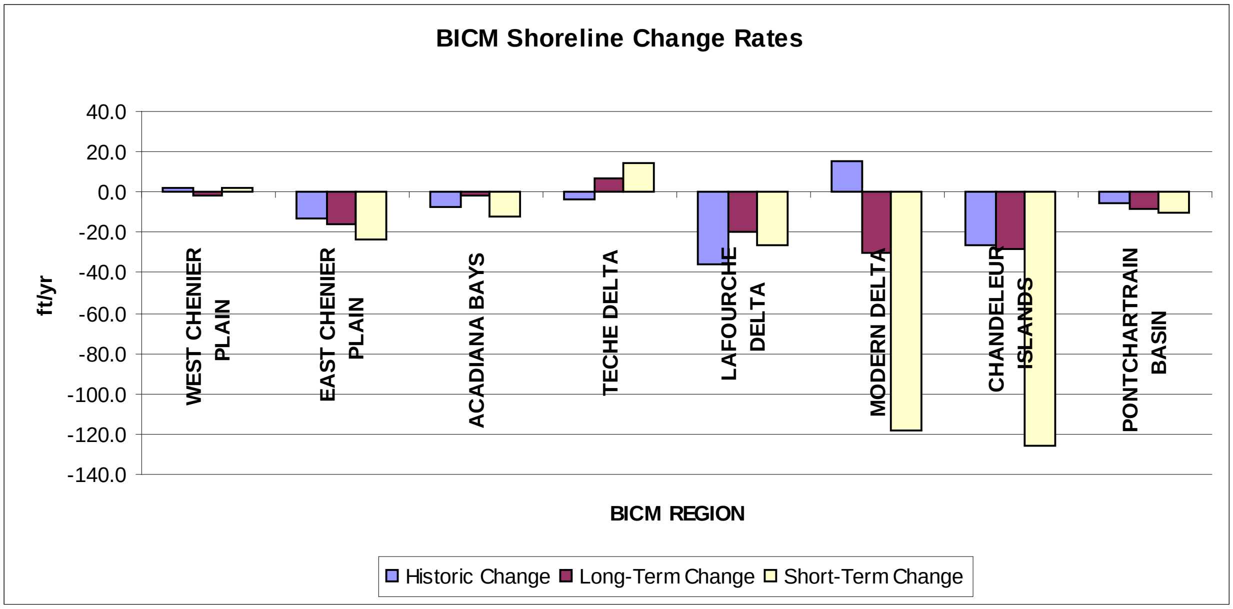


Figure 18. Average shoreline erosion rates for BICM Regions of the Louisiana Coast developed from aerial photography for Historic (1890s – 2005), Long-term (1930s – 2005), and Short-term (1996 – 2005) periods.

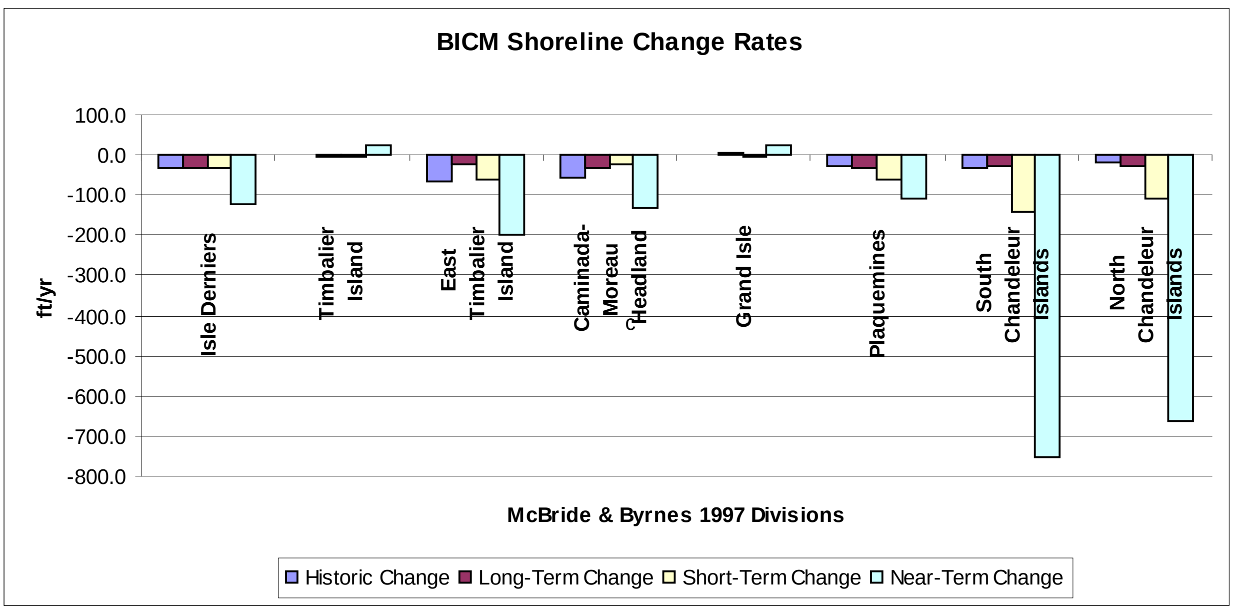


Figure 19. Average shoreline erosion rates for various sections of the Louisiana coast including the direct impacts of Hurricanes Katrina and Rita (Near-Term 2004 – 2005). Note that the Timbalier Island shoreline accreted due to the 2004/05 CWPPRA restoration project (TE-40) (McBride and Byrnes 1997).

Island	1800s	1922-30s	1996-98	2004	2005	Projected Year of Disappearance
Breton	820.4	669.7	212.3	128.7	43.6	2013
Chandeleur	6,827.50	6,140.60	4,333.10	2,789.60	913.9	2026
Grand Gossier/Curlew	1,119.40	71.7	595.5	75.2	0	
New Harbor	177.9	232.3	85.7	76.9	87	2135
North	1,455.50	966.2	125.8	77.1	79.7	2013
Freemason	538.7	247.1	28.8	17.6	4.8	2006
Isle Derniers	8,727.80	4,838.30	1,566.50	1,613.90	1,595.50	2033
Timbalier	3,669.50	2,646.50	1,147.40	1,028.40	1,069.40	2056
East Timbalier	476.9	229.8	311.7	311.4	245.3	2138
Grand Isle	2,616.80	2,347.50	2,439.50	2,232.00	2,286.00	2867
Grand Terre	4,198.30	2,614.40	1,093.40	1,021.10	997.7	2044
Shell Island	313.8	432.4	89.7	56.5	51	2029

Table 2. Historical (1800s-2005), long term (1930s-2005), and short term (1996-2005) barrier island changes in acres and the projected date of disappearance (Martinez et al., 2009).

1850 and 1920, this emphasizes the need to maintain the islands so that they are more sustainable during storm events. The data seem to indicate that there is a "tipping point" when an island breaches, beyond which erosion accelerates, restoration costs increase exponentially, and results may become less predictable.

The large reduction of Breton Island within the last decade, along with the extreme loss experienced from Hurricane Katrina, emphasizes the need to maintain flexibility in setting restoration priorities. McBride and Byrnes (1997) predicted that Breton Island would disappear in 2106 based on the land loss rates through the 1980s. When compared to other islands that were projected to be lost in the early 2000s, the restoration of Breton Island was a comparatively low priority. However, based on BICM data collected after Hurricanes Katrina and Rita, the projected disappearance for Breton Island based on the land loss rates through 2005 (does not include impacts from Hurricanes Gustav and Ike in 2008 or Hurricane Isaac in 2012) is now 2013 (Table 2). More dramatic than Breton Island are Grand Gossier and Curlew Islands which were predicted by McBride and Byrnes (1997) to last until 2174, yet these islands were both reduced to shoals by Hurricane Katrina in 2005.

The good news is that restoration efforts on other islands have shown benefits. McBride and Byrnes (1997) predicted Timbalier Island would disappear by 2046, based on data through the 1980s. However, restoration completed just prior to Hurricanes Katrina and Rita added approximately 10 years of life to the island. Also, McBride and Byrnes (1997) predicted that the Isles Dernieres would disappear by 2017; however, the CWPPRA barrier island restoration projects constructed on the islands have increased their life span by approximately 16 years. However, additional storms, increasing erosion rates, and predicted sea-level rise still need to be taken into account for designing future projects.

The *Deepwater Horizon* oil spill presented an entirely new challenge to coastal Louisiana. The state responded with a robust effort to safeguard its coast from the effects of the oil. In June 2010, the state began construction of barrier berms along the Chandeleur Islands east of the Mississippi River (East Barrier Berm) and from Shell Island to Scofield Island west of the river (West Barrier Berms). The construction of the Barrier Berm projects introduced a significant amount of sand into the state's barrier island systems. To maximize this opportunity, the state utilized the berm sand and approximately $100 million of the funds set aside for berm construction to convert the temporary berm features into the more resilient barrier island features that were designed as CWPPRA projects. Construction of the CWPPRA Scofield project (BA-40) and Shell Island East (BA-110) was funded by these Berm to Barrier funds.

Additional datasets and analysis, ongoing under BICM, are also beginning to show information which will hopefully increase our ability to forecast priority areas and better predict project outcome. Until final reports are concluded for all sections of the coast, the main indications are that:

1. Coastal shoreline erosion rates are increasing (Figures 18 and 19). Along the central coast barriers, interior wetland loss results in increasing tidal prism (volume of water that flows through the inlet during each tidal cycle) (Figure 20). Central coast sand is sequestered in expanding ebb tidal deltas as inlets widen and deepen and these processes occur at the expense of barrier island sand volume. This sequestering of sand volume offshore has dominated over relative sea level rise in reducing island area.
2. Hurricane impacts and subsequent recovery processes dominate Chandeleur Islands evolution, whereby sand is removed from the central portion of the island and distributed laterally, ultimately coming to rest in deepwater sinks at the flanks of the barrier island arc (Figure 21). This better understanding of the sediment transport pathways and scales allows efficient barrier island management strategies to be developed.
3. Seafloor change analysis results show that long-term sediment transport trends are about two orders of magnitude greater than calculated predictions of longshore sediment transport potential in the nearshore zone based on historical wave data (millions of cubic meters per year instead of tens of thousands) (Figure 22).
4. The identification and quantification of these sediment transport processes, pathways, and sinks is crucial for successful sediment budget management and sediment allocation and project prioritization.

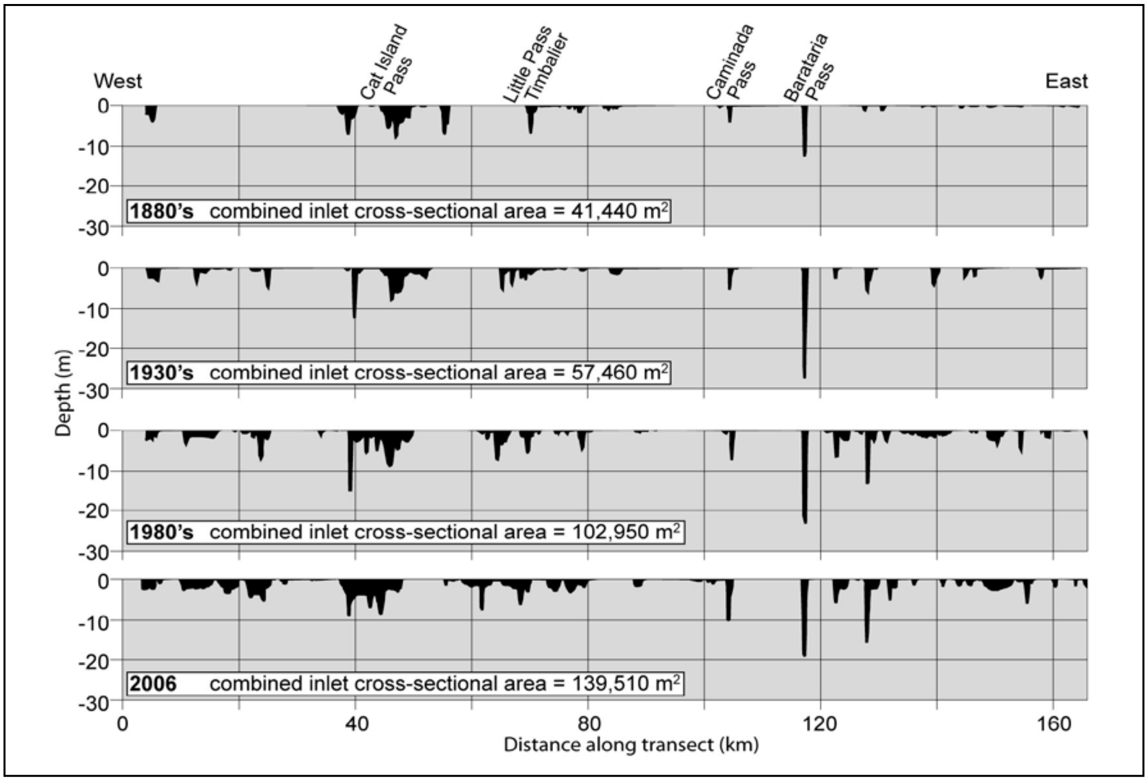


Figure 20. Combined tidal inlet cross-sectional area for Raccoon Point to Sandy Point for each time period covered by the study (1880–2006). Profiles trend along the barrier shoreline and intersect inlets at the location of minimum throat cross-sectional area for each time period. Note the widening and deepening at existing inlets as additional, stable inlets simultaneously form, resulting in a more than threefold increase in combined cross-sectional area during the past 125 years in response to an increasing tidal prism associated with interior marshland loss. The 1880s to 1980s bathymetry is from List et al. (1994) (from Miner et al., 2009).

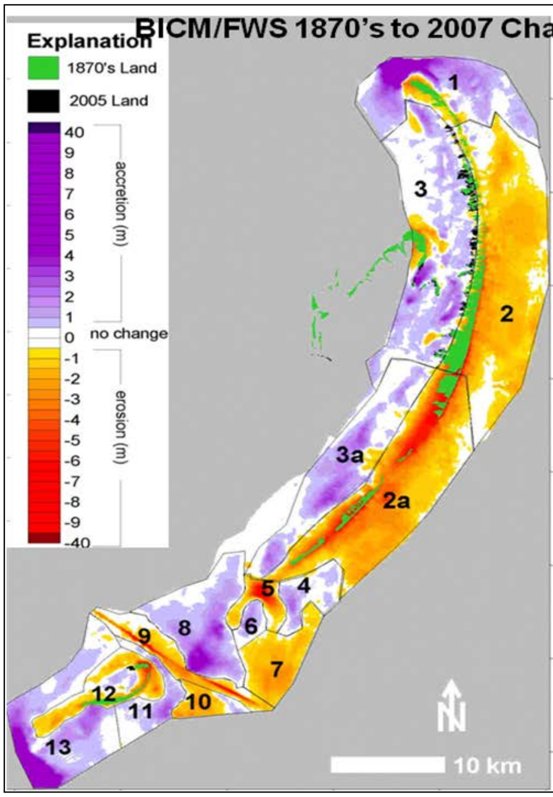
4.2 Teche Delta Barrier Islands (Raccoon Island to Wine Island)

The Teche Delta Barrier Islands (Isles Dernieres) benefitted from the first barrier island restoration projects funded through the CWPPRA program (Figure 23 and Table 3). In total, six projects have been constructed in this region.

According to the BICM data presented above through 2005, the Teche Delta barrier islands were projected to disappear by 2033. A more recent study including post-BICM data reports disappearance date by island and suggests that restoration projects may have extended the life expectancy of these islands.

4.2.1 Raccoon Island

The land area over time for Raccoon Island is plotted in Figure 24. It is noted that Raccoon Island underwent emergency restoration in 1994 which may have contributed to the upward trend between 1990 and 1998. Although no sediment was placed on the island, it has benefitted



Zone	Net Vol (x10⁶ m³)	Net vol Error +/-(x10⁶ m³)
1. Hewes Point/ North Inlet	128.77	25.67
2. Northern Chandeleur Shoreface	-285.29	59.41
3. Northern Chandeleur Backbarrier	84.11	46.69
2a. Southern Chandeleur Shoreface	-405.14	45.78
3a. Southern Chandeleur Backbarrier	75.47	23.78
4. Updrift Curlew Pass Ebb Delta	12.68	6.94
5. Curlew Pass Inlet Scour	-33.61	5.30
6. Downdrift Curlew Pass Ebb Delta	7.39	2.61
7. Grand Gosier Shoreface	-55.99	11.37
8. Updrift MRGO	91.04	19.71
9. MRGO	-52.08	7.10
10. Downdrift MRGO shoreface	-19.62	4.45
11. Breton Pass Ebb delta and inlet fill	20.04	5.79
12. Breton Island Nearshore/Backbarrier	-47.58	11.06
13. Downdrift Breton Island	176.35	2.10
TOTAL	-303.47	296.66

Figure 21. 1870s to 2006-07 seafloor change from Breton Island to Hewes Point. Note the large magnitude of erosion on the center shoreface as well as the large deposition zones at each terminal end of the arc. (UNO/PIES)

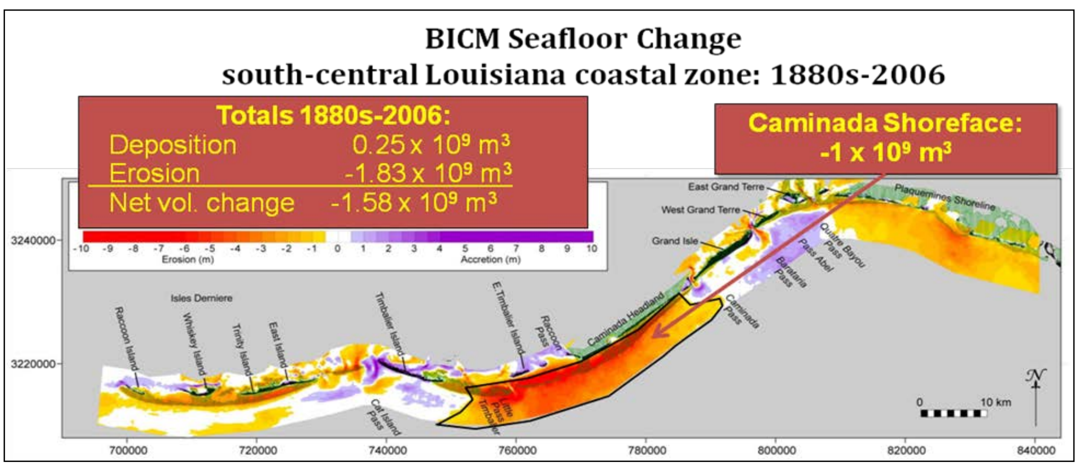


Figure 22. 1880s to 2006 seafloor change from Raccoon Point to Sandy Point. Note the large magnitude of erosion fronting the Caminada Headland and the Plaquemines barrier shoreline, as well as the deposition at ebb-tidal deltas in the coastal bights at Cat Island Pass and the Barataria Inlets. The map coordinate system is UTM Zone 15 N meters. The 1880s bathymetry is from List et al. (1994). Shoreline data are from Martinez et al. (2009). (Miner et al., 2009).

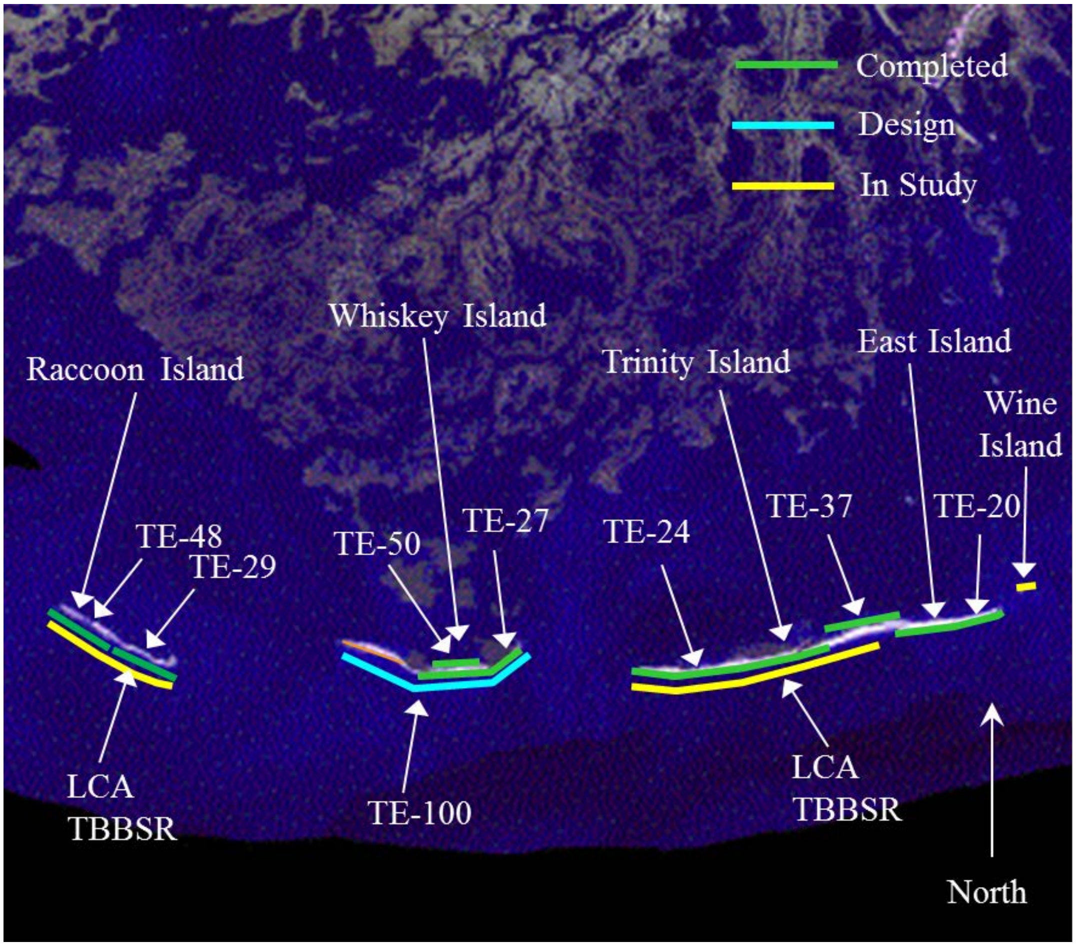


Figure 23. Location of barrier island restoration projects in Teche Delta Barrier System. (CEC, 2012).

Table 3. List of projects constructed, funded for construction, and for future implementation in the Teche Delta Barrier System.

Barrier Shoreline Restoration Projects	Funding Program	Construction Date
Teche Barrier System		
Constructed Projects		
Raccoon Island Breakwaters (TE-29)	CWPPRA	1997
Whiskey Island Restoration (TE-27)	CWPPRA	1999
Whiskey Island Back Barrier Marsh Creation (TE-50)	CWPPRA	2009
Isles Dernieres Restoration Trinity Island (TE-24)	CWPPRA	1999
New Cut Dune and Marsh Restoration (TE-37)	CWPPRA	2007
Isles Dernieres Restoration East Island (TE-20)	CWPPRA	1999
Raccoon Island Shoreline Protection/ Marsh Creation (TE-48)	CWPPRA	2007, 2013
Funded for Construction		
NRDA Caillou Lake Headlands (TE-100) (in design) (includes Ship Shoal: Whiskey West Flank Restoration (TE-47))	NRDA	TBD
Future Projects		
None		

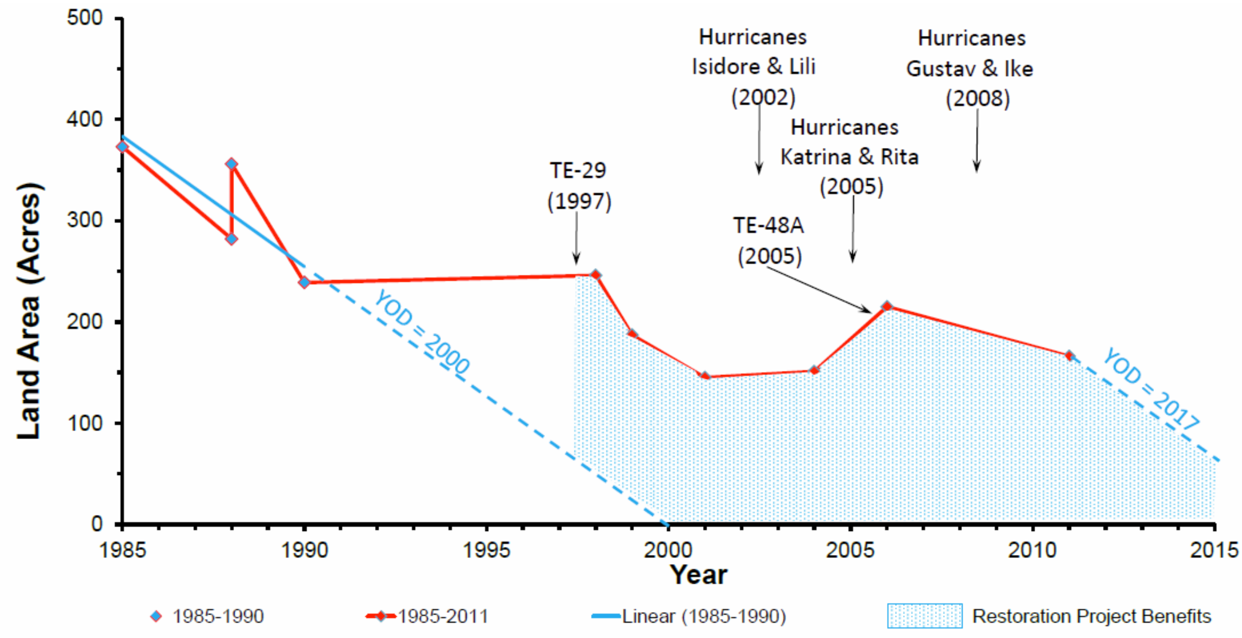


Figure 24. Raccoon Island Land Area Change Analysis (CEC, 2012).

from two CWPPRA projects, TE-29 and TE-48A, which included installing breakwaters, first in 1997 and again in 2007. These breakwaters re-oriented the wave climate/energy regime in such a way that sand from an adjacent, nearshore shoal was redistributed as inverted salients between the breakwaters and the island. The pre-breakwater Year of Disappearance (YOD) was projected to be 2000. Hurricanes Katrina and Rita caused significant land loss on Raccoon Island in 2005 (Martinez et al., 2006); however, post-breakwater installation, the YOD was projected to be 2017. The benefits of barrier shoreline restoration are evidenced by the post-breakwater increase in island longevity, projected to be 17 years, compared to the pre-breakwater projected rate of disappearance.

4.2.2 Whiskey Island

The land area over time for Whiskey Island is plotted in Figure 25. The island benefitted from two CWPPRA restoration projects, the first, TE-27, in 1999 and the second, TE-50, in 2009. The pre-restoration YOD was projected to be 2091. Post-restoration, the YOD was projected to be 2130. It is noted that Hurricanes Katrina and Rita caused significant land loss on Whiskey Island in 2005 (Martinez et al., 2006), reducing its acreage below the trend line. The benefits of barrier shoreline restoration are evidenced by the post-restoration increase in island longevity, projected to be 39 years, compared to the pre-restoration projected rate of disappearance.

4.2.3 Trinity-East Island

The land area over time for Trinity-East Island is plotted in Figure 26. It is noted that East Island was the site of a pilot study project in 1985, and received a breach repair project in 1996 which

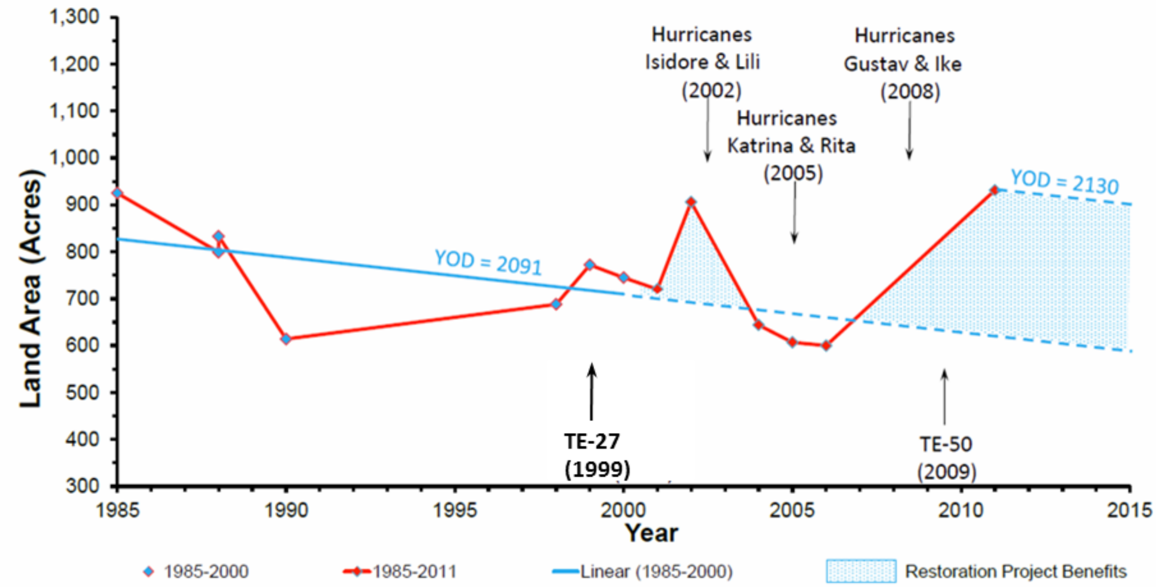


Figure 25. Whiskey Island Land Area Change Analysis (CEC, 2012).

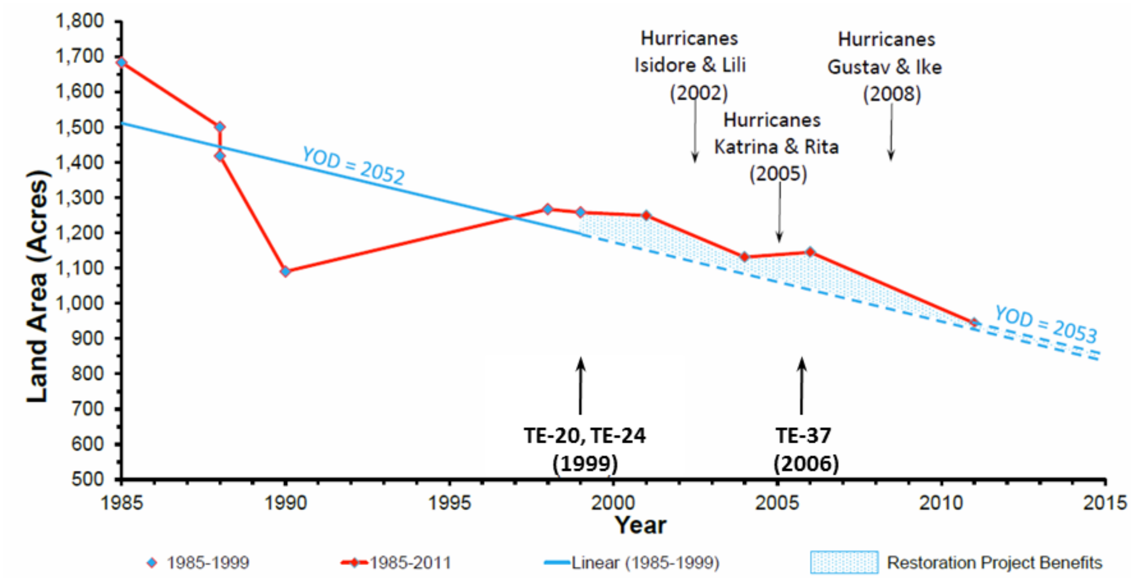


Figure 26. Trinity-East Island Land Area Change Analysis (CEC, 2012)

may have contributed to the upward trend between 1990 and 1998. The islands benefitted from the CWPPRA restoration projects, TE-20 and TE-24 in 1999, and TE-37 in 2007. The pre-restoration YOD was projected to be 2052. Post-restoration, the YOD was projected to be 2053. It is noted that Hurricanes Katrina, Rita, Gustav, and Ike caused significant land loss on Trinity-East Island between 2005 and 2008 (Doran et al., 2009; Martinez et al., 2006). As such, it is expected that the land loss rate would have accelerated, and in absence of the 1999 restoration project, Trinity-East Island would have disappeared significantly sooner than the 2052 projection.

4.3 Lafourche Delta Barrier Islands (Timbalier Island to Grand Isle)

The Lafourche Delta Barrier Islands have benefitted from a number of barrier island restoration projects, most recently the East Grand Terre Island Restoration project (BA-30) that was completed through CIAP (Figure 27 and Table 4). In total, five projects have been constructed in this region and several others are planned.

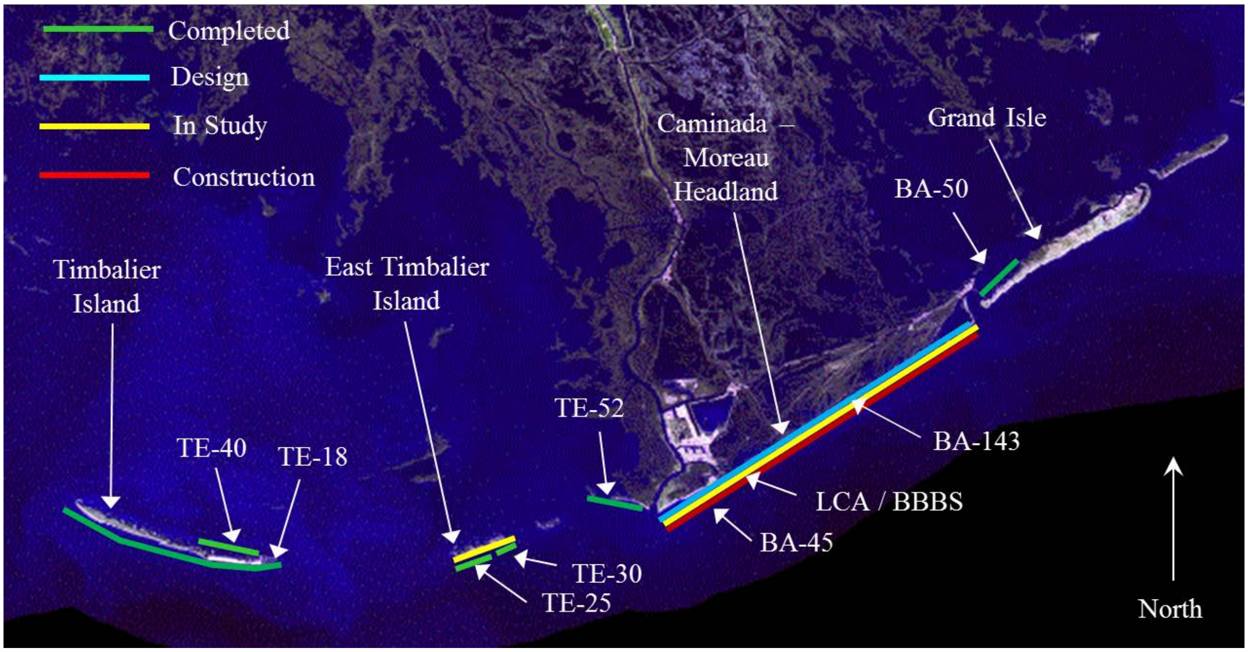


Figure 27. Location of barrier island restoration projects in Lafourche Delta Barrier System (CEC, 2012).

According to the BICM data through 2005, the projected years of disappearance for these islands are 2056 (Timbalier), 2138 (East Timbalier), 2867 (Grand Isle), and 2044 (Grand Terre). A more recent study including post-BICM data reports disappearance date by island and suggests much sooner rates of disappearance for Timbalier (2044) and East Timbalier (2018) islands.

4.3.1 Timbalier Island

The land area over time for Timbalier Island is plotted in Figure 28. It is noted that Timbalier Island was the site of a breach repair project in 1996, which may have contributed to the upward trend in land area between 1990 and 1998. The island was restored through CWPPRA project TE-40 in 2004. The pre-restoration YOD was projected to be 2043. Post-restoration, the YOD was projected to be 2044. It is noted that Hurricanes Katrina, Rita, Gustav, and Ike caused significant land loss on Timbalier Island between 2005 and 2008 (Rodrigue et al., 2011; Martinez et al., 2006). As such, it is expected that the land loss rate would have accelerated, and in absence of the 2004 restoration project, Timbalier Island would have disappeared significantly sooner than the 2043 projection.

Table 4. List of projects constructed, funded for construction, and for future implementation in the Lafourche Delta Barrier System.

Barrier Shoreline Restoration Projects	Funding Program	Construction Date
Lafourche Barrier System		
Constructed Projects		
Timbalier Island Planting Demonstration (TE-18)	CWPPRA	1996
Timbalier Island Dune and Marsh Creation (TE-40)	CWPPRA	2004
East Timbalier Island Sediment Restoration, Phase 1 (TE-25)	CWPPRA	2000
East Timbalier Island Sediment Restoration, Phase 2 (TE-30)	CWPPRA	2000
West Belle Pass Barrier Headland Restoration (TE-52)	CWPPRA	2012
Bayside Segmented Breakwaters at Grand Isle (BA-50)	CIAP	2012
Funded for Construction		
Caminada Headland Beach and Dune Restoration (BA-45) (under construction)	CIAP/ Surplus	2014
Caminada Headland Beach and Dune Restoration, increment 2 (BA-143) (headed to construction)	NFWF	TBD
Future Projects		
Barataria Basin Barrier Shoreline (BBBS) Restoration (BA-10) Eastern portion of Caminada	LCA	TBD
East Timbalier Island	NFWF	TBD

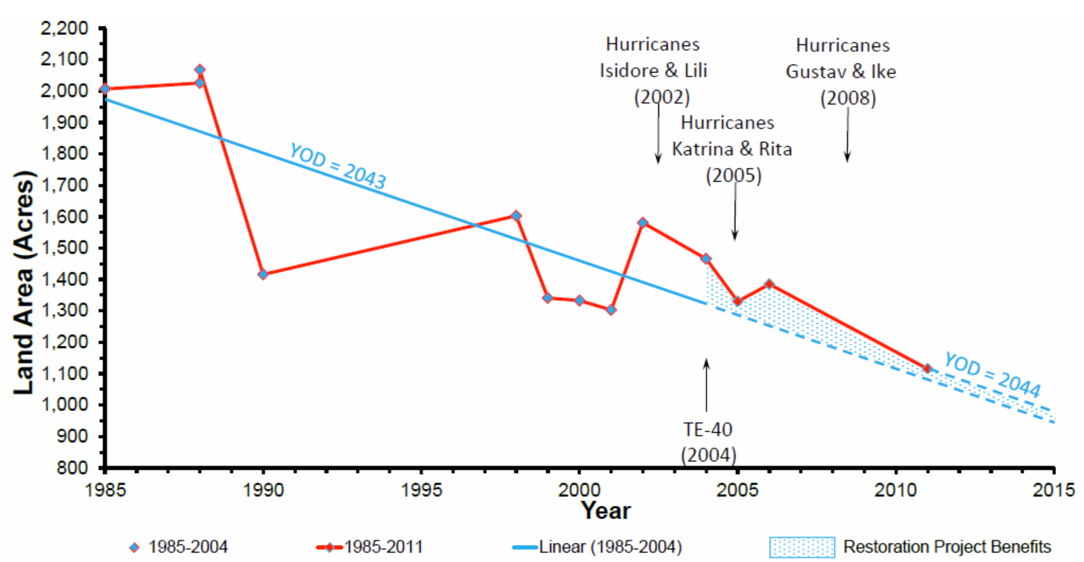


Figure 28. Timbalier Island Land Area Change Analysis (CEC, 2012)

4.3.2 East Timbalier Island

The land area over time for East Timbalier Island is plotted in Figure 29. The island was restored through CWPPRA projects TE-25 and TE-30 in 2000. The pre-restoration YOD was projected to be 2014. Post-restoration, the YOD was projected to be 2018. It is noted that Hurricanes Katrina, Rita, Gustav, and Ike caused significant land loss on East Timbalier Island

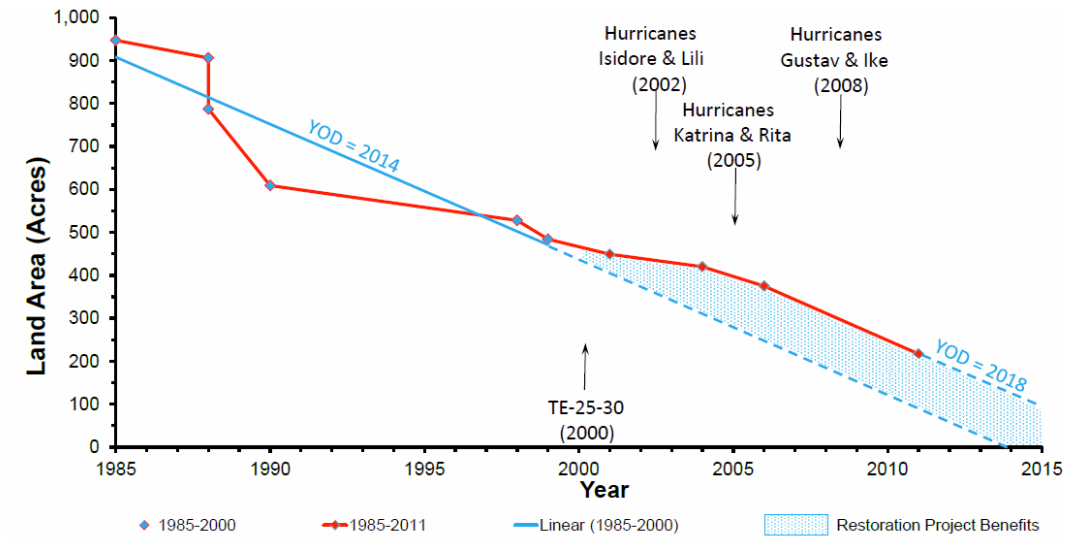


Figure 29. East Timbalier Island Land Area Change Analysis (CEC, 2012)

between 2005 and 2008 (Doran et al., 2009; Martinez et al., 2006). As such, it is expected that the land loss rate would have accelerated, and in absence of the 2000 restoration projects, East Timbalier Island would have disappeared significantly sooner than the 2014 projection.

4.4 Modern Delta Barrier Islands (Cheniere Ronquille to Scofield Island)

The Modern Delta Barrier Islands have benefitted from a number of very recent barrier island restoration projects, in addition to the Emergency Berms that were constructed as a part of the BP oil spill response (Figure 30 and Table 5).

Although BICM did not report estimated disappearance rates for all of these islands, the BICM data presented above through 2005 projected that Shell Island would have disappeared by 2029 (Table 2; Section 5.1). Recent assessment of shoreline erosion rates for the Modern Delta barrier islands suggest that the recent projects constructed by the CPRA have prograded the shoreline positions gulfward relative to their pre- hurricanes Katrina and Rita positions (Figure 31).

Pre-restoration average rates of shoreline erosion ranged from -4.5 ft/yr (Pelican Island) to -41.7 ft/yr (East Grand Terre Island). Post-restoration rates of shoreline erosion range from +12.7 ft/yr (Pelican Island) to +85.9 ft/yr (East Grand Terre Island) noting the higher value for East Grand Terre Island may be related to the fact the project was recently completed in 2010 and the analysis utilized the post-construction survey. For this same time period, the average erosion rate for Chenier Ronquille was -46.1 ft/yr. It is noted that the post-restoration period included the sand berms on Pelican and Scofield Islands, neither of which underwent full island restoration during this time period. These reversals of shoreline change rates, from erosion to accretion, are evidence that the restoration projects have benefitted not only the individual islands, but the system as a whole.

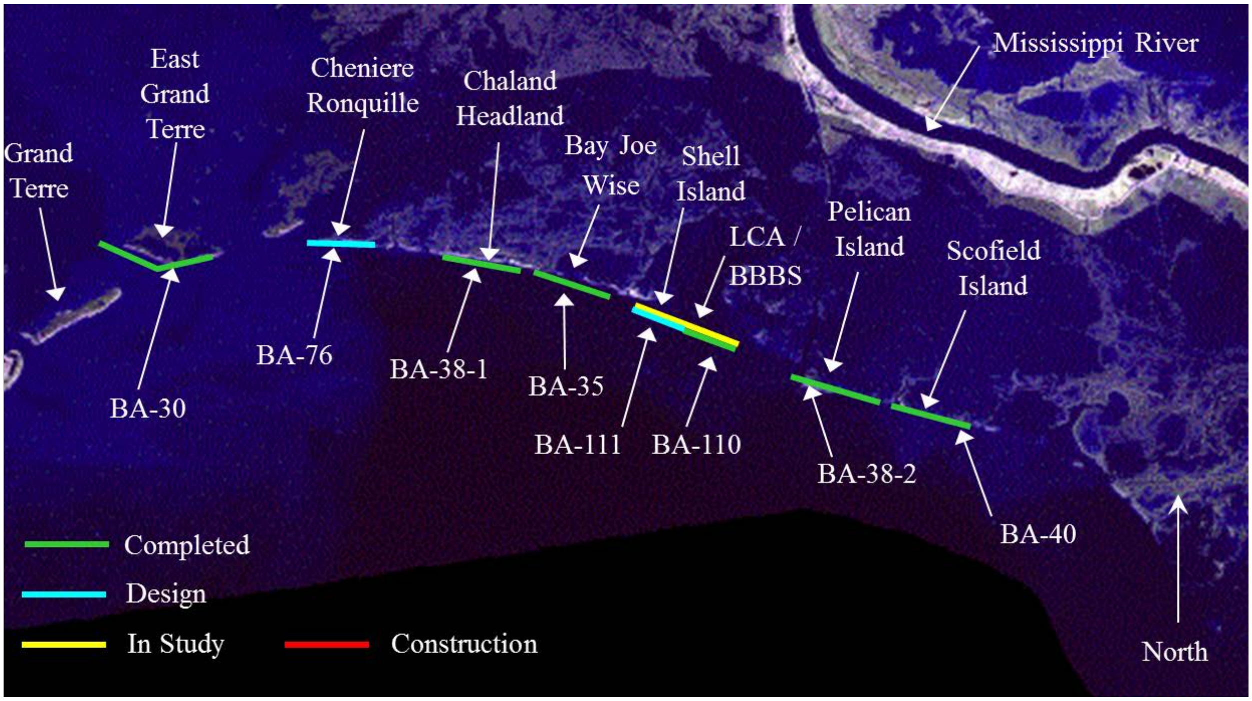


Figure 30. Location of barrier island restoration projects in Lafourche Delta Barrier System (CEC, 2012).

Table 5. List of projects constructed, funded for construction, and for future implementation in the Modern Delta Barrier System.

Barrier Shoreline Restoration Projects	Funding Program	Construction Date
Modern Barrier System		
Constructed Projects		
Vegetative Planting of a Dredged Material Disposal Site on Grand Terre (BA-28)	CWPPRA	2001
East Grand Terre Island Restoration (BA-30)	CIAP	2010
Pass La Mer to Chaland Pass (BA-38-1) also known as "Chaland Headland"	CWPPRA	2007
Pass Chaland to Grand Bayou Pass Barrier Shoreline Restoration (BA-35) also known as "Bay Joe Wise"	CWPPRA	2009
Barataria Barrier Island Complex Project: Pelican Island and Pass (BA-38-2)	CWPPRA	2012
Emergency Berms W8, W9, W10	Berm Funds	2010-2011
Riverine Sand Mining/Scofield Island Restoration (BA-40)	*CWPPRA/ Berm Funds*	*2013*
Shell Island Restoration East Berm (BA-110)	Berm Funds	2013
Funded for Construction		
Cheniere Ronquille Barrier Island Restoration (BA-76)	NRDA	TBD
Shell Island Restoration West NRDA (BA-111; in final design)	NRDA	TBD
Future Projects		
BBBS Restoration (BA-10)	LCA	TBD

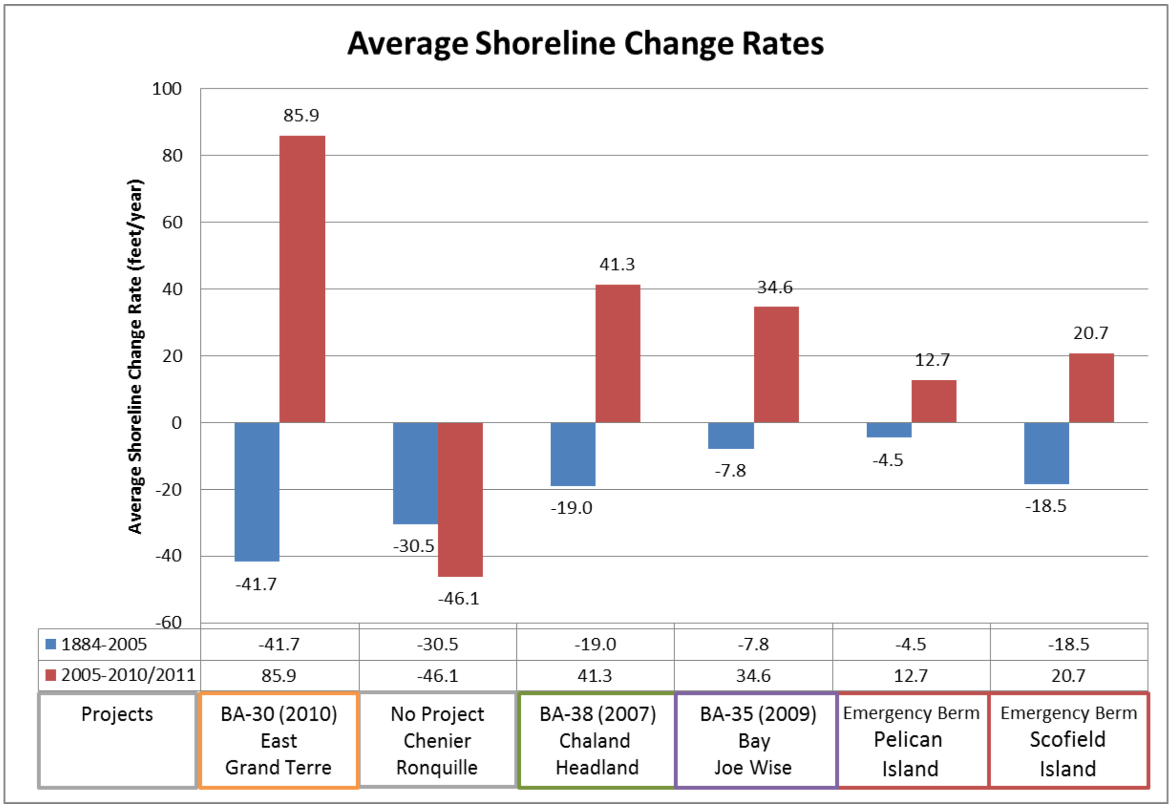


Figure 31. Barrier island average gulf-side shoreline change rates pre-restoration (1884-2005) and post-restoration (2005-2010/2011). Projects constructed (and years) are also listed in the data table.

4.4.1 East Grand Terre

East Grande Terre Island is part of the original Grand Terre Island which has divided into East and West Grand Terre Islands separated by Pass Abel. This island was restored in 2010 through the construction of the East Grand Terre Island Restoration Project (BA-30) by the CPRA with funding from CIAP (CPE, 2011). The East Grand Terre Island Restoration Project was part of the original East and West Grand Terre Island Restoration Project which was cooperatively designed and engineered by the CPRA and National Marine Fisheries Service through the CWPPRA program.

Presented in Figure 32 are the average shoreline change rates for East Grand Terre. The pre-restoration erosion rates ranged from -38.9 ft/yr (BICM short-term) to -48.3 ft/yr (BICM long-term) noting the BICM historical average was on the same order of magnitude equal to -41.7 ft/yr. East Grand Terre has experienced breaching throughout the long-term and short-term intervals. The island experienced net accretion in the near-term interval (+85.9 ft/yr on average) noting this period included the recently completed restoration project. The new historical average, equal to -34.7 ft/yr, is less than the BICM time period averages. Thus restoration of the island's geomorphic form and function offset a significant percentage of the erosion experienced in the short-term period, returning the historical erosion rate to less than pre-restoration rates.

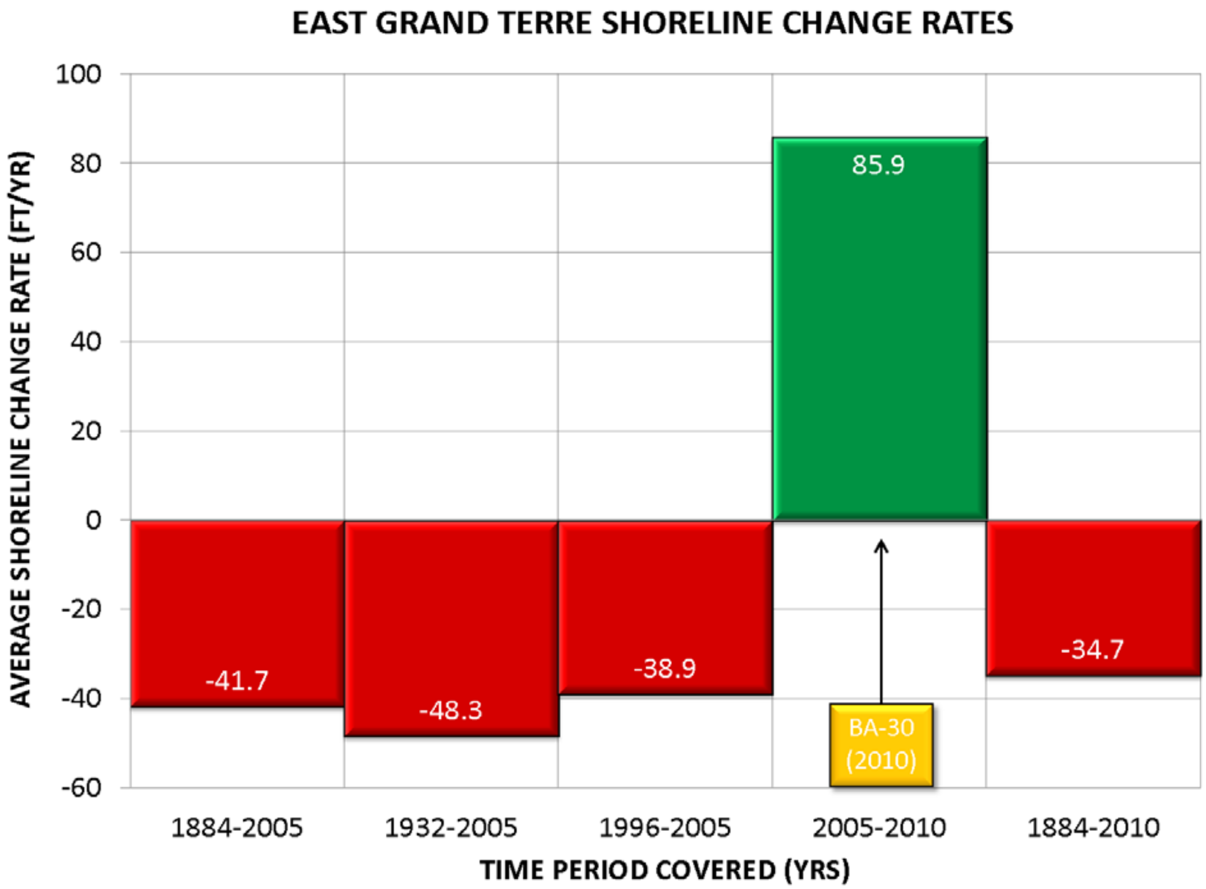


Figure 32. East Grand Terre Average Shoreline Change Rates (CEC, 2012).

4.4.2 Cheniere Ronquille

Presented in Figure 33 are the average shoreline change rates for Cheniere Ronquille. In general the erosion rates have accelerated over time, ranging from -30.5 ft/yr (BICM historical) to -46.1 ft/yr (near-term). Shell Island experienced multiple breaches between 2004 and 2006 attributed to Hurricanes Katrina and Rita. Cheniere Ronquille has not been restored to date, but future restoration projects are planned (BA-76). The new historical erosion rate average, equal to -30.7 ft/yr, is nearly identical to the BICM historical rate.

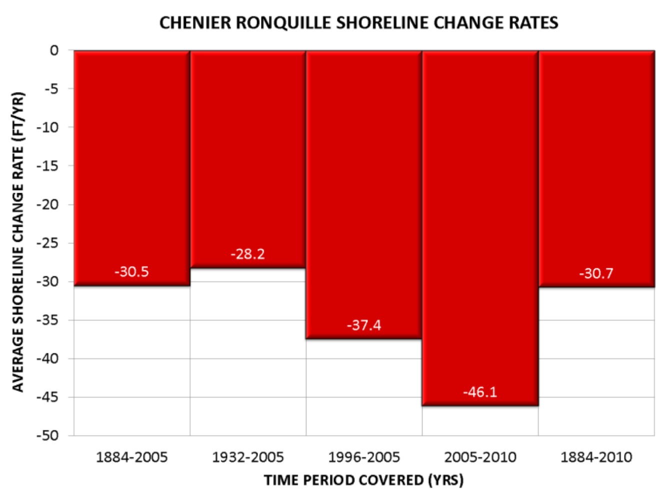


Figure 33. Cheniere Ronquille Average Shoreline Change Rates (CEC, 2012).

4.4.3 *Chaland Headland*

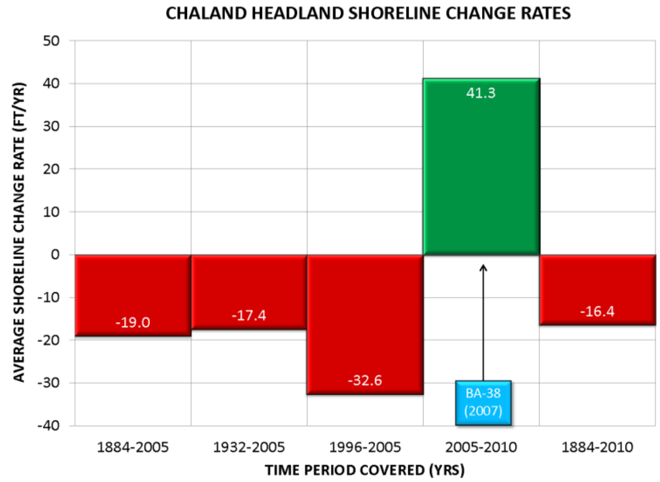


Figure 34. Chaland Headland Average Shoreline Change Rates (CEC, 2012).

The Chaland Headland extends from Pass Chaland (now closed) on its eastern end to Pass La Mer on its western end. This headland was restored in 2006 under CWPPRA Project BA-38-2 (CPE, 2008). Presented in Figure 34 are the average shoreline change rates for the Chaland Headland. The pre-restoration erosion rates ranged from -17.4 ft/yr (BICM long-term) to -32.6 ft/yr (BICM short-term) noting the short-term average was over 1.5 times the long-term average and the BICM historical average equal to -19.0 ft/yr. The Chaland Headland first breached between 1998 and 2004 and experienced additional breaching in 2005 attributed to Hurricanes Katrina and Rita, all of which occurred during the short-term interval. This breaching correlates to the amplified shoreline erosion rate. The island experienced net shoreline progradation in the near-term interval (+41.3 ft/yr on average) noting this period included the restoration project. The new historical average shoreline erosion equaled -16.4 ft/yr, which was on the same order of magnitude as the BICM historical and long-term averages. Thus restoration of the island's geomorphic form and function offset a significant percentage of the erosion experienced in the short-term period, returning the historical erosion rate to pre-restoration rates.

4.4.4 *Bay Joe Wise*

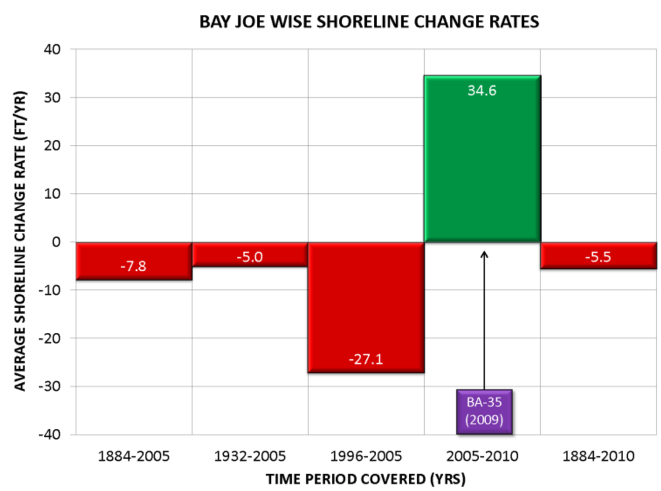


Figure 35. Bay Joe Wise Headland Average Shoreline Change Rates (CEC, 2012).

This barrier shoreline extends from Grand Bayou Pass (now closed) on its eastern end to Pass Chaland on its western end. This headland was restored in 2008-2009 under CWPPRA Project BA-35 (CEC, 2010) entitled Pass Chaland to Grand Bayou Pass Barrier Shoreline Restoration. Presented in Figure 35 are the average shoreline change rates for the Bay Joe Wise Headland. The pre-restoration erosion rates ranged from -5.0 ft/yr (BICM long-term) to -27.1 ft/yr (BICM short-term) noting the short-term average was over 5 times the long-term average and over 3 times the BICM historical average equal to -7.8 ft/yr. Bay Joe Wise first breached between 1998 and 2004 and experienced additional breaching in 2005 attributed to Hurricanes Katrina and Rita, all of which occurred during the short-term interval. This breaching correlates to the amplified shoreline erosion rate. The island experienced net accretion in the near-term interval (+34.6 ft/yr on average) noting this period included the restoration project. The new historical average equaled -5.5 ft/yr, which was on the same order of magnitude as the BICM historical and long-term averages. Thus restoration of the island's geomorphic form and function offset a significant percentage of the erosion experienced in the short-term period, returning the historical erosion rate to pre-restoration rates.

4.4.5 Shell Island

Presented in Figure 36 are the average shoreline change rates for Shell Island. The erosion rates ranged from -74.9 ft/yr (BICM historical) to -355.6 ft/yr (BICM short-term) noting the short-term average was over 4.5 times the historical average and over 3.5 times the BICM long-term average equal to -94.8 ft/yr. Shell Island first breached between 1884 and 1922 and continued to divide into multiple islands as it disintegrated over time. Shell Island's high erosion rate is in part attributed to the Empire Waterway jetties which interrupt the natural alongshore transport from east to west.

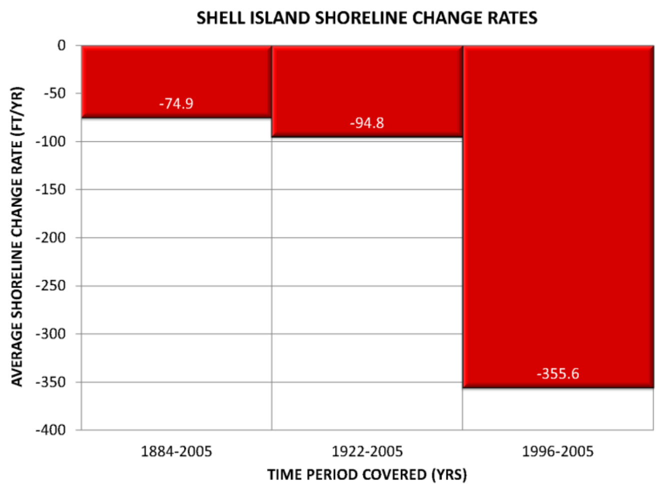


Figure 36. Shell Island Average Shoreline Change Rates (prior to Emergency Berm construction; CEC, 2012).

The initial template of emergency berm reach W8 was located within the footprint of the Shell Island restoration project which was proposed under the LCA – BBBS project. However, pre-construction surveys indicated that the island had receded, so the profile was shifted approximately 750 feet north (landward). The construction template for the W8 berm reach was identical to the templates used on the other berm reaches: a 20-foot crest width, +5 feet, NAVD 88 crest elevation, 1V:25H side slopes above -2.0 feet, NAVD 88 and 1V:50H below -2.0 feet, NAVD 88. Construction of approximately 9,000 linear feet of berm on Shell Island started on October 9, 2010 and was completed by November 23, 2010. Approximately 790,000 cubic yards of sand was placed along the island. Monitoring of emergency sand berm reach W8 indicates that 83% of the material had been retained after the first 360-day monitoring event.

4.4.6 Pelican Island

Presented in Figure 37 are the average shoreline change rates for Pelican Island. It is noted this island benefitted by emergency Sand Berm W9 (Thompson. 2012). The pre-berm erosion rates ranged from -4.5 ft/yr (BICM historical) to -40.5 ft/yr (BICM short-term) noting the short-term average was 9 times the historical average and over 2.5 times the BICM long-term average equal to -16.2 ft/yr. Pelican Island first breached between 1998 and 2004, which occurred during the short-term interval. This breaching correlates to the amplified shoreline erosion rate. The island experienced net shoreline progradation in the near-term interval (+12.7 ft/yr on average) noting this period included the sand berm construction. The new historical average equaled -3.8 ft/yr, which was on the same order of magnitude as the BICM historical average. Thus placement of the sand berm restored some of the island's geomorphic form and function, returning the historical erosion rate to pre-breach rates.

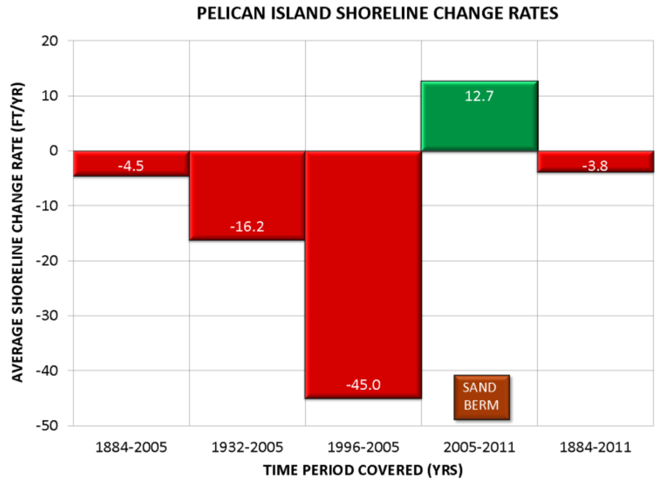


Figure 37. Pelican Island Average Shoreline Change Rates (CEC, 2012).

Construction of emergency berm reach W9 along Pelican Island started on July 18, 2010 and was completed by October 2, 2010. Sand was transported from re-handling area 35-E and emplaced within the construction template, which was identical to the template used for the other berm reaches. The template was superimposed on the existing island and within the footprint of the proposed CWPPRA Pelican Island Restoration Project (BA-38-2). A total length of 12,700 feet of berm was constructed and approximately 1,294,000 cubic yards of sand was emplaced within the berm along Pelican Island. Monitoring of emergency sand berm reach W9 indicates that 79% of the material had been retained after the first 360-day monitoring event.

4.4.7 Scofield Island

Presented in Figure 38 are the average shoreline change rates for Scofield Island. Similar to Pelican Island, it is noted this island was the site of emergency berm W10 as part of the Louisiana Berm Project (Thompson, 2012). The pre-berm erosion rates ranged from -11.7 ft/yr (BICM long-term) to -30.2 ft/yr (BICM short-term) noting the short-term average was over 2.5 times the long-term average and over 1.5 times the BICM historical average equal to -18.5 ft/yr. Scofield Island first breached between 1998 and 2004, which occurred during the short-term interval.

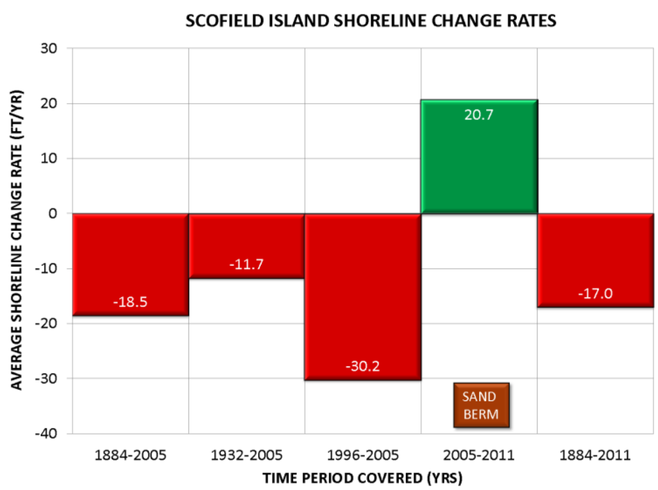


Figure 38. Scofield Island Average Shoreline Change Rates (CEC, 2012).

This breaching correlates to the amplified shoreline erosion rate. The island experienced net shoreline progradation in the near-term interval (+20.7 ft/yr on average) noting this period included the sand berm. The new historical average equaled -17.0 ft/yr, which was on the same order of magnitude as the BICM historical average. Thus placement of the sand berm restored some of the island's geomorphic form and function, returning the historical erosion rate to pre-breach rates.

Construction of berm reach W10 on Scofield Island started on September 13, 2010. Approximately 935,000 cubic yards of sand was transported from rehandling site 25-5 between September 13 and November 23, 2010 for constructing approximately 14,755 feet of berm. The construction template for berm reach W10 was identical to the other berm reaches. The berm was constructed within the footprint of the proposed CWPPRA Scofield Island Restoration Project (BA-40). Monitoring of emergency sand berm reach W10 indicates that 91% of the sand had been retained after the first 360-day monitoring event.

4.5 St. Bernard Delta Barrier Islands

Emergency Berm Reach E4 was constructed adjacent to the northern Chandeleur Islands. Dredging operations in the Hewes Point borrow site (Figure 39 and Table 6) commenced after the state received the notice to proceed on June 11, 2010 and ended by March 21, 2011. For the northern section of berm reach E4, sand was pumped directly by dredging from the approved borrow areas in Hewes Point. Once adjacent to the island, the sand was shaped into the final berm alignment using grader equipment. All work performed by the equipment at the berm site

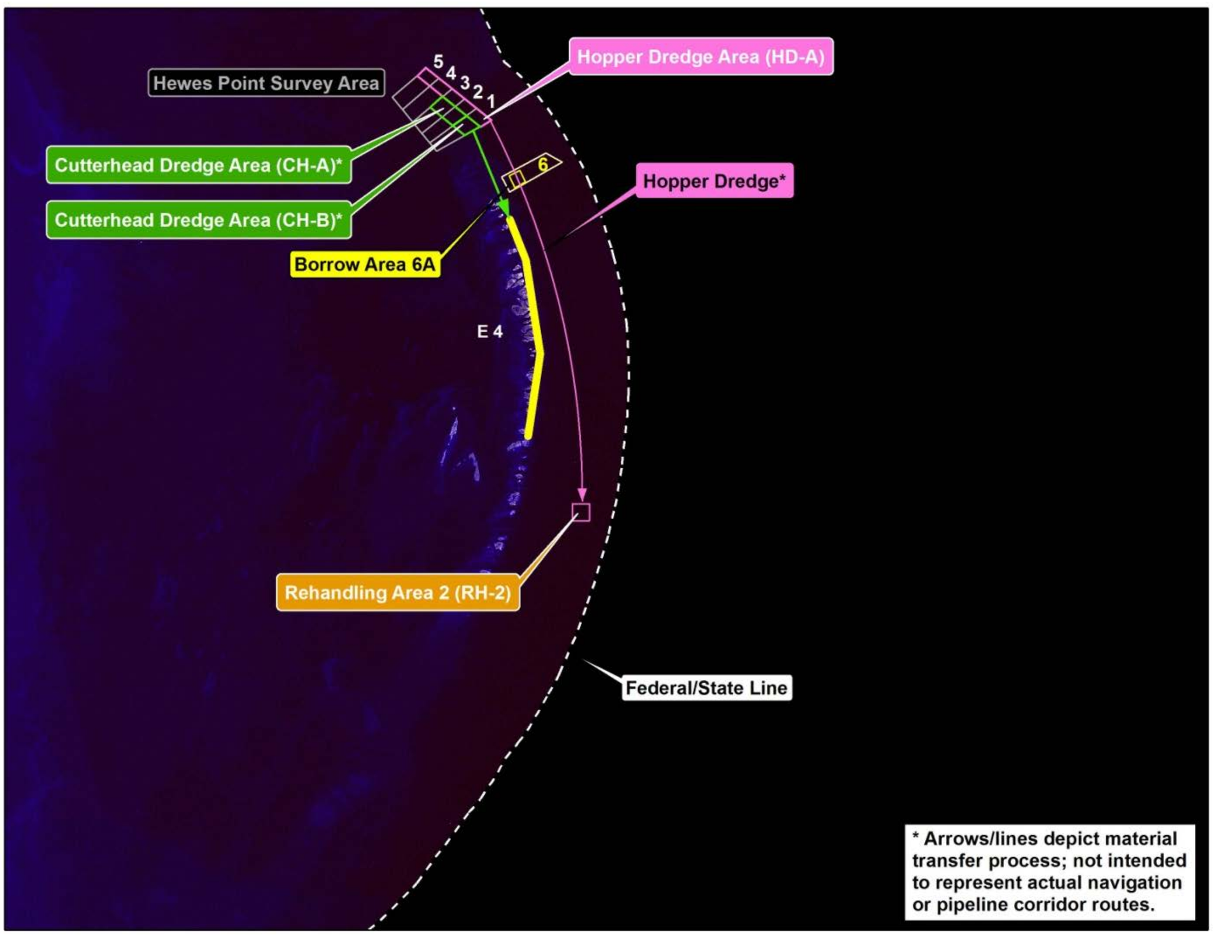


Figure 39. Location of emergency Berm E4 and surrounding features in the vicinity of the Chandeleur Islands.

Table 6. List of projects constructed, funded for construction, and for future implementation in the St. Bernard Delta Barrier System.

Barrier Shoreline Restoration Projects	Funding Program	Construction Date
St. Bernard Delta System		
Constructed Projects		
Chandeleur Islands Marsh Restoration (PO-27)	CWPPRA	2001
Emergency Berms E4		2010
Funded for Construction		
Louisiana Outer Coast Restoration: Breton Island	NRDA	TBD
Future Projects		
None		

remained within the footprint of the berm section or seaward of the berm. Sand for the southern portion of berm reach E4 was transported via hopper dredge from Hewes Point and emplaced in rehandling area RH-2 (Figure 39).

The berm template has a dune height of +5 feet, NAVD 88 with a crest width of 20 feet. Side slopes of 1V:25H were constructed above -2.0 feet, NAVD 88, while a construction slope of 1V:50H was applied below -2.0 feet, NAVD 88. Initially, the berm was constructed so that the landward toe of fill was located 100 feet seaward of the mean high water line. However, this requirement was adjusted starting at Station 187+11 so that the berm could be constructed along the shoreline. This reduced the fill density necessary to construct the berm template.

A total of 47,000 feet (8.9 miles) of berm was constructed along the Chandeleur Islands. Construction of the berm along Chandeleur Island (Reach E4) placed approximately 3,170,000 cubic yards of sandy material from Hewes Point. The shoreline was extended an average of 430 feet and numerous breaches were plugged.

Based on the 360-day monitoring survey, approximately 77% (2,450,000 cubic yards) of the sediment remains within the initial fill footprint. Although comparison of the as-built survey and the 360-day monitoring survey suggests that there has been a volumetric loss of 720,000 cubic yards, this anomaly could be at least partially attributed to survey error. The shoreline has remained stable such that the average shoreline position is roughly five feet seaward of the as-built shoreline position. It should be noted that as of the 360-day monitoring survey, the berm had not been subjected to a significant storm event with the exceptions of Tropical Storm Lee and Tropical Storm Debby. Shoreline recession and erosion are highest at the center of the constructed island where the largest landmass existed prior to construction.

There has been a measurable reduction in the berm crest elevation, likely due to overwash. It is estimated that more than 50% of the overwash occurred between the as-built and 30-day monitoring surveys. It is thought that this overwash is a result of nor'easter storm events and the island adjusting to an equilibrium elevation. Overwash is not considered a loss of sand as the sand stays within the system.

4.6 Factors affecting Barrier Island Stability

Figure 40 illustrates the major pathways for sand movement, which affect barrier island stability. These sediment pathways are discussed below.

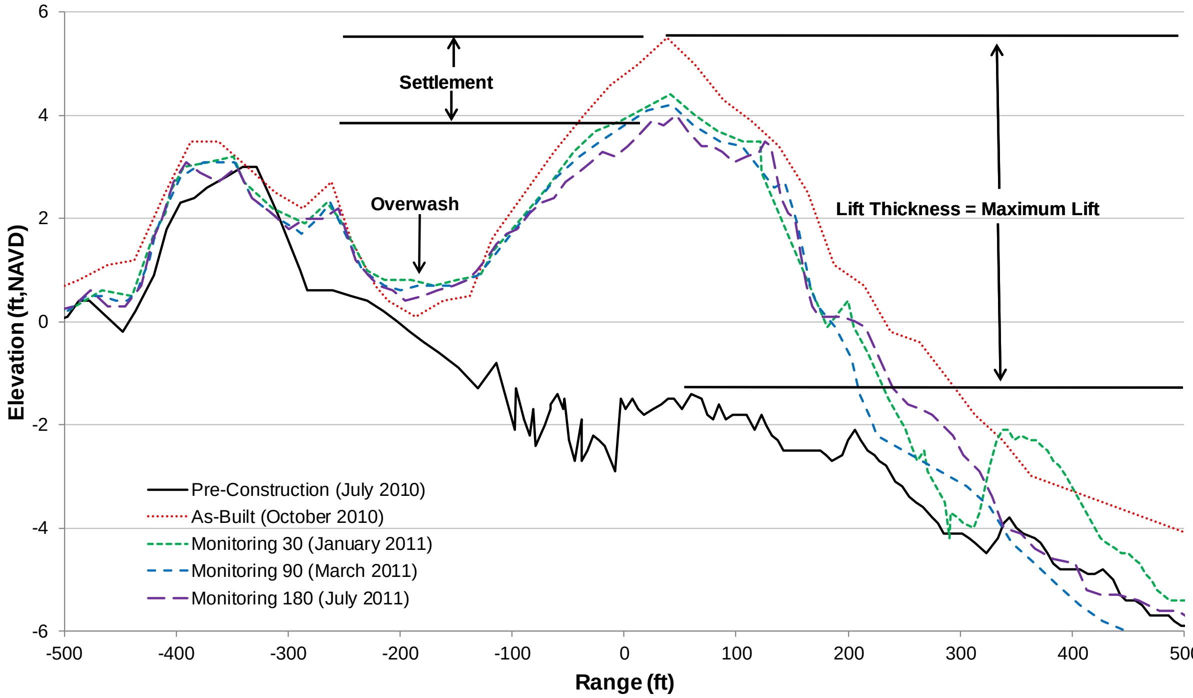


Figure 40. Illustration of various sediment movement pathways which contribute to barrier island stability.

4.6.1 Settlement

In addition to hydrodynamic processes, consolidation of the underlying substrate (settlement) lowers the profile elevation suggesting an apparent volumetric loss of material. This apparent loss is not the result of material leaving the placement area, but is the result of material sinking in place. It is critical to understand the extent of this process because ignoring it could attribute a greater volume change to other processes, such as longshore transport, than is actually occurring.

Rosati's (2009) research suggests that consolidation under the weight of a barrier island is a dominant process governing morphologic evolution and migration. Results indicate that the volume of sand that is sequestered through the consolidation process can be as large as 68 percent for a barrier island overlying a poorly consolidated substrate, such as would occur for new construction of a barrier island (or sand berm) over a compressible substrate.

4.6.2 Overwash

Overwash is a significant component of the sediment budget, although overwash is not considered a loss from the system. As it is a redistribution of sediment, it describes the performance of the project and explains observed sediment redistribution. Overwash can be calculated by measuring the volume change landward of the location of maximum elevation on the as-built survey. The overwash density (and corresponding volume when calculating volumes using the average end area method) was obtained by calculating the volume change landward of the project between the as-built and monitoring profiles.

4.6.3 Offshore Loss of Fine Sediment

Fine-grained sediment (silt and clay) is more easily resuspended by waves and transported offshore than coarse-grained sediment (sand). Some barrier island projects are constructed with a mixture of sand, silt, and clay. Silts and clays can be used to effectively construct back-barrier marsh platforms, but are highly erosive on the shoreface of barrier islands. A distinction must be made within a sediment budget to account for the difference in sediment types. From a coastal engineering perspective, it is the volume of sand within the system that is important because the sand provides longer term protection from wave attack. When silt and clay are exposed they are more easily suspended in the water column and can be transported offshore.

4.6.4 Longshore Transport

The losses due to longshore transport (sediment moving along the shoreline) can be estimated by taking the total measured volume change between surveys and subtracting the offshore loss. Longshore transport is the process which typically results in sediment being deposited in navigation channels that bisect barrier islands. The slope of the longshore transport curve indicates whether erosion or accretion is occurring and the severity of this erosion or accretion. Areas of higher erosion (or accretion) will result in a steeper longshore transport curve. Stable areas will result in a flatter longshore transport curve.

4.6.5 Island Breaching

It is noted that the period of time when shoreline erosion rates increased dramatically above the historical averages corresponds with breaching of the barrier shorelines. These periods of time correlated with the passage of significant hurricanes and resultant breaching of shorelines. Often times these breaches occurred adjacent to canals which act as sediment sinks when the beach has overwashed and sediments deposited in the canals. The sediments are no longer available for transport and in essence are removed from the littoral system.

Recent studies have documented that breaching of islands contributes to accelerated shoreline erosion and island disintegration. Numerous barrier island breaches caused by hurricanes over the past seven years have benefitted by recent restoration projects, which in many cases, have returned islands to their historic shoreline positions. The CPRA is developing a Breach Management Program in response to this recommendation. Refer to Section 3.4 (above) for more information.

4.7 Minimized Design Template

The minimized design template is defined as a design template with minimal barrier island dimensions that restores the barrier shoreline's geomorphic form and ecologic function and retains this form and function after being subjected to the design storm events. There are several components needed to construct the minimized design template for a barrier system including bathymetric/topographic data, sediment transport pathways, design storm criteria, subsidence and compaction, existing restoration project footprints, and site constraints (e.g., unique environmental habitats).

A minimized design template was developed for the Terrebonne Basin barrier shorelines extending from East Timbalier Island to Raccoon Island as part of the Louisiana Coastal Area program for the Terrebonne Basin Barrier Shoreline Restoration Project (TBBSR) (USACE, 2010). The design storms selected included a hypothetical 50-year design storm and historic storms, Hurricanes Katrina and Rita, which occurred in 2005, and Hurricanes Gustav and Ike, which occurred in 2008. Table 7 presents dimensions of the minimized restoration template developed for the Terrebonne Basin islands.

Table 7. Summary of Minimized Restoration Templates for TBBSR

Island	Raccoon	Whiskey	Trinity	East	Timbalier	East Timbalier
Gulf-side Beach Width (ft)	250	250	250	250	250	250
Dune Crest Width (ft)	100	100	100	100	100	100
Bay-side Beach Width (ft)	100	100	100	100	100	100
Marsh Width (ft)	1,000	1,000	1,000	1,000	1,000	1,000
Beach Elev. (ft, NAVD88)	4.2	4.0	4.0	4.0	4.0	4.0
Dune Elev. (ft, NAVD88)	6.4	6.2	6.2	6.2	6.2	6.2
Marsh Elev. (ft, NAVD88)	2.5	2.1	2.3	2.3	2.2	2.3

A number of barrier island projects have been constructed in the Teche, Lafourche, and Modern delta reaches since 1994. With the recent updating and adoption of the 2012 *Louisiana's Comprehensive Master Plan for a Sustainable Coast* (CPRA, 2012), it is timely to consider the status of the already-accomplished restoration projects. In order to improve the understanding of barrier system evolution and enhance the science behind barrier system restoration design, it is both essential and prudent to evaluate performance of the constructed projects as completed in the recently-commissioned barrier island performance study (CEC, 2012).

4.8 Benefits of BI Restoration on Longevity of System(s)

With several major restoration projects in place, the post-restoration estimated Year of Disappearance (YOD) for several barrier island systems in Louisiana have been extended by years to decades. This increase in island longevity throughout the system is a direct benefit of the restoration projects. Further, with the increase in both frequency and intensity of major hurricanes over the past 12 years (and similar projections into the future), in the absence of the restoration and protection program, it is expected many of these islands would have disappeared much sooner than original projections.

5.0 Future Plans

Future plans for Louisiana's barrier islands include additional projects, continuation of system-wide monitoring, and the management of relevant sediment and geophysical data, and overall understanding of sediment management requirements to support the sediment needs of the 2012 Coastal Master Plan projects.

5.1 Projects

In addition to the "Future Projects" listed above in Section 2, the 2012 Coastal Master Plan identifies barrier island restoration projects in four main groupings. These projects are listed as: Isles Dernieres Barrier Island Restoration (from Raccoon Island to Wine Island); Timbalier Islands Barrier Island Restoration (from Timbalier Island to Belle Pass); Belle Pass to Caminada Pass Barrier Island Restoration; and Barataria Pass to Sandy Point Barrier Island Restoration. In addition to these projects, eight of the 13 NRDA Early Restoration Projects that Louisiana has submitted are barrier island projects:

1) Cheniere Ronquille
2) Grand Isle Bayside Breakwaters
3) West Grand Terre Beach Nourishment
4) West Grand Terre Stabilization
5) Barataria Basin Barrier Shoreline – Caminada Headland
6) Caillou Lake (Whiskey Island)
7) Chandeleur Island Restoration
8) Shell Island Restoration

These projects will be prioritized for development and for construction in the near future.

5.2 Monitoring

As discussed above in Section 3.1, the Barrier Island Comprehensive Monitoring (BICM) program has provided an extremely useful baseline of barrier island condition. Now that we have this tremendous tool, there is a need to continue this effort to assess how the islands continue to change over time. The CPRA will continue BICM with a second increment of data collection over the next five years, referred to as BICM2 (Figure 14). Also as discussed in Section 3.6 monitoring of subsidence (Phase 4) due to emplacement of sand during barrier island restoration will continue under Caminada-Moreau Subsidence Study.

5.3 Louisiana Sand Resources Database (LASARD)

The Coastal Protection and Restoration Authority developed the Louisiana Sand Resources Database (LASARD) to archive, populate, and maintain the geoscientific and related data acquired for ecosystem restoration on a GIS platform. The objective of LASARD is to centralize relevant data from various sources for better project coordination. That will facilitate future planning for delineating and utilizing sediment resources for a sustainable ecosystem restoration in coastal Louisiana by streamlining access to existing data sources, which will minimize the cost and time required to identify appropriate resources. To keep pace with the large amount of data being delivered to the CPRA from ongoing projects, the current LASARD database will need to be updated to incorporate these new data sets. Keeping LASARD current will provide the benefit of real cost savings to upcoming projects by not only providing valuable data for planning, but also by reducing the potential for costly, redundant data collection efforts. This will include finalizing updates to the LASARD attribute formats, updating existing data to match these new formats, and processing additional data sets that are generated by ongoing implementation of coastal restoration projects. The data which has been collected during BICM 1 and which will be collected in future studies will ultimately reside in LASARD. The LASARD database, along with the mapping of surficial sediment distribution, is an important component of the Louisiana Sediment Management Plan (LASMP).

5.4 Louisiana Sediment Management Plan (LASMP)

To ensure the timeline as described in the 2012 Coastal Master Plan for reversing the trend of coastal land loss is realized, the state must depend upon sound environmental and fiscal management of sediment resources. As such, introduction of river sediment and freshwater nutrients to coastal marshes must be an integral component of restoration efforts, and sand deposits associated with ancient distributary channels and remnant shoals formed during the destructive phase of delta evolution should continue to be pursued as viable sources for barrier island and back-barrier marsh restoration. Moreover, sediment needs are likely to increase due to rapid subsidence in south Louisiana and potential increases in sea-level rise over the next century. Thus, the success of restoration efforts depends on locating, managing, and utilizing sediments in a cost-effective manner. One of the metrics the state has chosen to track their progress is average rate of land change for the next 50 years. The goal is to change the trajectory of land loss from net loss to one of net gain by the year 2042.

Khalil and Finkl (2009) and Khalil et al. (2010) stressed the importance of developing and implementing a sediment management plan for coastal Louisiana in support of coastal restoration efforts. Developing a clear understanding of the evolutionary processes controlling coastal sedimentation in deltaic environments is critical to any successful sediment management strategy. This involves direct knowledge of natural coastal processes (e.g., sea level change, subsidence, wave and current energy, sedimentation patterns, and geologic controls) and the impact of engineering activities (e.g., dredging/channels, levees/dams) on these processes.

Effective restoration efforts should be consistent with natural system evolution. Ultimately, one must understand the imbalance between sediment input and erosion (energy required to mobilize and transport sediment) to properly evaluate net sediment movement within wetlands to design effective restoration strategies. The CPRA is focused on long-term conservation and management of state natural resources. As part of this focus, the CPRA developed the Louisiana Sediment Management Plan (LASMP) framework that embraces a regional sediment management strategy upon which restoration projects are planned within a regional purview as opposed to merely a project-focused approach.

LASMP is a working model to incorporate the influence of scale on resource availability (river, in-shore, and continental shelf) and resource distribution for effective restoration. Although technical considerations associated with sediment borrow areas, river sediment, and engineering activities are critical for successful plan implementation, coastal policy/regulation requirements are expected to have significant influence on plan implementation.

The desired result of LASMP is a more cost-effective implementation of the Master Plan via comprehensive management of renewable and non-renewable sediment resources; a reduction in project costs and environmental impacts; and a long-term, safe and sustainable coast to protect Louisiana communities, national critical energy infrastructure, and state natural resources for future generations.

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