BENEFICIAL USE OF DREDGED MATERIAL MONITORING PROGRAM 1998 ANNUAL REPORT

Part 1: Results of Monitoring the Beneficial Use of Dredged Material at the Barataria Bay Waterway, Louisiana - Barataria Bay and Bar Channel Reaches

Base Year 1985 through Fiscal Year 1997

Prepared for:
U.S. Army Corps of Engineers
New Orleans District
New Orleans, LA 70160-0267

Prepared by:

University of New Orleans
Department of Geology and Geophysics
New Orleans, LA 70148

Contract No. DACW29-98-D-0008

1999

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

Beneficial Use of Dredged Material Monitoring Program (BUMP)

The U.S. Army Corps of Engineers New Orleans District (USACE-NOD) maintains eleven major navigation projects in Louisiana that require regular maintenance dredging (Figure 1). More than 90 million cubic yards of sediment is dredged annually and the USACE-NOD coordinates with state and federal natural resource agencies to determine the most appropriate methods for the disposal of dredged material and, where possible, to beneficially use this material to create or enhance wetlands and other habitats. The USACE-NOD has developed long-term disposal plans incorporating beneficial use for each of these navigation channels. In 1994, the USACE-NOD, working in cooperation with Louisiana State University - Center for Coastal, Energy and Environmental Resources (LSU), implemented a large-scale monitoring program to quantify the amount of new habitat created and to improve dredge disposal placement techniques to maximize beneficial use. A contract was awarded to the University of New Orleans in 1998 to continue the monitoring program which is known as the USACE-NOD Beneficial Use of dredged material Monitoring Program (BUMP).

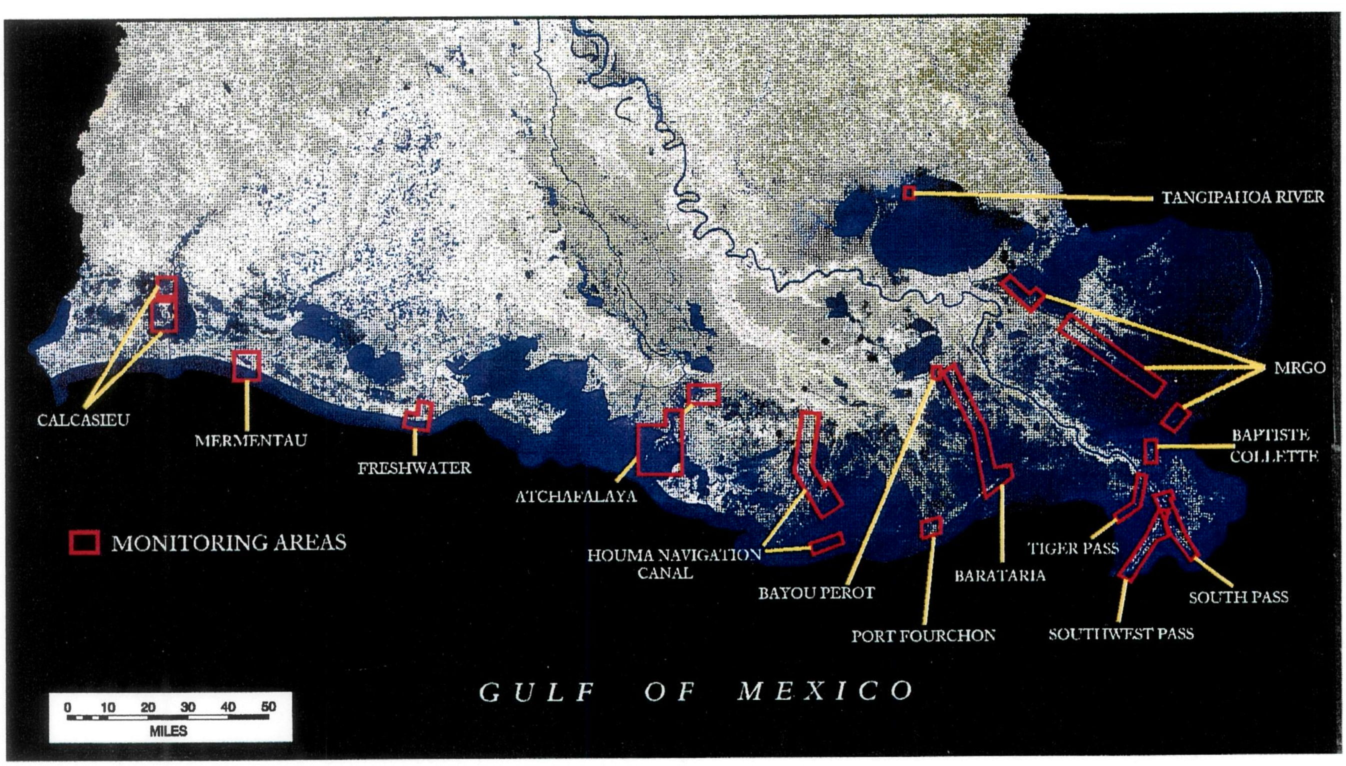


Figure 1. Locations of the beneficial use of dredged material monitoring areas.

Each year, vertical photography is acquired and digital mosaics are produced for each of the study sites listed on Figure 1. GIS habitat analysis and field surveys are conducted on only those sites specified by the USACE-NOD. The work products for the sites selected for full monitoring include dredging history maps, habitat maps for the base year, habitat maps for the selected monitoring years, and habitat change maps. From this analysis, coastal change data quantifies the creation of new coastal lands and other habitats at selected navigation channel locations. The field program includes ground truthing operations to verify and update the habitat maps and field surveys to collect information about vegetation, disposal elevations, and placement practices which maximize beneficial use.

This is part one of the two part Beneficial Use of Dredged Material Monitoring Program (BUMP), 1998 Final Report. The two parts are:

Part 1: Results of Monitoring the Beneficial Use of Dredged Material at the Barataria Bay Waterway - Barataria Bay and Bar Channel Reaches (Mile 0 - 15)

Part 2: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River, Baton Rouge to the Gulf of Mexico, Louisiana - Southwest Pass

BUMP at the Barataria Bay Waterway

The Barataria Bay Waterway navigation channel is located in Jefferson Parish in south-central Louisiana (Figure 2). The navigation channel runs north to south from the Intracoastal Waterway at Lake Salvador 15 miles south of New Orleans, and extends approximately 40 miles through Barataria Bay, and then between Grand Isle and Grand Terre Island via Barataria Pass into the Gulf of Mexico. Construction of the channel was completed in 1925 and the re-alignment of the southern 15 miles was completed in 1963. Maintenance by the USACE-NOD of discontinuous reaches of the channel has been accomplished on an as-needed basis. The material dredged from the channel during maintenance dredging is placed in upland confined disposal areas, along either bank of the navigation channel or in semi-confined and confined beneficial use areas for wetland development. Disposal areas are limited and usually confined because of the concentration of oyster leases in the area that can be adversely affected by the dredge effluent. The channel is primarily used by fishing and mineral production vessels.

This report presents the results of the BUMP analysis at the Barataria Bay Waterway navigation channel, representing monitoring results through the USACE-NOD Fiscal Year 1996 maintenance event. Only the lower 15 miles of the navigation channel, including the west Grand Terre Island, were monitored and the statistics are only of the areas specified by the USACE-NOD (Figure 3). BUMP results are provided in map series, reports, and scientific literature.

Using aerial photography, the natural and man-made habitats in the study area for December 1985 and October 1997 were classified. Through GIS analysis, these areas were measured and changes calculated. Field surveys were conducted in November 1998 on the beneficial use areas created in FY96 at Grand Terre Island and in the Barataria Bay Reach. Habitats were ground truthed and survey transects established to document vegetation species, stacking elevations, and as a base for measuring compaction.

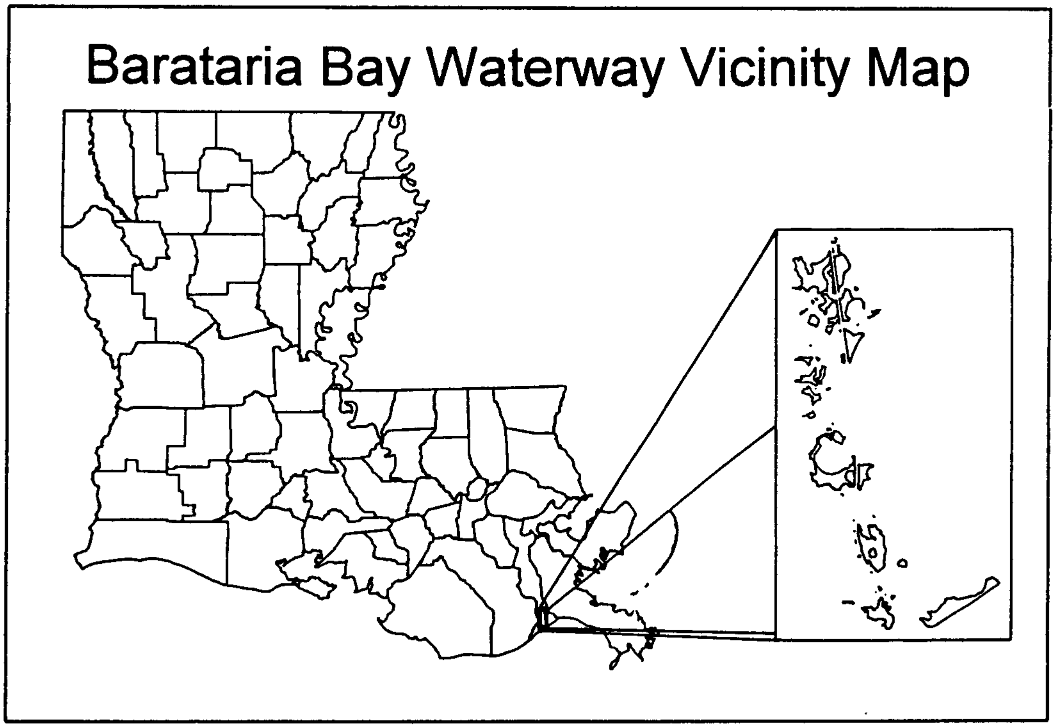


Figure 2. The location of the Barataria Bay Waterway navigation channel - BUMP study area in Louisiana.

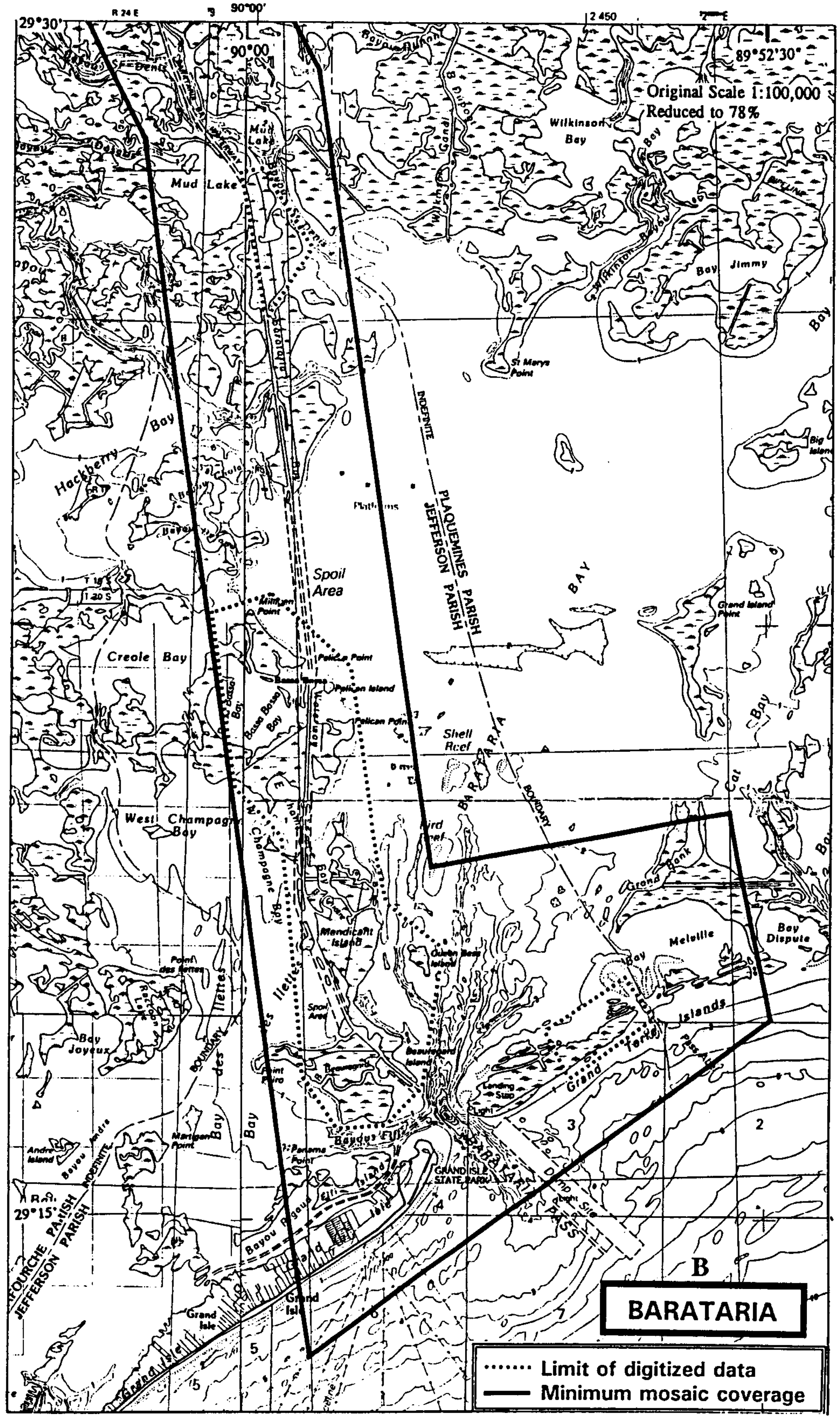


Figure 3. The lower reach of the Barataria Bay Waterway BUMP study area showing the minimum coverage of the aerial photo-mosaic and the limits of the area digitally analyzed for the Barataria Bay Reach and west Grand Terre Island.

DREDGED MATERIAL DISPOSAL HISTORY OF THE BARATARIA BAY WATERWAY

The Rivers and Harbors Act of March 2, 1919 authorized the USACE-NOD to construct a 37-mile long channel, 5 feet deep by 50 feet wide from Bayou Villars to Grand Isle, Louisiana. This channel ran from Lake Salvador and Bayou Villars past the town of Barataria via Bayou Barataria, then through a newly cut channel called Dupre Cut to Bayou Cutler, thence along Bayou St. Denis and Mud Lake into the open Barataria Bay, and then through Barataria Pass. Disposal of dredged material was along the banks or in open water on either side of the new channel. The project was completed in 1925.

The Rivers and Harbors Act of July 3, 1958 authorized an enlargement and realignment of the channel. The 1958 Act provided for a channel approximately 37 miles long with a 12-foot depth and 125-foot width at Mean Low Gulf (MLG) from its beginning at the Gulf Intracoastal Waterway at Lake Salvador to Grand Isle. The new channel followed the route of the previous channel to Mile 15.5 in Bayou St. Denis, and then was relocated along the western shore of Barataria Bay and through Barataria Pass to the 12-foot depth contour in the Gulf of Mexico, with a 4.3-mile extension of the project to include the westerly 4.3 miles of Bayou Rigaud. This route was more direct and provided more shelter from wave action to vessels passing through Barataria Bay. This project modification was completed in 1963.

In 1967, authority was granted under Section 5 of the Rivers and Harbors Act of March 4, 1915 to widen the bar channel to Barataria Bay Waterway from 125 feet to 250 feet between Mile -1.26 and the 12-foot contour. The bar channel widening was completed in 1967. In 1978, authority was granted to increase the dimensions of the bar channel to 15 feet deep MLG by 250 feet wide from Mile 0 to the 15-foot contour of the Gulf of Mexico. However, deepening of the bar channel actually was completed in 1973.

For the purposes of this report, the Barataria Bay Waterway is divided into three reaches as follows: the Dupre Cut Inland Reach (Mile 36.7 to Mile 16); the Barataria Bay Reach (Mile 16 to Mile 0); and the Bar Channel Reach (Mile 0 to Mile -3.8). Areas that can be used for disposal of dredged material are limited in the lower part of the Dupre Cut reach and in the Barataria Bay reach because of the presence of oyster leases adjacent to the waterway. The dredged material must be confined or semi-confined to prevent adverse impacts to oyster leases. Since completion of construction, maintenance of discontinuous segments of these reaches has been conducted on an as-needed basis approximately every 2 to 3 years. Through FY97, beneficial use of dredged material has taken place only in the Barataria Bay Reach and the Bar Channel Reach.

Dupre Cut Inland Reach (Mile 36.7-16)

Dredging records dating back to 1960 indicate that dredged material from construction and maintenance in this reach of the waterway was placed into confined disposal facilities and along the east and west banks of the waterway.

Barataria Bay Reach (Mile 16-0)

Dredged material from construction of this reach of the channel was placed in open water on either side of the channel or into three upland confined disposal facilities located in the vicinity of Mile 10, at Pelican Point (Mile 7), and at Mendicant Island (Mile 3). During maintenance events beginning in 1965 and continuing through 1989, this practice continued.

In 1989, the Louisiana Department of Natural Resources, Coastal Restoration Division, requested that the USACE-NOD consider placement of dredged material from maintenance of the Barataria Bay Reach on Queen Bess Island to restore the island to its 1978 dimensions. Queen Bess Island, a relict oyster reef located approximately one mile east of the navigation channel near Mile 3, was recognized as one of the few nesting areas for the endangered brown pelican. Erosion and subsidence were decreasing the area available for the expanding pelican population, and the island was subjected to frequent overwashing by even small storms.

The USACE-NOD worked with the Louisiana Department of Natural Resources, the Louisiana Department of Wildlife and Fisheries, and other state and Federal natural resources agencies to develop a disposal plan to restore the island. In 1990, the USACE-NOD received authority pursuant to Section 150 of the Water Resource Development Act of 1976 to protect and restore the island using dredged material from maintenance of the waterway, and the state of Louisiana cost-shared the project.

During the FY90 maintenance event (September 3, 1990 - November 15, 1990), a shell retaining dike in conjunction with shore dikes were constructed to approximately +3.8 feet MLG (+3.0 feet National Geodetic Vertical Datum) to enclose an 8-acre shallow water disposal area on the western edge of Queen Bess Island. An estimated 80,000 cubic yards (CY) of material dredged from the navigation channel were pumped into the disposal area to an initial elevation of +3.5 feet MLG (+2.7 feet NGVD). The dredged material effluent was allowed to flow through and onto the adjacent existing marsh, using the marsh to filter the effluent before it reached the surrounding waters. A shell dike also was built to keep the dredged material off the primary brown pelican nesting site on the northern end of the island.

In June, 1991, the State of Louisiana planted vegetation on the dikes and within the Queen Bess Island disposal area to help retain and stabilize the dredged material.

No maintenance took place in this reach of the waterway during FY 1992 through FY 1995.

During the FY 1996 maintenance event (August 3, 1996 - November 22, 1996), dredged material from the Barataria Bay Reach was placed on Queen Bess Island to continue island restoration and in wetlands development disposal areas in the vicinity of Mile 14 and Mile 6.5.

The Coastal Wetland Planning, Protection, and Restoration Act of 1990 authorized additional restoration efforts at Queen Bess Island. A 9-acre shallow water disposal area on the western edge of the island was enclosed by a geotextile reinforced shell core dike covered with riprap. Approximately 52,000 CY of dredged material was discharged into the disposal area to a maximum initial elevation of +4.5 feet MLG (+3.7 feet NGVD).

Dredged material was placed semi-confined into the wetlands development disposal area at Mile 14. Earthen dikes, constructed to an elevation of +6.0 feet MLG (+5.2 feet NGVD), and riprap dike closures were used to contain approximately 120,574 CY of dredged material to a maximum initial elevation of +4.5 feet MLG (+3.7 feet NGVD). Approximately 72,000 CY of dredged material was placed into the confined wetlands development disposal area at the Mile 6.5 site to an initial elevation of +4.5 feet MLG (+3.7 feet NGVD).

Bar Channel Reach (Mile 0 to Mile -3.8)

Prior to FY 1996, all dredged material removed during routine maintenance of the Barataria Bay Waterway bar channel was placed in the ocean dredged material disposal site located on the northeast side of the channel, approximately 1.25 miles southeast of Grand Terre Island and approximately 2 miles east of Grand Isle.

In 1995, the USACE-NOD designated a 327-acre disposal area at Grand Terre Island pursuant to Section 404 of the Clean Water Act for placement of dredged material from maintenance of the bar channel for restoration of and enlargement of the island. The island had been breached in several locations in 1992 during Hurricane Andrew. The USACE-NOD received authority and funding under Section 204 of the Water Resources and Development Act of 1992 to begin island restoration during the FY 1996 maintenance event. The state of Louisiana was the non-Federal sponsor for the project.

During the FY 1996 maintenance event (June 24, 1996 - September 5, 1996), a 130-acre area was enclosed by earthen dikes, and the area was further sub-divided into two cells of 115 acres and 15 acres each. The dike on the Gulf side of the larger cell was constructed to +12 feet MLG (+11.2 feet NGVD) and the dike on the Barataria Bay side was constructed to +11 feet MLG (+10.2 feet NGVD). Dikes around the smaller cell were constructed to +7.0 feet MLG (+6.2 feet NGVD). An estimated 666,258 CY of dredged material was placed into the cells. The estimated initial elevation of the dredged material slurry was +9.0 feet MLG (+8.2 feet NGVD) in the larger cell and +5.0 feet MLG (+4.2 feet NGVD) in the smaller cell.

Figure 4 illustrates the dredging history for the lower Barataria Bay Waterway navigation channel.

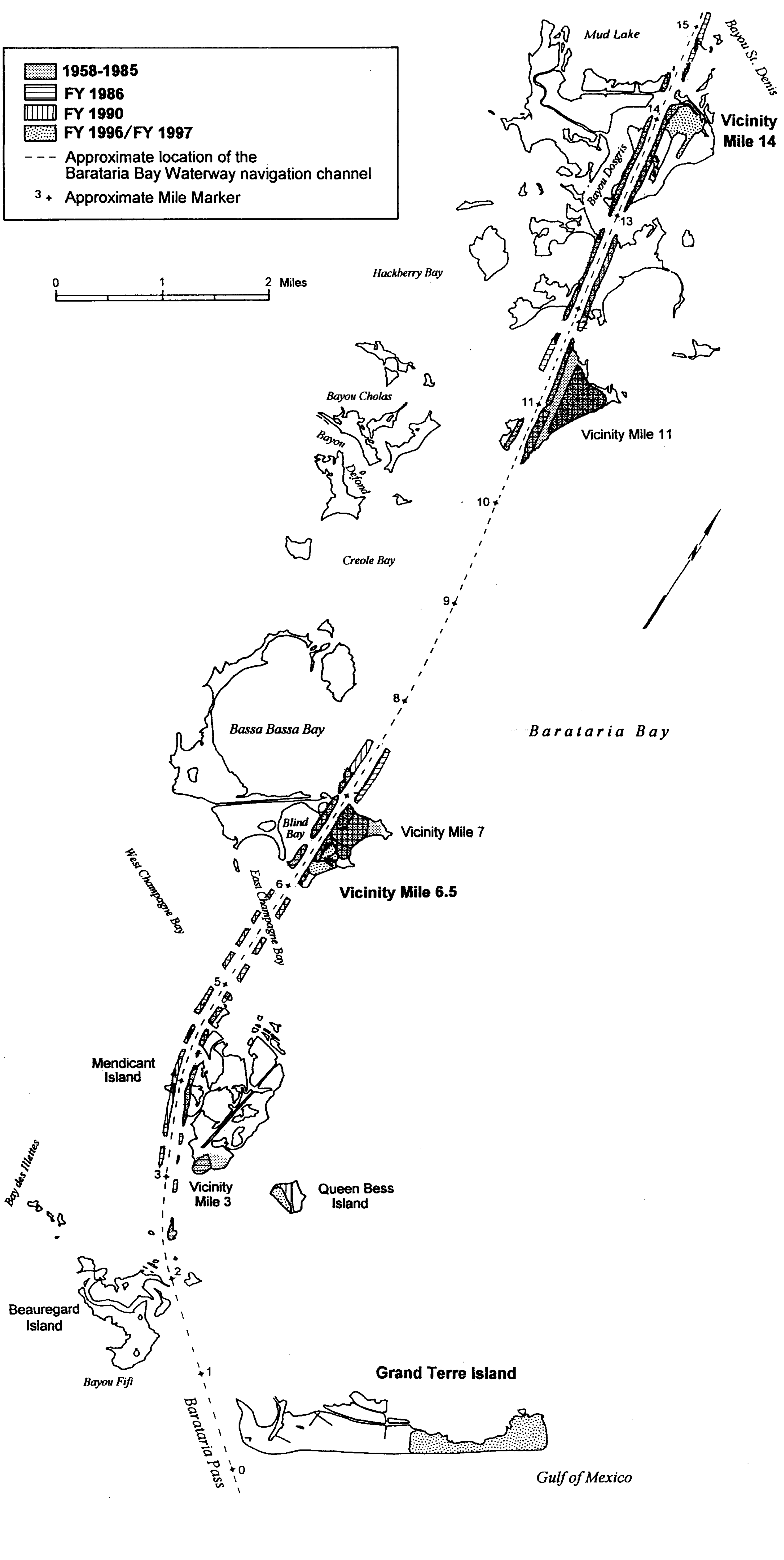


Figure 4. The dredged material disposal history for the lower Barataria Bay Waterway navigation channel in Louisiana including the Barataria Bay Reach and Grand Terre Island BUMP study areas.

BASIC METHODOLOGY

Aerial Photographic Analysis and Habitat Determination

The aerial photographic analysis was the basis for all statistics and analyses. For each monitoring site, a base year was selected against which the assessment of changes are made. The base year for the Barataria Bay Waterway navigation channel was 1985 and the historical 1985 aerial photography was acquired from the U.S. Geological Survey Earth Resources Observation Systems (EROS) Data Center. Aerial photography was acquired by UNO's air photo contractor during October 1997. Color infrared photography was acquired at a scale of 1:24,000. There was a 60 percent forward overlap of the photography which allowed the use of stereo plotting techniques for better accuracy. Color infrared photography was used for mapping and photo-interpretation because it provided a better definition of vegetation types, habitats, and the land/water interface. A copy of the color infrared photography was archived at LSU. A second set of color infrared photography was provided to the USACE-NOD.

The study areas were interpreted and mapped from the base year photography and the color infrared aerial photography using a Bausch and Lomb Zoom Transfer Scope. USGS quadrangle maps were used for the initial ground control to set the interpretations in the state plane coordinate system. The absolute accuracy is ±50' and the relative accuracy is ±10'. The shoreline was interpreted according to the location of the wet/dry beach contact visible on aerial photographs, the outer edge of well-established marsh, or the outer edge of organic beaches. An accurate shoreline was important to area calculations and assessments of trends in erosion, accretion, or effects of dredged material disposal.

The interpretations of habitat type were verified by taking the photography or interpreted map into the field to check specific areas against the actual landscape for positive habitat identification and vegetative community composition. Corrections were made where necessary to the map, and the revised map was then submitted for GIS digitization and final analysis.

Habitat types were important to understanding the result of disposal practices. The Appendix of this report lists the species documented during the field visits, including scientific names, common names, type of vegetation and habitat it prefers. This information verifies the habitat interpretations, helps to further characterize the habitat type, and can give further insight to the type of habitats created by the placement of dredged material. The habitats were broken into simple classes and sub-classes based on the types of vegetation present: water, wetlands (marsh and forested wetlands), and land (beach, bare, dune, upland, shrub/scrub, and forest). These very general characterizations necessarily incorporate many other habitats and transition areas.

The habitat categories used are in quotes below and were delineated using the definitions and criteria defined below.

Water (not included in statistics)

"***Open water***" is water not completely encircled by land, including some intertidal areas.

"***Intertidal***" is an indistinct, shallow area that indicates natural sediment deposits or dredge material deposits below normal high tide that does not support emergent vegetation. Some of these areas do support submerged aquatic vegetation or can become colonized by marsh vegetation.

Wetlands

"***Marsh***" for our purpose, is any unforested, vegetated area normally subject to inundation or tidal action at any time, sufficient to support wetland-dependant, emergent vegetation. *High marsh*, an area above normal high tides but inundated frequently by spring and storm tides or seasonally heavy rainfall, can occur in conjunction with any type of marsh, but is associated most commonly along the coast with saline marshes and is dominated there by *Spartina patens* and *Distichlis spicata.* High marsh associated with fresh or brackish marsh is often represented by grasslands and considered "upland".

"***Forested Wetlands***" is any forested area normally subject to inundation through part of the growing season, or with permanent or near-permanent standing water. This includes swamps, batture communities, bottomland forest, and riparian forest.

Land

"***Beach***" is an unvegetated area adjacent to open water that is subject to direct wave action at some time during the daily tidal cycle or during average storm surges. This can be sand, shell, organic, or a mixture of sediment types. This area is unlikely to permanently support vegetation because of frequent reworking by wave action. Most colonization occurs on the upper beach area less frequently affected by waves.

"***Dune***" is an area above the high water line formed by aeolian deposition of sand into ridges or hummocks.

"***Bare land***" encompasses the areas that are unvegetated and not normally subject to direct wave action. It may be adjacent to open water but in a more sheltered orientation not subject to active wave reworking. Usually it indicates areas of freshly deposited dredged material or recent natural sediment deposition. It may include areas of sparse plant colonizations that may become either upland or marsh.

"***Upland***" is a natural area or dredged material deposition area that is elevated and not subject to tidal action or inundation under normal circumstances so that upland species (non-marsh species) thrive. For this study, it includes barrier island habitats as well as inland habitats, does not include significant shrub or tree coverage, and usually denotes a grassland, meadow, natural levee or elevated area within a marsh, or some types of agricultural or artificially altered land. Natural succession may lead to shrub/scrub in some areas.

"***Shrub/scrub***" is an area dominated by shrubs or small trees under 20 feet tall. This may be within an upland area or within a marsh area. Within a marsh, shrubs usually occupy elevated areas, marking natural levees or areas artificially elevated. Natural succession may eventually lead to forest or forested swamp in some areas.

"***Forest***" is any area dominated by trees, that is not normally subject to inundation during the growing season or is only periodically influenced by flooding. For this study it includes bottomland hardwood areas as well as oak or pine woods.

Field Program

The field program supported the air photo-interpretation and GIS analysis tasks. The field program was comprised of two work efforts. The first field effort, ground-truthing, verified the interpretation of habitat type based on the density and types of vegetation present, and verified surface morphology from the aerial photographic analysis. The initial ground-truthing for the Barataria Bay Reach BUMP study sites was done on November 12, 1998. The second field effort, field monitoring, recorded changes in elevation, vegetative species and cover, geomorphic character, and surface texture at selected beneficial use sites in order to assess the best disposal practices. Field monitoring for Barataria Bay Reach was conducted on November 17, 1998.

The objective of the field monitoring is to clarify the habitat types by identifying dominant vegetative communities, and to determine the best disposal elevation and placement configuration in order to produce the maximum habitat benefits. Monitoring changes in elevation, habitat type and surface morphology at a disposal site will identify the important processes that control change. Understanding the relationships between change and process and between habitat and elevation will facilitate better predictions of the potential habitat benefits associated with different placement elevations and configurations.

Geographic Information System (GIS) Analysis

Once the photography was acquired and interpreted for each site, the digital files were imported into the GIS, ground truthed, and referenced to its true geographic position. The line work was checked for gaps, overshoots and other digitizer errors and edited accordingly. A project schema was created to organize data attributes: area, habitat type, and perimeter. After corrected digital data sets were generated for each USACE-NOD beneficial placement site, two primary forms of GIS analysis were used to quantify and characterize wetland conditions at selected sites. The first form of analysis was the extraction of area measures for each habitat type. Values were generated per type for each year and location. The second form of GIS analysis was the creation of change detection maps and tables for interim periods. These illustrated primary trends in geomorphic change by comparing shoreline configurations and total areas of habitat for the different time periods.

World Wide Web Site

To facilitate the transfer of information to the natural resource trustees and other interested parties, UNO has a World Wide Web site for the dissemination of the beneficial use of dredged material monitoring data. A home page allows the user to click (hyperlink) through data on the beneficial use of dredged material, including scanned aerial photographic mosaics, habitat maps, habitat change maps, habitat data spread sheets, and the results of field investigations. The web site is updated periodically after data has been checked and approved by the USACE-NOD. The site can be found at:

http://beach.geol.uno.edu/bump/

BARATARIA BAY REACH

The Barataria Bay reach BUMP study area is located where the Barataria Bay Waterway passes through the marsh islands on the west side of Barataria Bay, Louisiana, approximately Mile 0 to Mile 15 (Figure 4). It traverses a series of marsh islands, only a few of which were designated for statistical study.

FIELD SURVEY RESULTS

Methodology

The collection of elevation and vegetation profile surveys was conducted in two phases. Phase-I involved assessing the characteristics of various beneficial use disposal areas to determine the most appropriate sites to document the beneficial use of dredged material and habitat development. This was accomplished by discussion with the USACE-NOD, reviewing vertical aerial photography, and reviewing dredging schedules and history. Based on these factors, two areas were selected: the wetland creation site at Vicinity Mile 14 to the north and the wetland creation site at Vicinity Mile 6.5 to the south. On November 12, 1998, one transect line was positioned on each site along the navigation channel (Figure 5). Two stakes were placed to define each transect line, recording secondary features such as towers or navigation markers to assist in relocating the transects should the vegetation become taller or thicker, or should erosion or other action remove the stakes. Permanent 1-inch diameter by 6-foot galvanized stakes were buried approximately 1-foot in the sediment and secured with concrete. Temporary white, ten-foot PVC poles with flagging and neon orange paint were slipped over the galvanized stakes to make profile siting and re-location easier. Initial ground-truthing was also done at this time.

Phase-II involved the actual collection of profile data. On November 17, 1998, profile surveys were conducted along the transects defined by the stakes during phase-I. One transect profile was collected from the wetland creation site along the navigation channel at Vicinity Mile 14, but the site near Vicinity Mile 6.5 proved to be too difficult to obtain reasonable data. Survey datum were collected using a Topcon GTS-300$_{DPG}$ Total-Station, tri-prism, and TDS48 Data Collection System. Horizontal accuracy of the GTS-300 is 0.25 ft $\pm$ 0.0125 ft., with a vertical accuracy of 0.45 ft $\pm$ 0.0125 ft. The maximum horizontal range with tri-prism is 3,525 ft. A Pathfinder Professional MC-5 global positioning system (GPS) device was used to record the horizontal positions of each stake, instrument location, and the position and exact orientation of each transect line. The transect data collected were processed, referenced to the local tide gage, and entered into a graphic software program to produce topographic profiles.

The topographic profiles for the study area were constructed in reference to Micronautics Tide Table - Grand Isle gage #4609, Louisiana (29°16' N / 89° 58' W). The mean diurnal tidal range for the Barataria Bay Waterway study area is published as 1.0 ft.

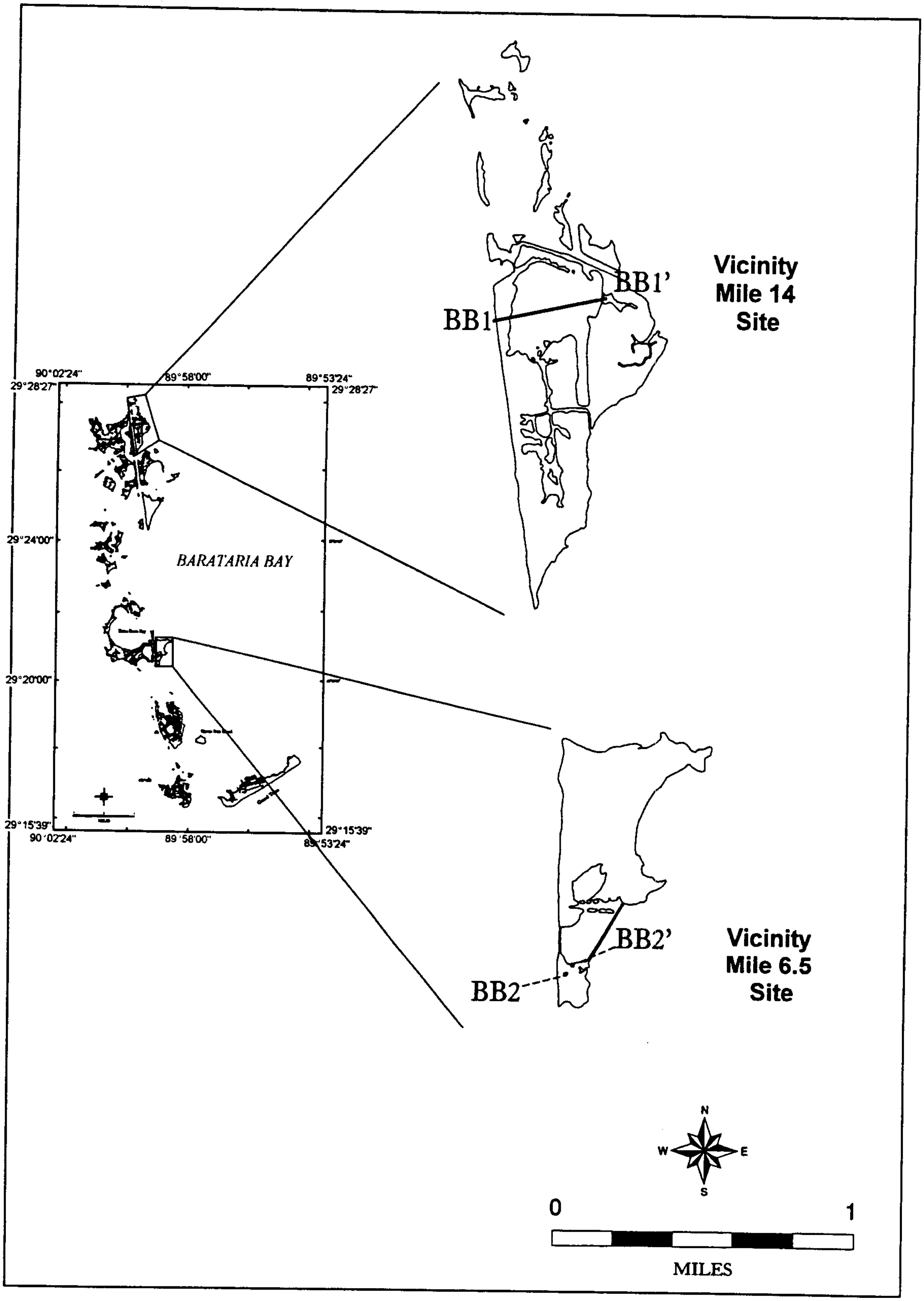


Figure 5. Location of the elevation and vegetation transects at the Barataria Bay Reach - BUMP study area.

Field monitoring for vegetative species composition and habitat verification was done on November 17, 1998. Species composition was determined within a six-foot swath along each profile, and major divisions between vegetative communities were entered as points on the elevation profile. No submerged aquatic species were considered for this report. Plants were identified in the field with only representative specimens taken for confirmation by taxonomic keys and/or verification by the LSU Department of Plant Biology. The better specimens and uncommon specimens were entered into the LSU herbarium collection; all others were archived by the contractor. The percent composition of each species was visually estimated in order to determine the relative abundance and dominance of species for habitat determinations. These percentages were not intended to provide scientific ratios or statistics. The species list included in the Appendix of this report is not complete; it reflects only those species that were readily observed during the profiling period. Some plants can only be identified during a short flowering period which may not have coincided with the ground-truthing or the profile data collection, and therefore can not be included in the list other than by a broad classification.

Profiles

The 1998 profiles were established with two metal poles (stakes) partially buried and anchored with concrete, with one near or on the earthen retaining dike and extending 2-3 feet from the sediment surface. A second stake was placed at a distance to define each profile.

Barataria Bay Reach - Vicinity Mile 14

The Barataria Bay Reach disposal site at Mile 14 is located on the east side of the channel just south of Bayou St. Denis and Mud Lake (Figures 3 & 5). The site is confined by a series of earthen and rock dikes (Figure 6). Material was placed within this site during the FY96 maintenance event (August 3, 1996 - November 22, 1996), and had settled to appear as open water during average water levels (Figure 7). The elevated ridge along the channel has been created by disposal during maintenance dredging since the channel was constructed in 1960, and serves as a dike for the existing disposal area.

The transect BB1 was delineated by 1 stake set in the west earthen dike of the site near the tallest chinaberry trees along the channel, and the second stake was set in the marsh at the base of the dike, in line with a set of platform tanks visible on the horizon to the northeast (Figure 8). The material within the disposal site was extremely fine, soft mud. A pirogue was used to obtain approximate elevations within the open water area.

The profile here had a length of 2105 ft. The maximum relief along the axis is 6.9 ft MLG (6.1 ft NGVD), at the ridge next to the navigation channel, with an average relief of 2.3 ft MLG (1.5 ft NGVD). The profile done in November, 1998 and aerial photography taken in October, 1997 indicate that most of the dredged material placed within the disposal site has settled or been removed by tidal action to an elevation that will not likely be colonized by saltmarsh (Figure 9).

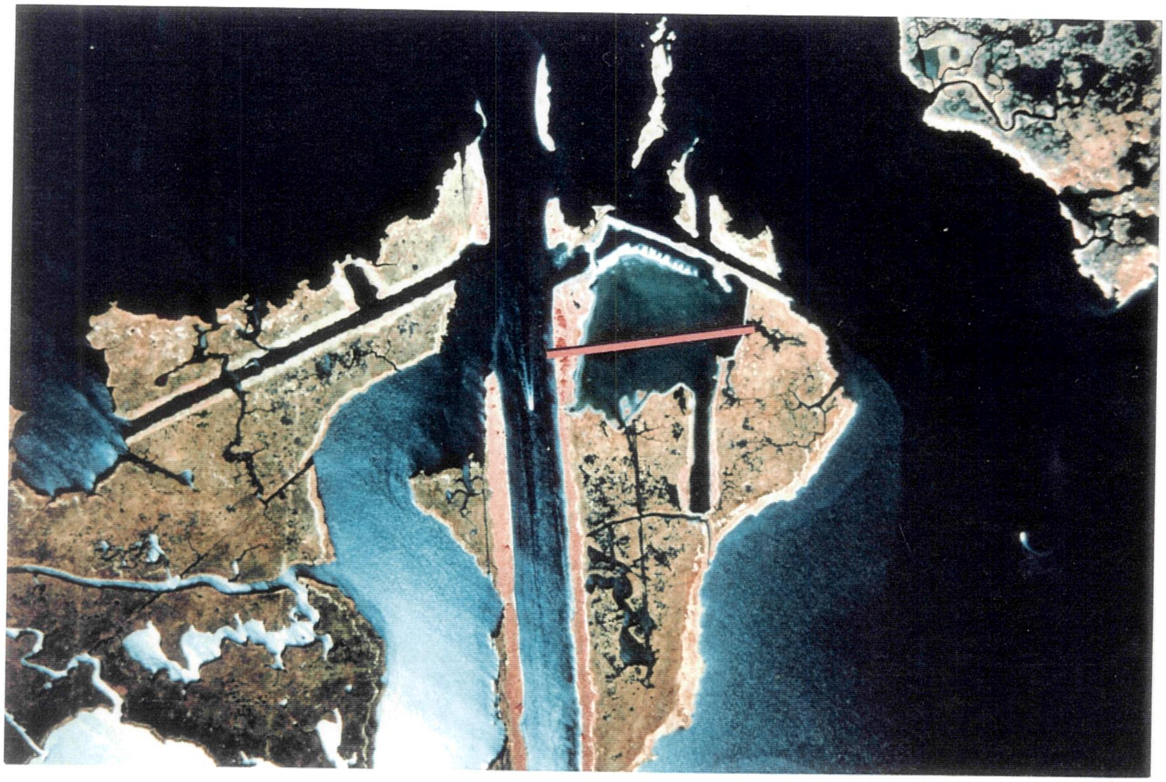


Figure 6. Vertical aerial infrared photograph of the Barataria Bay Waterway - Barataria Bay Reach Vicinity Mile 14 BUMP study site taken on October 5, 1997. The approximate location of the transect (BB1-BB1') is indicated by the orange line.

Figure 7. Photograph of the disposal site at the Barataria Bay Waterway - Barataria Bay Reach Vicinity Mile 14 BUMP study site on November 12, 1998. This view is from the west side looking across the disposal site to the pre-existing saltmarsh.

Figure 8. Photograph taken on November 12, 1998 along the transect (BB1-BB1') and across the disposal site from the stake on the ridge at the Barataria Bay Reach Vicinity Mile 14 BUMP study site.

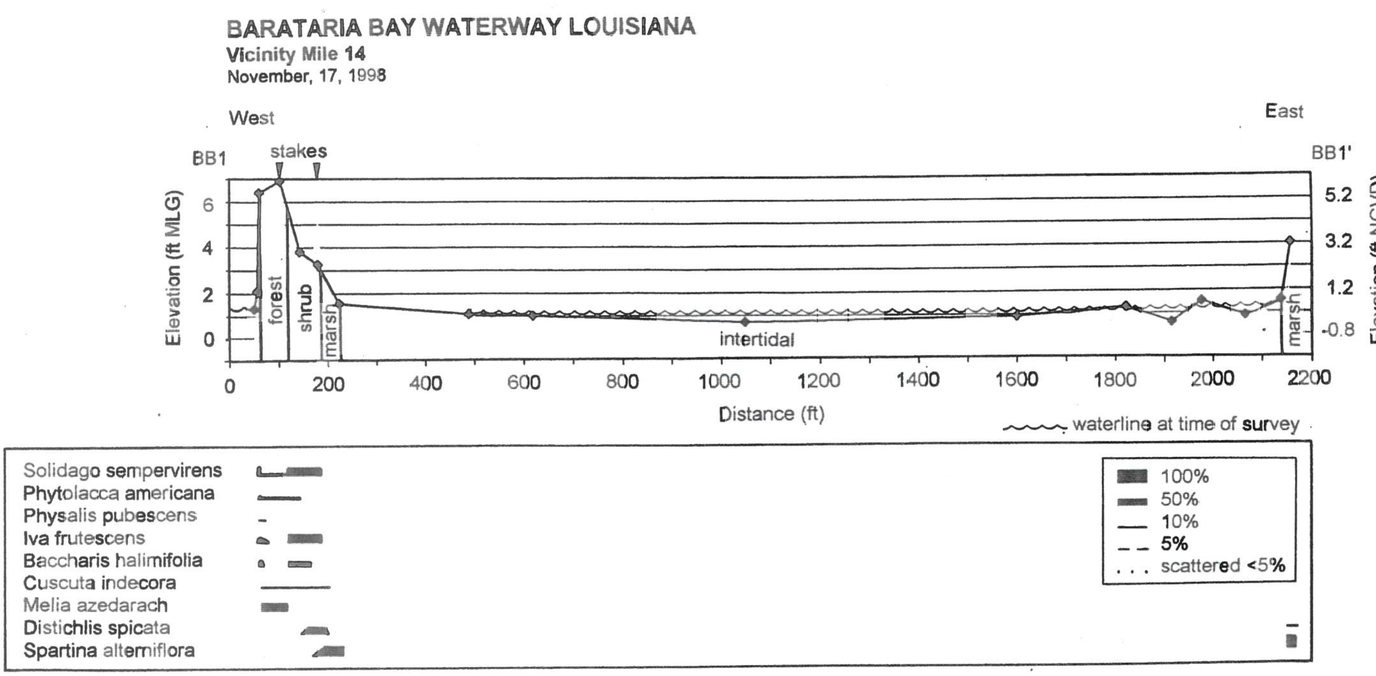


Figure 9. Elevation profile (BB1-BB1') of the Barataria Bay Waterway - Barataria Bay Reach Vicinity Mile 14 BUMP study site with vegetation data illustrated.

Barataria Bay Reach - Vicinity Mile 6.5

The site at Mile 6.5 is located along the east side of the Barataria Bay Waterway near Bassa Bassa Bay, across from Blind Bay, below the upland disposal site at Vicinity Mile 7 and Pelican Point (Figures 3 & 5). The elevated ridge along the channel has been created by disposal during maintenance dredging since the channel was constructed in 1960, and serves as a dike for the existing disposal area. Rock dikes were constructed to close the open areas between existing saltmarsh and the ridge along the channel. Dredged material was placed within this confined area during the FY96 maintenance event. However, the rock dike along the southeast side has subsided in at least two places allowing tidal flow and wave action to remove much of the material placed therein (Figure 10).

The stakes were placed on the marsh island at the south end of the site. The transect BB2 was delineated by one stake set within a shrub thicket at the base of the ridge along the channel on the southwest side of the site (Figure 11), the second was set along the southern edge of the disposal site and was aligned with a pipeline marker across the disposal site to the north (Figure 12). The material within the disposal site was extremely fine, soft mud. Wind and wave action prevented the use of a pirogue within the disposal site and the substrate was too soft to traverse. Therefore, no elevation profile was obtained at this site.

The island is typically characterized as a low relief saltmarsh with shrub/scrub habitats along the channel ridge. No new marsh colonization was observed at the time of the transect, but the intertidal mudflats on the north side of the disposal site are of adequate elevation and are expected to colonize.

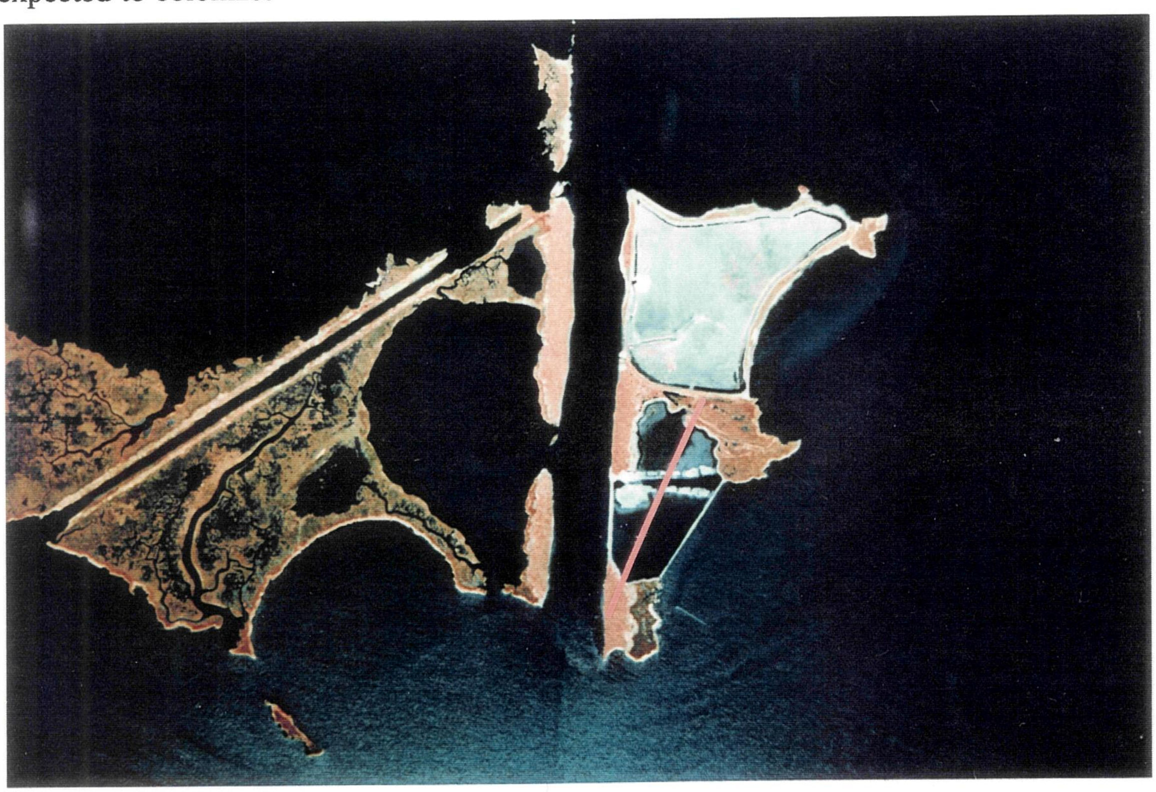


Figure 10. Vertical aerial infrared photograph of the Barataria Bay Waterway - Barataria Bay Reach Vicinity Mile 6.5 BUMP study site taken October 5, 1997. The approximate location of the transect (BB2-BB2') is indicated by the orange line.

Figure 11. Photograph of the Barataria Bay Waterway - Barataria Bay Reach Vicinity Mile 6.5 BUMP study site taken on November 12, 1998, looking along the transect (BB2-BB2') into the shrub thicket where the first stake was placed.

Figure 12. Photograph of the Barataria Bay Waterway - Barataria Bay Reach Vicinity Mile 6.5 BUMP study site taken on November 12, 1998, looking along the transect (BB2-BB2') at the placement of the second stake.

Vegetative Character of the Barataria Bay Reach

General Description

Beneficial use at Vicinity Mile 14 and Vicinity Mile 6.5 consisted of placing dredged material adjacent to deteriorating marsh within a protective retaining dike that was partially earthen and partially rock. Wave and tidal action eroded the earthen dikes on the channel side and rearranged the rock dikes in some places to increase tidal action to the enclosed area. The material deposited in the Barataria Bay Mile 14 and Mile 6.5 sites appears to have settled or been removed by the constant tidal action and had not induced any additional colonization at the time of the elevation transect. The most recent disposal at these sites was conducted during FY96 (August 3, 1996 - November 22, 1996).

Vegetative community types

The overall marsh type for this area is classified as salt marsh typified by Oyster grass (*Spartina alterniflora*) and salt grass (*Distichlis spicata*). The older ridges around the Barataria Bay sites provided an upland habitat for vegetative growth and supported a dense shrub/scrub community consisting mainly of marsh elder (*Iva frutescens*) and golden rod (*Solidago sempervirens*) or stands of forest characterized by the china-berry tree (*Melia azedarach*) or Chinese tallow tree (*Sapium sebeferum*).

GIS ANALYSIS RESULTS FOR THE BARATARIA BAY REACH

Shoreline Changes of the lower Barataria Bay Waterway: 1985-1997

Figure 13 graphs the data from Table 1 to show the spatial history of the Barataria Bay reach BUMP study area (BBR) between 1985 and 1997. The data shows that erosion dominates the processes of the study area. The statistics are only for the areas delineated as BUMP study areas (Figures 3 & 5).

The Barataria Bay Reach BUMP study area was measured at 1819.5 acres in December 1985, and 1284.7 acres in October 1997. This is a cumulative area decrease of -534.8 acres or a decrease in area of 29.4 percent for the 11.83 year period at an overall rate of change of -45.2 acres per year. There was an overall loss of -456.8 acres of natural habitats and a loss of -95.6 acres of other man-made habitats, offset by the creation of +17.6 acres due to the beneficial use of dredged materials. Without the contribution of new habitats due to the beneficial placement of dredged material, the total coastal land loss in the study area would have exceeded -552.4 acres at a rate of -46.7 acres per year, which is equivalent to a 2.6 percent loss of the area per year.

Land loss within the study areas was primarily associated with edge erosion of marsh islands, predominantly along those shorelines directly exposed to Barataria Bay. Most of the increase in specific habitats was due to vegetative succession or changes in habitat classification rather than an actual progradation or new land created. The only area of habitat creation identified due to BUMP was 8.8 acres of marsh and 8.8 acres of bare land adjacent to Queen Bess Island.

Figure 14 shows the shoreline change history of the Barataria Bay Waterway BUMP study area between December 1985 and October 1997. Only the areas outlined in yellow were used for the statistics.

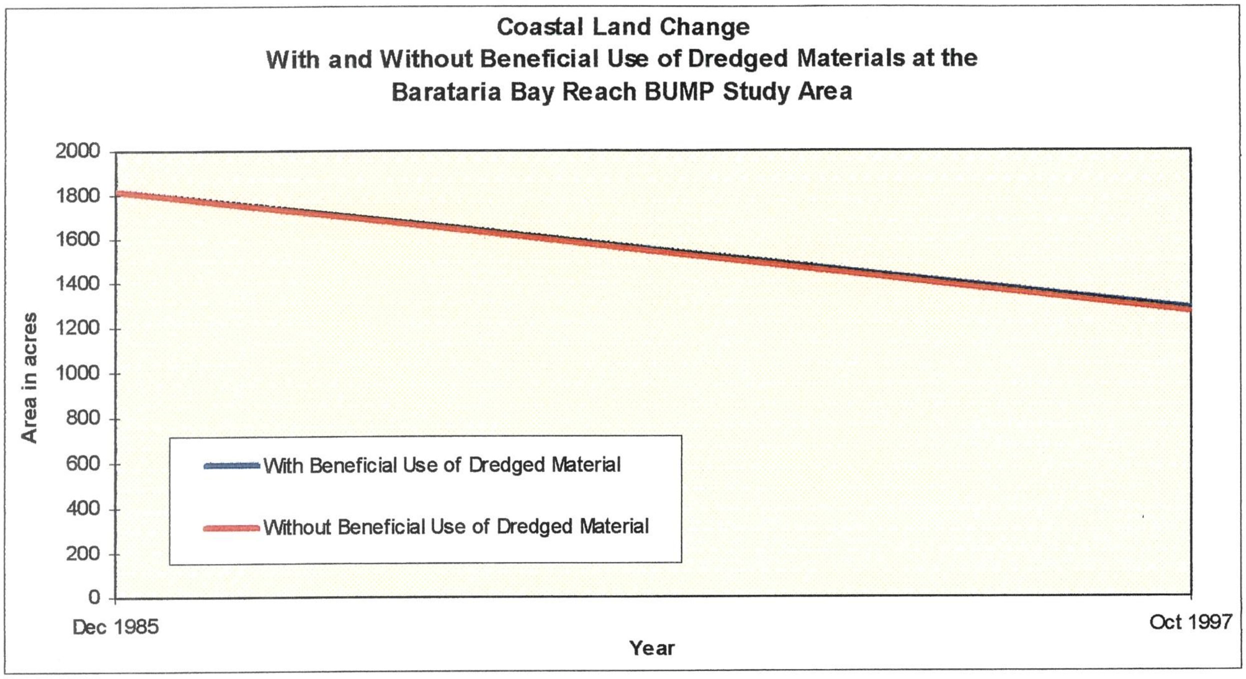


Figure 13. Graph of the area of the Barataria Bay Reach BUMP study area over time, with and without the beneficial placement of dredged material

TABLE 1
Barataria Bay Reach Area: 1985-1997

Barataria Bay Reach	Dec 1985	Oct 1997
Natural Areas	1466.8	1010.0
BUMP Man-made Areas	0.0	17.6
Other Man-made Areas	352.7	257.1
Total	1819.5	1284.7

Note: Statistics are for BUMP delineated areas only.

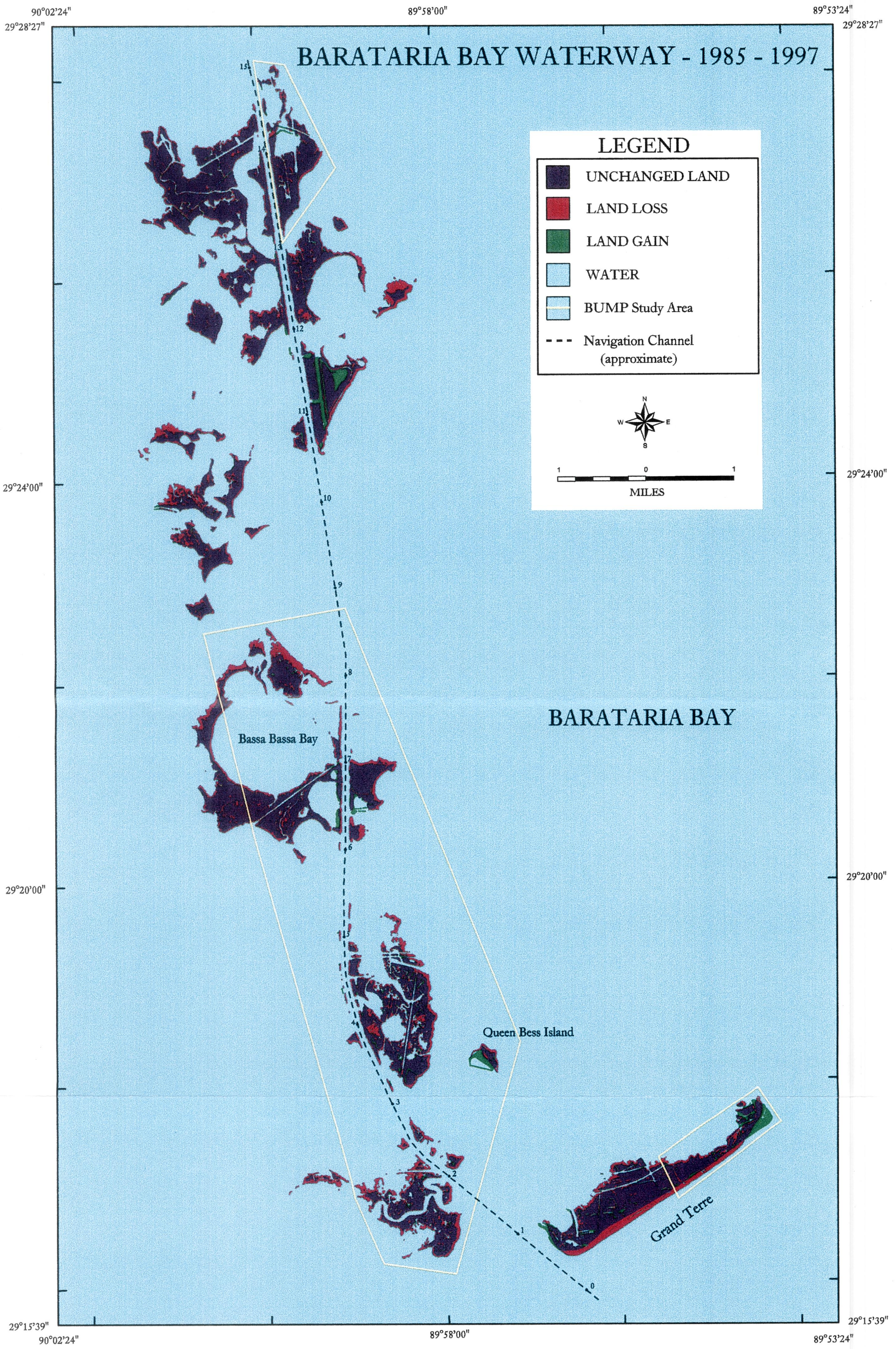


Figure 14. Shoreline changes of the Barataria Bay Waterway BUMP study areas between December 1985 and October 1997.

Habitat Inventory of the Barataria Bay Reach BUMP study area

The aerial photographic interpretation combined with field surveys identified six major habitat types in this Barataria Bay Waterway study area. Five were identified in the Barataria Bay Reach BUMP (BB) study area. These habitats are further classified as natural and man-made. The natural class identifies natural deltaic and coastal processes as responsible for habitat creation. The BUMP man-made (BUMP-made) class identifies the habitats created by the beneficial use of dredged material. The non-BUMP man-made (other-made) class identifies areas created as a result of activities other than BUMP, such as areas associated with the oil industry access and pipeline canals, or general channel maintenance. Disposal material reworked by natural processes are most often classified as "natural" unless specifically identified by the USACE-NOD as "BUMP-created." On the habitat maps presented in this report, an intertidal class is included to indicate nearshore topography. Because the seaward extent of these areas is not clearly defined, the area of this class is not calculated or included in the inventory.

Barataria Bay Reach BUMP study area- 1985

Table 2 lists the areas of the five habitat types found in the BB study area in December 1985. The location and arrangement of these habitats are presented in figure 15. The statistics of Grand Terre will be discussed separately later. The total area of the BB study area in December 1985 was 1819.5 acres. Of this total, 1466.8 acres or 80.6 percent were natural and 352.7 acres or 19.4 percent were man-made. There was no acreage classified as BUMP-made in 1985. In order of decreasing size and importance, the largest habitat found was natural marsh (1410.9 acres) followed by other-made shrub/scrub (123.2 acres), other-made bare land (108.7 acres), other-made marsh (62.2 acres), other-made upland (55.0 acres), natural upland (25.1 acres), natural beach (18.8 acres), natural bare land (10.9 acres), other-made beach (3.6 acres), and natural shrub/scrub (1.1 acres).

In terms of habitat totals, marsh (1473.1 acres or 81%) dominated the Barataria Bay Reach BUMP study area landscape.

TABLE 2
December 6, 1985 Habitat Inventory of the Barataria Bay Reach BUMP Study Areas

HABITAT	TOTAL	NATURAL	OTHER-MADE	BUMP-MADE
Marsh	1473.1	1410.9	62.2	0.0
Upland	80.1	25.1	55.0	0.0
Shrub/Scrub	124.3	1.1	123.2	0.0
Bare Land	119.6	10.9	108.7	0.0
Beach	22.4	18.8	3.6	0.0
Habitat Total	1819.5	1466.8	352.7	0.0

Note: Statistics are for BUMP delineated areas only.

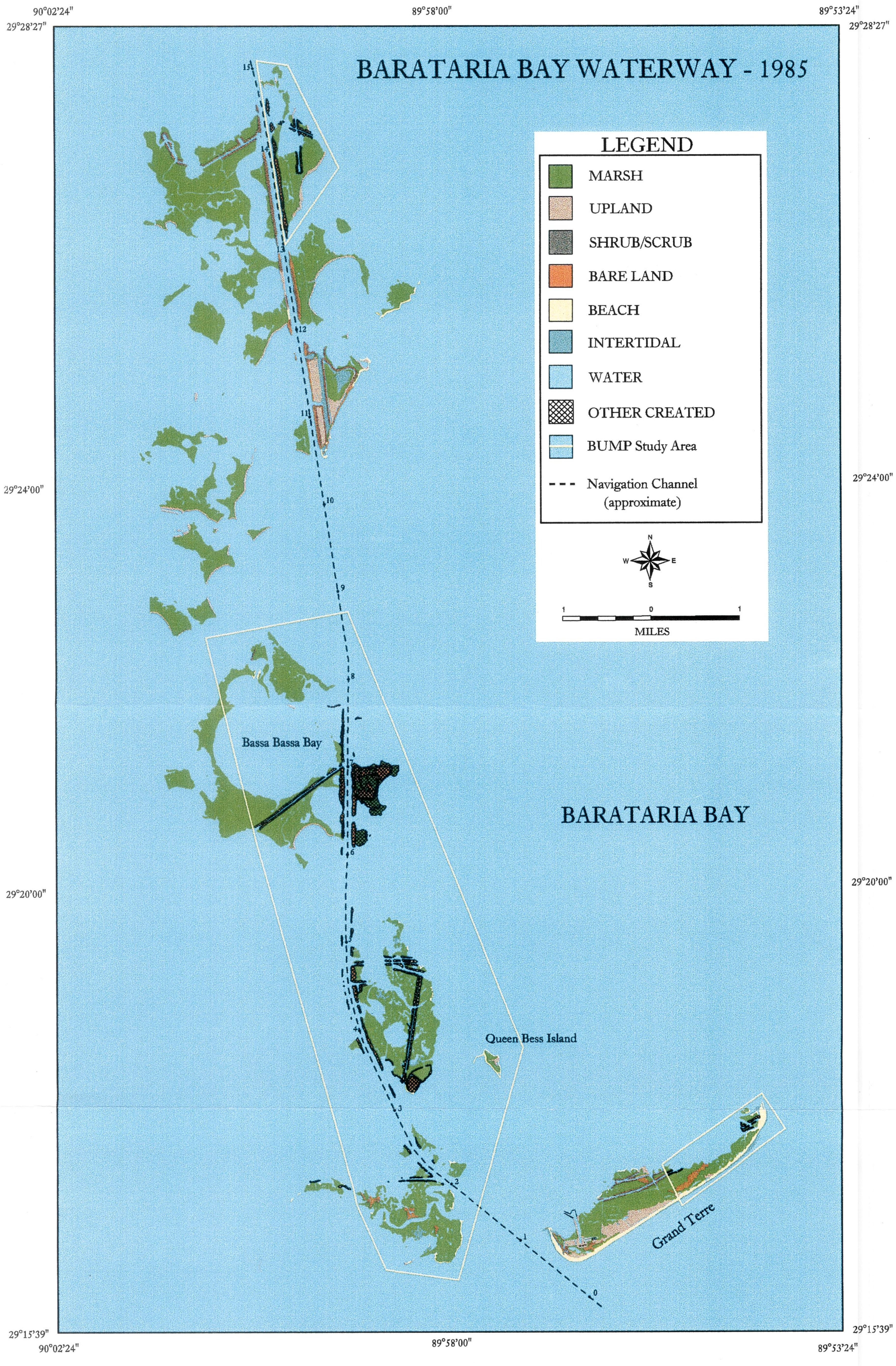


Figure 15. Habitat inventory map of the Barataria Bay Waterway BUMP study area in December 1985. Only the area delineated in yellow was used for statistical analysis. Grand Terre Island will be discusses in detail later.

Barataria Bay Reach BUMP study area- 1997

Table 3 lists the areas of the six habitat types found in the Barataria Bay Reach BUMP (BB) study area in October 1997. The location and arrangement of these habitats are presented in Figure 16. The total area of the BB study area in October 1997 was 1284.7 acres. Of this total, 1010.0 acres were natural and 274.7 acres were man-made including 257.1 acres other-made and 17.6 acres of BUMP-made, or 78.6 percent were natural, 20.0 percent was other-made, and 1.4 percent were BUMP-made. In order of decreasing size and importance, the largest habitat found was natural marsh (969.8 acres) followed by other-made shrub/scrub (98.7 acres), other-made upland (66.8 acres), other-made bare land (66.3 acres), natural upland (34.2 acres), other-made marsh (22.1 acres), BUMP-made marsh (8.8 acres) and BUMP-made bare land (8.8 acres), natural beach(6.0 acres), other-made forest (2.7 acres), and other-made beach (0.5 acres).

In terms of habitat totals, marsh (1000.7 acres or 77.9%) dominated the Barataria Bay Reach BUMP study area landscape.

TABLE 3
October 5, 1997 Habitat Inventory of the Barataria Bay Reach BUMP Study Areas

HABITAT	TOTAL	NATURAL	OTHER-MADE	BUMP-MADE
Marsh	1000.7	969.8	22.1	8.8
Upland	101.0	34.2	66.8	0.0
Shrub/Scrub	98.7	0.0	98.7	0.0
Bare Land	75.1	0.0	66.3	8.8
Beach	6.5	6.0	0.5	0.0
Forest	2.7	0.0	2.7	0.0
Habitat Total	1284.7	1010.0	257.1	17.6

Note: Statistics are for BUMP delineated areas only.

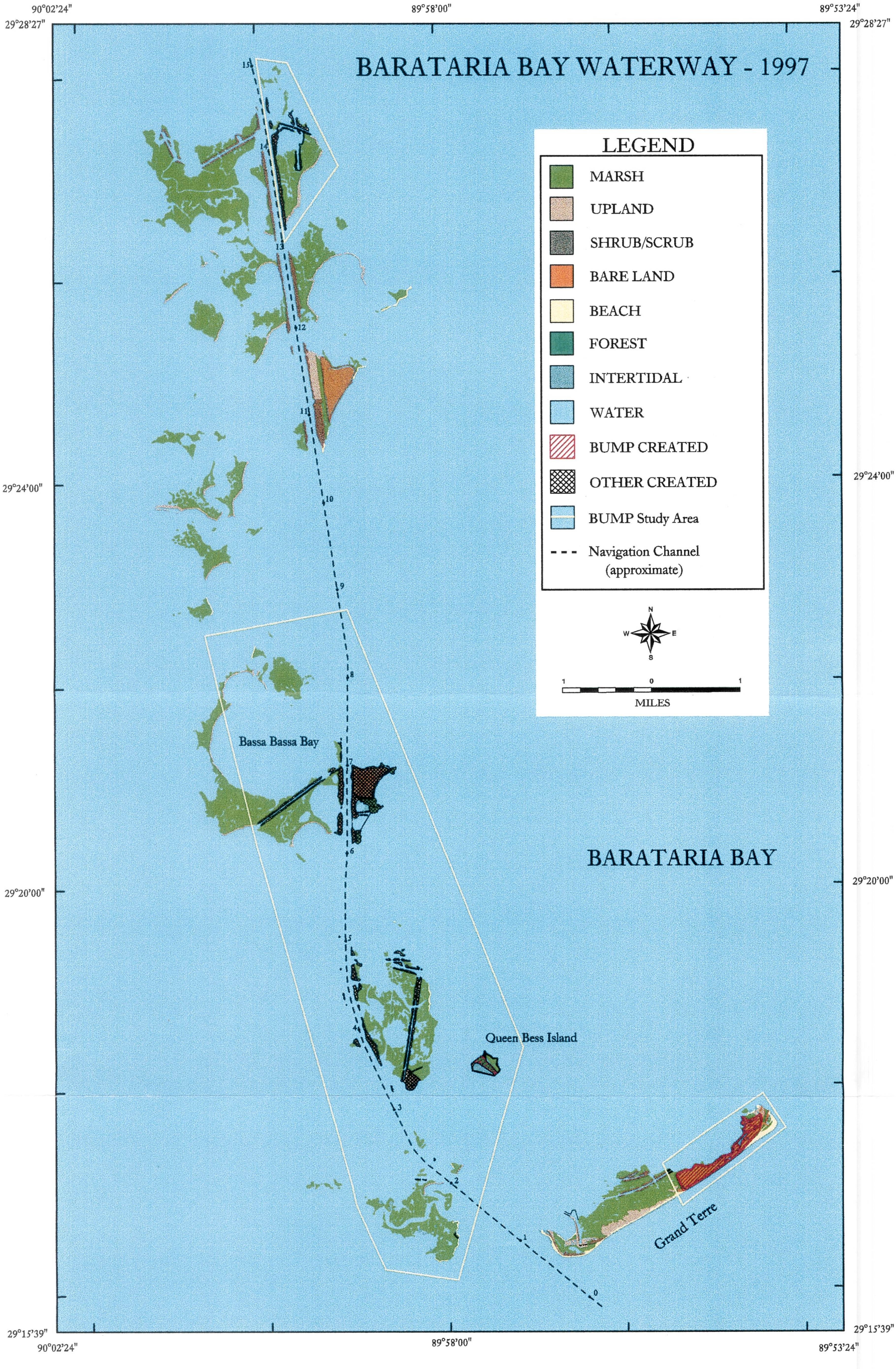


Figure 16. Habitat inventory map of the Barataria Bay Waterway BUMP study areas in October 1997. Only the area delineated in yellow was used for statistical analysis. Grand Terre Island will be discussed in detail later.

Habitat Changes of the Barataria Bay Reach BUMP study site

Erosion due to natural processes dominates the processes of this area. Figure 17 shows the relative changes in total area of the natural, other-made and BUMP habitats. Figure 18 shows the cumulative creation of new habitat, including natural, other-made and BUMP-made, in the Barataria Bay Reach BUMP (BB) study area between December 1985 and October 1997. Table 4 lists the major habitat changes during the period between December 1985 and October 1997. The total area of the BB study area decreased by -534.8 acres between 1985 and 1997 which represents a -29.4 percent decrease in area at a rate of -45.2 acres/yr for this 11.83 year period. There was an overall -456.8 acres of decrease of the natural habitats and a -95.6 acre decrease of other-made habitats, offset by a +17.6 acres of increase in BUMP-made habitats.

The major habitat change by natural processes was the decrease of natural saltmarsh (-441.1 acres) at a rate of -37.3 acres/yr. There was also a decrease of natural beach (-12.8 acres), bare land (-10.9 acres) and shrub/scrub (-1.1 acres), and an increase in natural upland (+9.1 acres) for an overall loss of -456.8 acres of natural habitat at a rate of -38.6 acres/yr.

The major habitat change by man-made processes occurred in the other-made habitats with a decrease of -42.4 acres of bare land and a decrease of -40.1 acres of marsh. There was also a loss of -24.5 acres of shrub/scrub, and -3.1 acres of beach; with a gain of +11.8 acres of upland and +2.7 acres of forest. An additional +8.8 acres of BUMP-made marsh and +8.8 acres of BUMP-made bare land was created at Queen Bess Island, for a total loss of -78.0 acres of man-made habitats at a rate of -6.6 acres/yr.

Figure 19 shows a time series of habitat changes along the BB study areas. Figure 19A graphs the natural habitat changes over time. Natural marsh degradation and erosion dominates the processes affecting the natural habitat class. Figure 19B graphs man-made habitats. In terms of the beneficial use process, the only areas of new habitat creation was 17.6 acres of BUMP-made marsh and bare land at Queen Bess Island as indicated by the most recent inventory in November 1997.

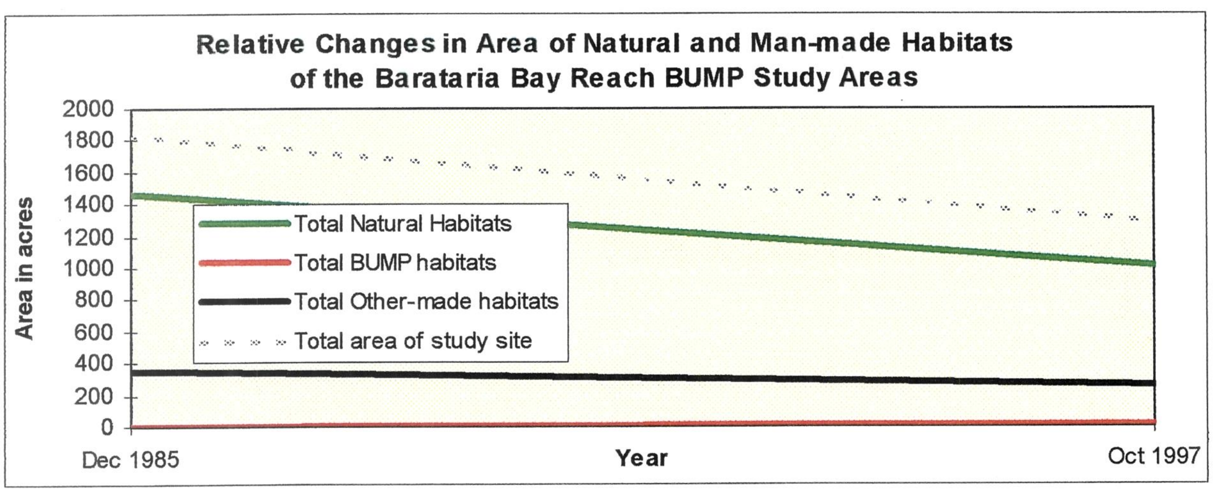


Figure 17. Graph showing the relative changes in total area of the natural, other-made and BUMP habitats at the Barataria Bay reach BUMP study area.

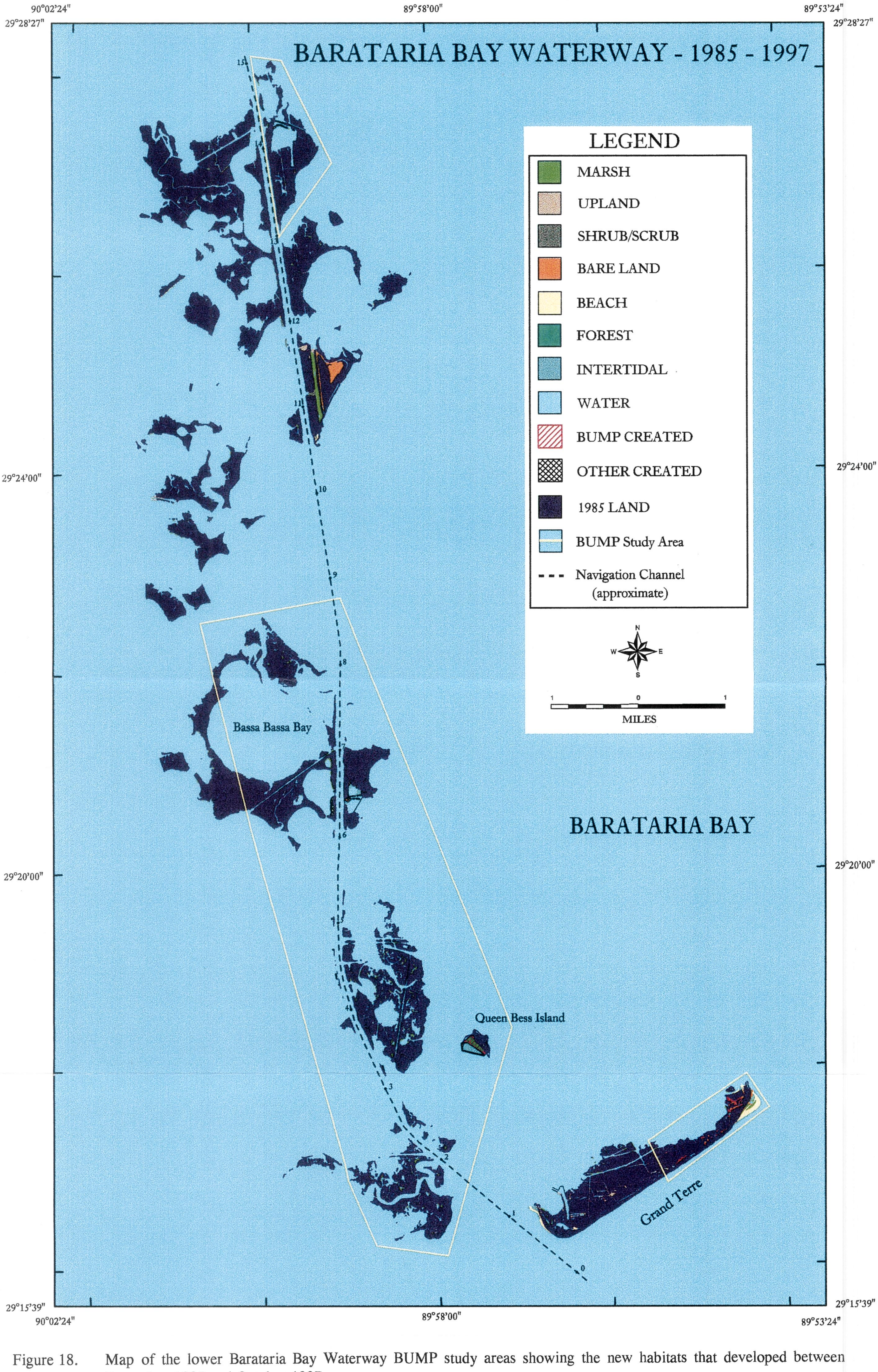
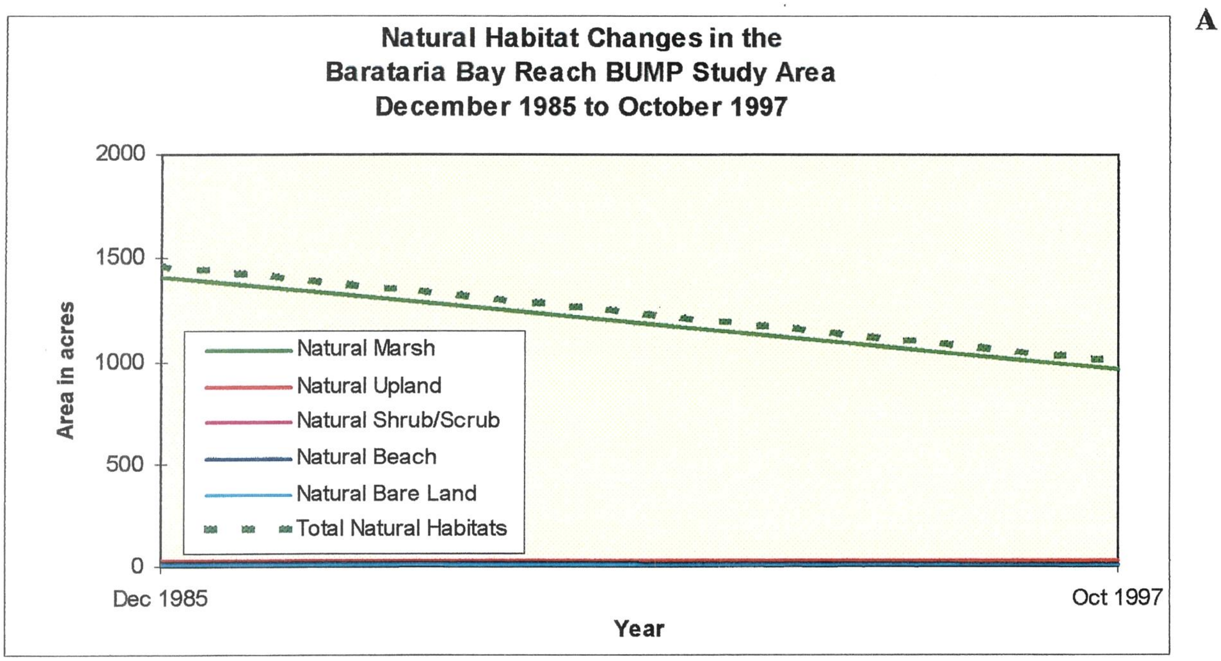


Figure 18. Map of the lower Barataria Bay Waterway BUMP study areas showing the new habitats that developed between December 1985 and October 1997.

TABLE 4
Barataria Bay Reach BUMP Study Site
Cumulative Change in Total Acres of Each Habitat
Between December 1985 and November 1997

HABITAT	1985	1997	Dec 1985-Oct 1997 (acres)	Rate of Change (acres/yr)
Natural Marsh	1410.9	969.8	-441.1	-37.3
Natural Upland	25.1	34.2	+9.1	+0.8
Natural Shrub/Scrub	1.1	0.0	-1.1	-0.1
Natural Bare Land	10.9	0.0	-10.9	-0.9
Natural Beach	18.8	6.0	-12.8	-1.1
Total Natural Habitats	1466.8	1010.0	-456.8	-38.6
Other-made Marsh	62.2	22.1	-40.1	-3.4
Other-made Upland	55.0	66.8	+11.8	+1.0
Other-made Shrub/Scrub	123.2	98.7	-24.5	-2.1
Other-made Bare Land	108.7	66.3	-42.4	-3.6
Other-made Beach	3.6	0.5	-3.1	-0.3
Other-made Forest	0.0	2.7	+2.7	+0.2
Total Other-made	352.7	257.1	-95.6	-8.1
BUMP-made Marsh	0.0	8.8	+8.8	+0.7
BUMP-made Upland	0.0	0.0	--	--
BUMP-made Shrub/Scrub	0.0	0.0	--	--
BUMP-made Bare Land	0.0	8.8	+8.8	+0.7
BUMP-made Beach	0.0	0.0	--	--
BUMP-made Forest	0.0	0.0	--	--
Total BUMP-made Habitats	0.0	17.6	+17.6	+1.5
HABITAT TOTAL	1819.5	1284.7	-534.8	-45.2

Note: Statistics are for BUMP delineated areas only.



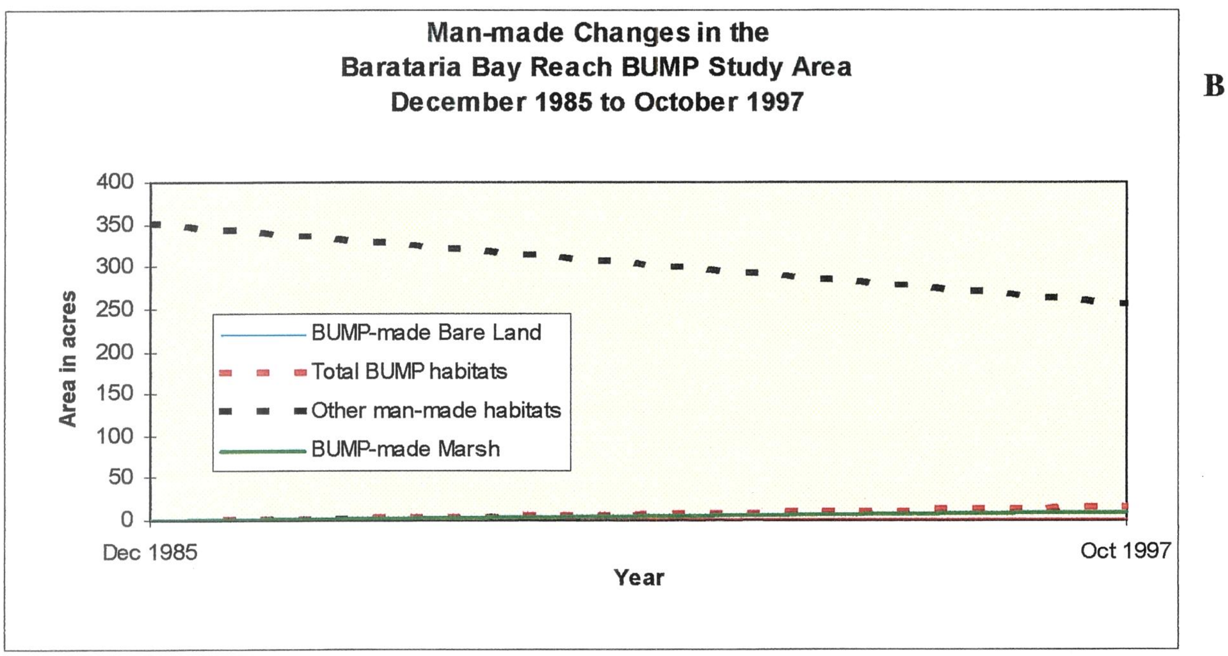


Figure 19. Time series showing the changes in total area of each habitat in the Barataria Bay Reach BUMP study areas between December 1985 and October 1997. A) natural habitat changes. B) Man-made habitat changes.

GRAND TERRE ISLAND

Grand Terre Island has been divided by erosion and storms into several smaller islands. These islands form part of a land barrier for Barataria Bay and the associated estuary against coastal processes originating from the Gulf of Mexico. The Grand Terre Island BUMP study area is located on the east end of the western-most Grand Terre Island, east-northeast of Grand Isle and Barataria Pass (Figure 3).

FIELD SURVEY RESULTS

Methodology

The collection of elevation and vegetation profile surveys was conducted in two phases. Phase-I involved assessing the characteristics of various beneficial use disposal areas to determine the most applicable sites to document the beneficial use of dredged materials and habitat development. This was accomplished by discussion with the USACE-NOD, reviewing vertical aerial photography, and reviewing dredging schedules and history. Based on these factors, the barrier island restoration site at Grand Terre Island was selected. On November 12, 1998, three transects were positioned across Grand Terre Island (Figure 20). Two stakes were placed to define each transect line, recording the GPS location and secondary features such as platforms to assist in relocating the transects should the vegetation become taller or thicker, or should erosion or other action remove the stakes. Permanent 1-inch diameter by 6-foot galvanized stakes were buried approximately 1-foot in the sediment and secured with concrete. Temporary white, ten-foot PVC poles with flagging and neon orange paint were slipped over the galvanized stakes to make profile siting and re-location easier. Initial ground-truthing was also done at this time.

Phase-II involved the actual collection of profile data. On November 17, 1998, profile surveys were conducted along the transects defined by the stakes during phase-I. Three transect profiles were collected from Grand Terre Island. Survey datum were collected using a Topcon GTS-300_{DPG} Total-Station, tri-prism, and TDS48 Data Collection System. Horizontal accuracy of the GTS-300 is 0.25 ft $\pm$ 0.0125 ft., with a vertical accuracy of 0.45 ft $\pm$ 0.0125 ft. The maximum horizontal range with tri-prism is 3,525 ft. A Pathfinder Professional MC-5 global positioning system (GPS) device was used to record the horizontal positions of each stake, instrument location, and the position and exact orientation of each transect line. The transect data collected were processed, referenced to the local tide gage, and entered into a graphic software program to produce topographic profiles.

The topographic profiles for the study area were constructed in reference to Micronautics Tide Table - Grand Isle gage #4609, Louisiana (29°16' N / 89° 58' W). The mean diurnal tidal range for the Barataria Bay Waterway study area is published as 1.0 foot.

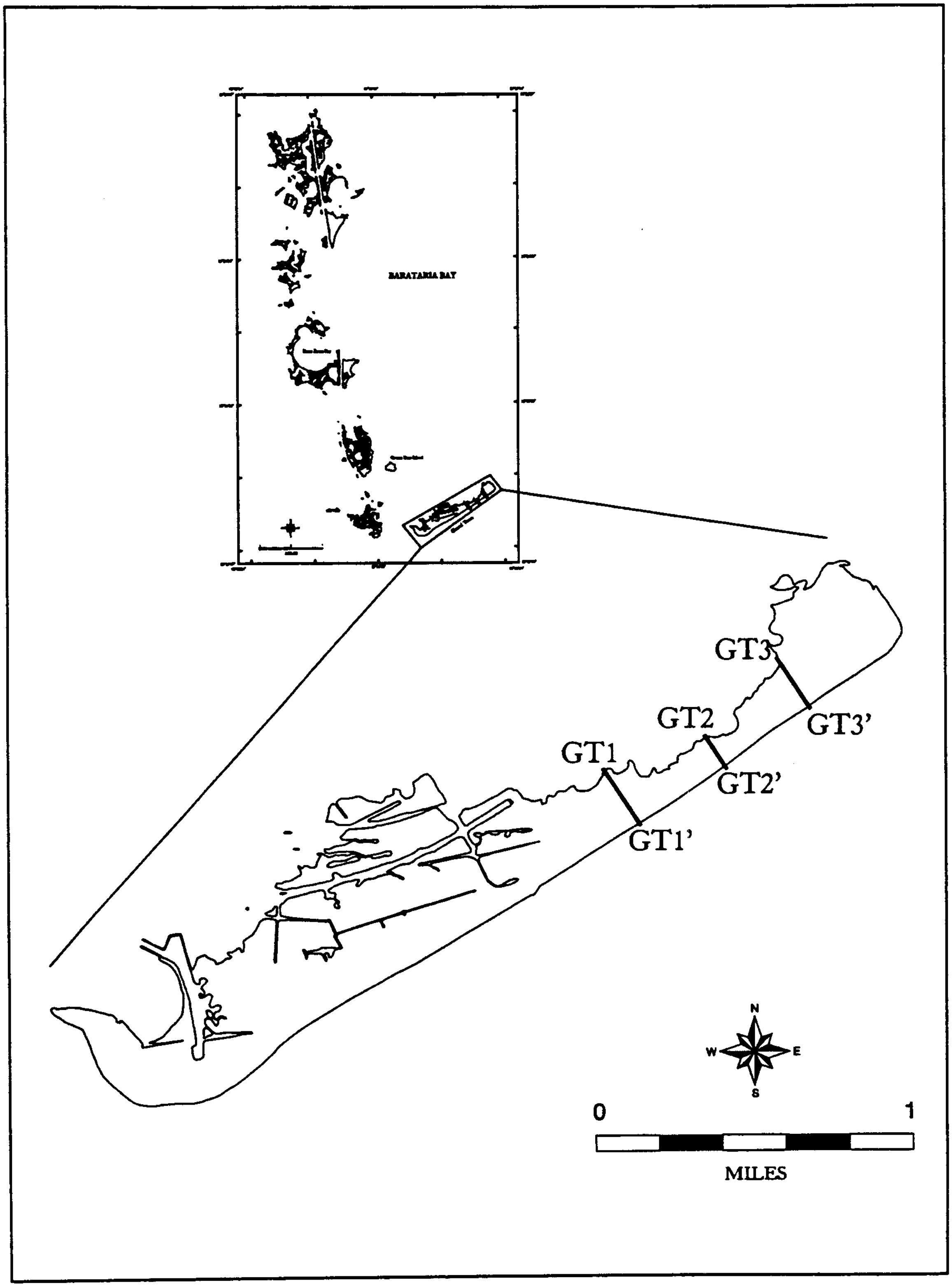


Figure 20. Location of the elevation and vegetation transects at the Grand Terre Island - BUMP study area.

Field monitoring for vegetative species composition and habitat verification was done on November 17, 1998. Species composition was determined within a six-foot swath along each profile, and major divisions between vegetative communities were entered as points on the elevation profile. No submerged aquatic species were considered for this report. Plants were identified in the field with only representative specimens taken for confirmation by taxonomic keys and/or verification by the LSU Department of Plant Biology. The better specimens and uncommon specimens were entered into the LSU herbarium collection; all others were archived by the contractor. The percent composition of each species was visually estimated in order to determine the relative abundance and dominance of species for habitat determinations. These percentages were not intended to provide scientific ratios or statistics. The species list included in the Appendix of this report is not complete; it reflects only those species that were readily observed during the profiling period. Some plants can only be identified during a short flowering period which may not have coincided with the ground-truthing or the profile data collection, and therefore can not be included in the list other than by a broad classification.

Profiles of the Barataria Bar Reach - Grand Terre Island

Grand Terre Island is located on the northeast side of Barataria Pass across from Grand Isle, Louisiana (Figure 3). The BUMP disposal site consists of a series of earthen dikes encircling two cells of 115 acres and 15 acres each on the eastern end of the island (Figure 21). The dike on the Gulf side of the larger cell was constructed to +12 feet MLG (+11.2 feet NGVD) and the dike on the Barataria Bay side was constructed to +11 feet MLG +10.2 feet NGVD). Dikes around the smaller cell were constructed to +7.0 feet MLG (+6.2 feet NGVD). Material was placed within this site in FY96 (June 24, 1996 - September 5, 1996).

The three transects were placed across the larger disposal cell, parallel to each other, roughly equi-distance apart, and perpendicular to the general orientation of the island. Each transect was delineated by 1 stake set in at the inner toe of the northwest earthen dike of the site, and the second stake was set toward the Gulf side, within the barrier flat for two transects or on top of the south earthen dike for the third. The profiles were typically vegetated at the northern end of the transects where salt marsh survived outside of the cell dikes along the bay shore of the island. The interior of the BUMP site was covered with sandy dredged material and was being colonized by quick growing, annual, beach species and by perennial species that survived the fill.

The profiles ranged in length between 517.6 ft and 1054.0 ft. The maximum relief along the profiles was 9.8 ft MLG (9.1 ft NGVD) at the Gulf-side levee on the eastern transect, with an average relief of 3.6 ft MLG (2.8 ft NGVD) (Figures 22, 23 & 24).

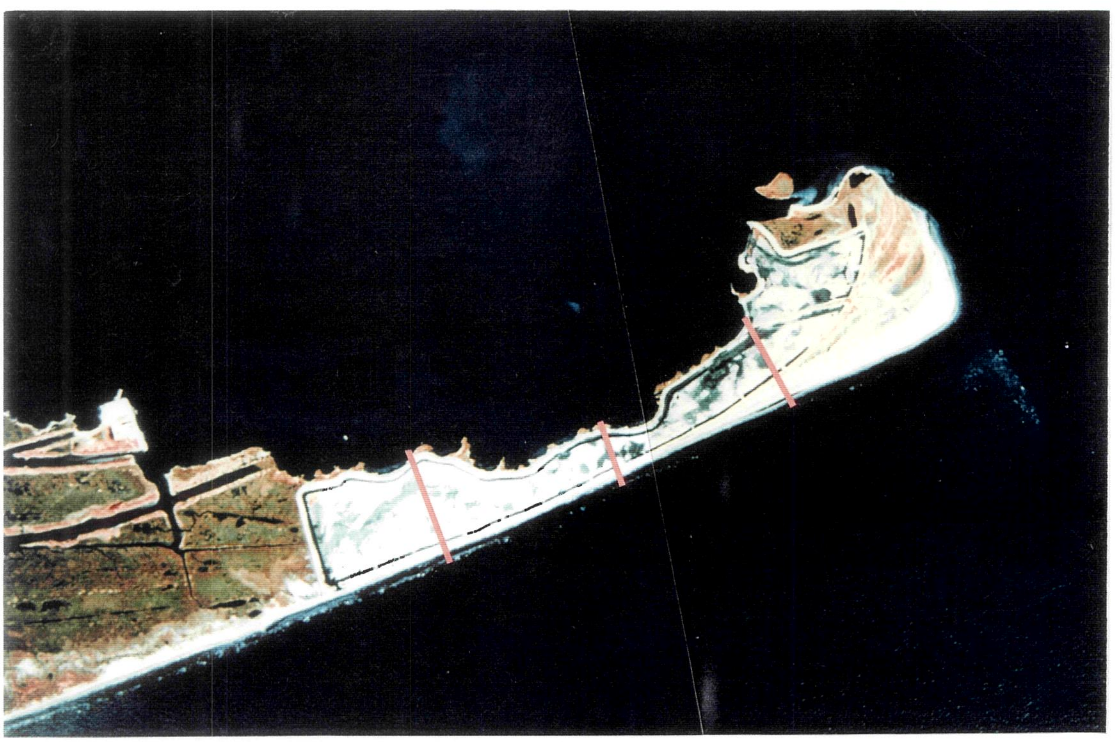


Figure 21. Vertical aerial infrared photograph of the Grand Terre Island BUMP study site taken on October 5, 1997. The approximate locations of the three transects are indicated by orange lines.

Figure 22a. Photograph of the north dike, looking southwest, on the west transect (GT1-GT1') at the Grand Terre Island BUMP study site in November 1998.

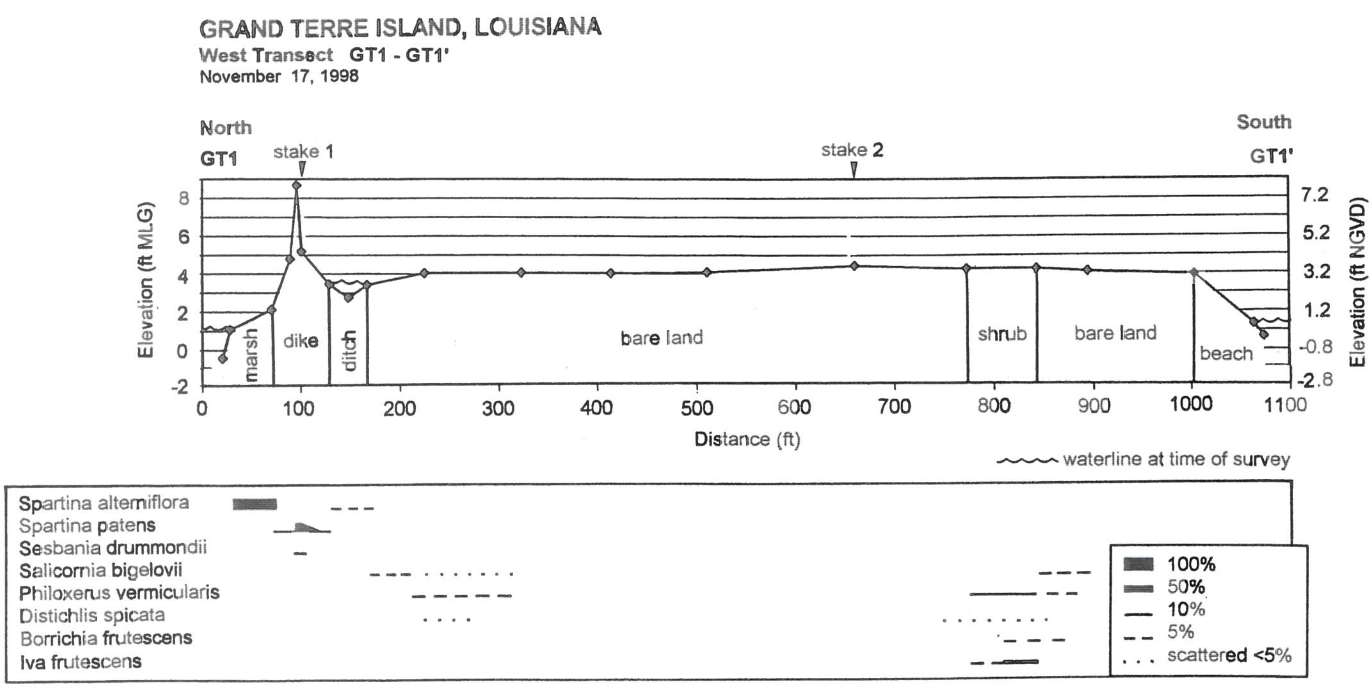


Figure 22b. Elevation profile with vegetation data illustrated for the West transect (GT1-GT1') at the Grand Terre Island BUMP study site .

Figure 23a. Photograph of the borrow ditch and partially vegetated sand flat, looking south from the first stake of the central transect (GT2-GT2') at the Grand Terre Island BUMP study site in November 1998.

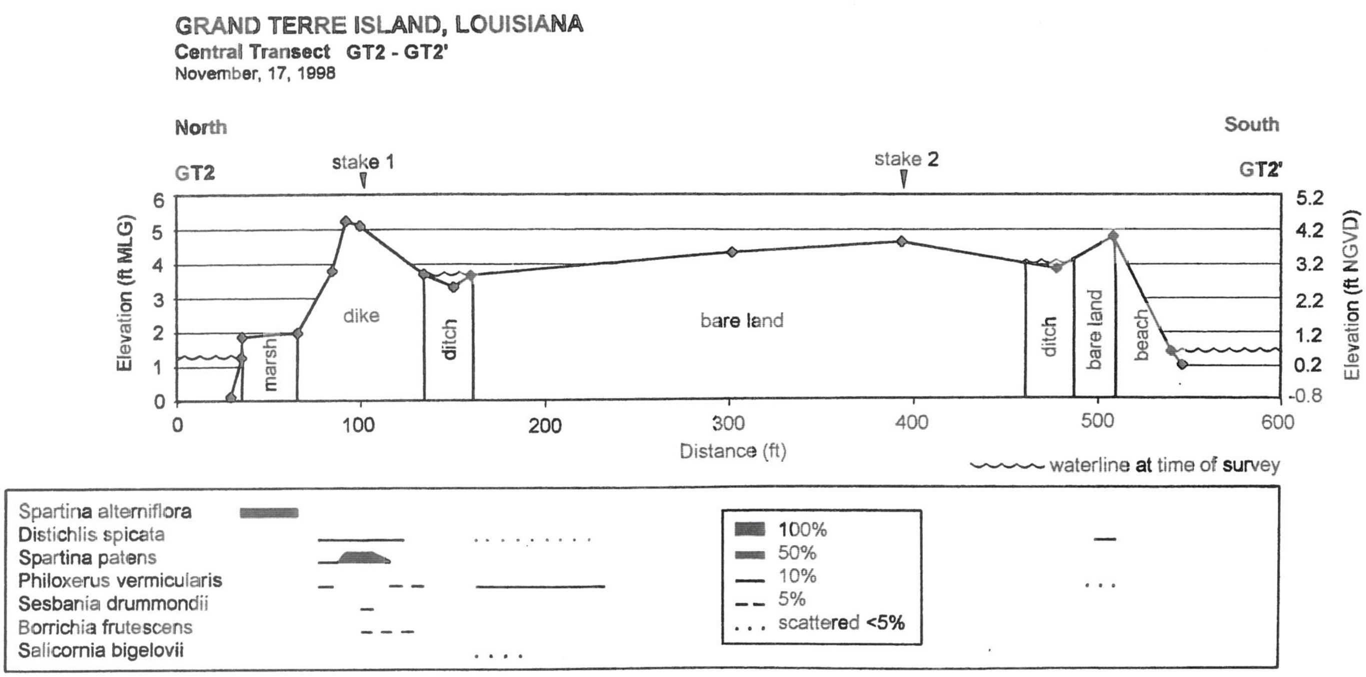


Figure 23b. Elevation profile with vegetation data illustrated for the Central transect (GT2-GT2') at the Grand Terre Island BUMP study site.

Figure 24a. Photograph of the Gulf side of the south dike along the East transect (GT3-GT3') at the Grand Terre Island BUMP study site in November 1998.

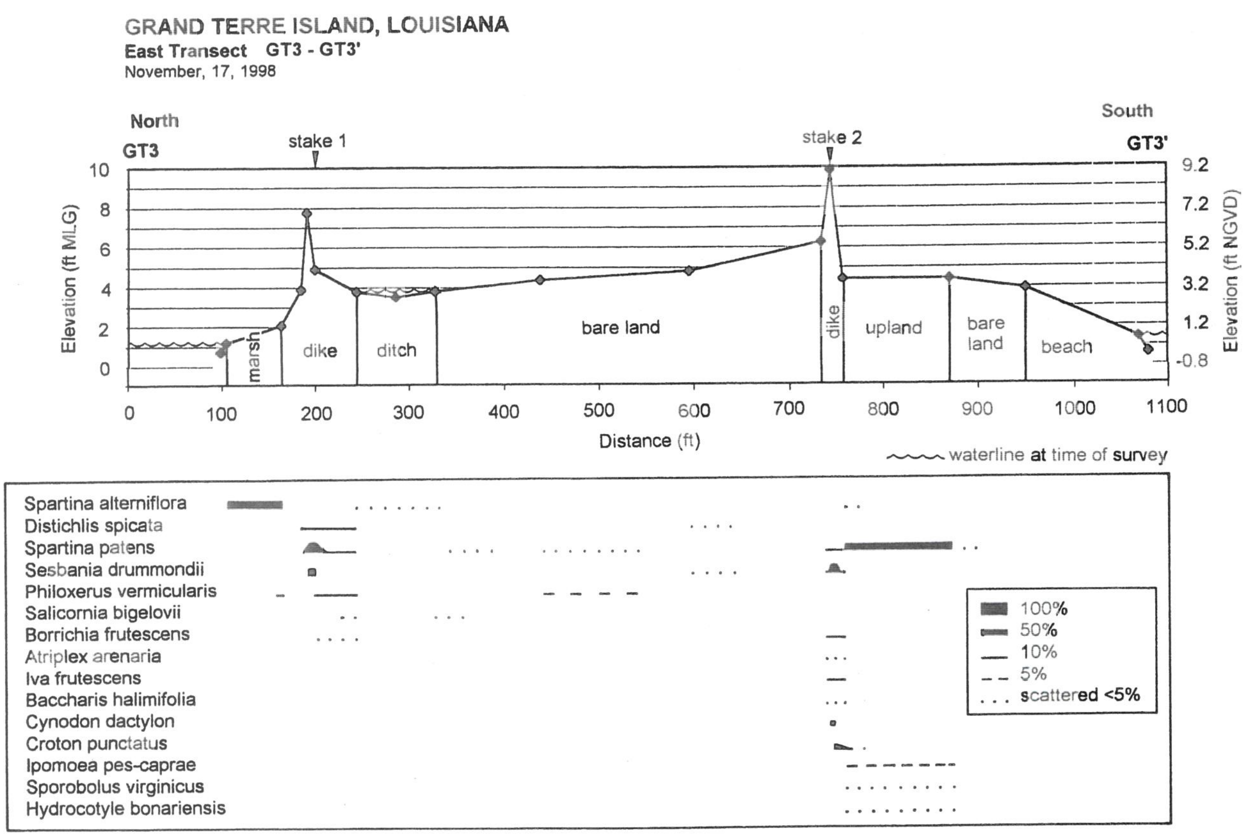


Figure 24b. Elevation profile with vegetation data illustrated for the East transect (GT3-GT3') at the Grand Terre Island BUMP study site.

Vegetative Character of Grand Terre Island

General Description

The west Grand Terre Island is typical of the low relief Louisiana barrier islands with narrow beaches, wide overwash terraces, sand flats, extensive salt marshes, and recurved spits at either end. It is a highly erosional shoreline for the most part and is considered to be in a sediment deficient system. The few dunes that exist are of extremely low relief, providing little resistance to overwash by frequent storms. The marsh vegetation and cohesive root-mat form the most erosion resistant part of the island and release very little sediment when reworked by waves.

Beneficial use on the east side of the west Grand Terre Island was in the form of barrier restoration at a particularly narrow and low part of the island that was in danger of being breached by storms. The restoration activities consisted of placing sandy dredged material on top of the island to increase the relief and extend the Gulf shoreline seaward. This sandy substrate was being sparsely colonized by the rapidly growing, annual beach species and by perennial species that survived burial by the placement of dredged material.

Vegetative community types

The overall marsh type for the Grand Terre Island BUMP study area is classified as salt marsh typified by Oyster grass (*Spartina alterniflora*). The sand flats and overwash areas were being colonized by silverhead (*Philoxerus vermicularis)*, salt grass (*Distichlis spicata*), sea ox-eye (*Borrichia frutescens*), and glasswort (*Salicornia bigelovii*). The sand flats exhibited evidence of former unidentified vegetation that had recently gone dormant or experienced a freeze. The barrier flat formed at the eastern recurved spit was vegetated by marshhay cordgrass (*Spartina patens*) along with scattered goat's foot morning glory (*Ipomoea pes-caprae*) and sea-side pennywort (*Hydrocotyle bonariensis*). The retaining dikes supported a community of barrier island grassland and shrub/scrub such as marshhay cordgrass (*Spartina patens*), yellow rattle-box (*Sesbania drummondii*), beach tea (*Croton punctatus*), groundselbush (*Baccharis halimifolia*) and marsh elder (*Iva frutescens*).

GIS ANALYSIS RESULTS FOR GRAND TERRE ISLAND

Shoreline Changes of Grand Terre Island: 1985-1997

Figure 25 graphs the data from Table 5 to show the spatial history of the Grand Terre Island BUMP study areas (GTI) between 1985 and 1997. The data shows that erosion dominates the processes of the study area. Habitat statistics are only for the areas delineated as BUMP study areas (Figure 3).

The GTI study area was measured at 158.6 acres in December 1985, and 147.1 acres in October 1997. This is a cumulative area decrease of -11.5 acres or a decrease in area of 7.3 percent for the 11.83 year period at an overall rate of change of -1.0 acres per year. There was an overall loss of -93.7 acres of natural habitats and a loss of -6.3 acres of other man-made habitats, most of which was replaced by +88.5 acres of BUMP-made habitats.

The whole of the west Grand Terre Island including the portion outside the BUMP study area was measured at 547.9 acres in December 1985 and 468.7 acres in October 1997. This is a decrease of -79.2 acres or a decrease in area of 14.5 percent at an overall rate of -6.7 acres/yr for the entire island. Just the western portion of the island lost -67.7 acres or 17.4 percent at a rate of -5.7 acres/yr.

Land loss within the study areas was primarily associated with shoreline erosion along the Gulf shoreline of Grand Terre Island. The only area of natural progradation was on the ends of Grand Terre Island due to natural recurved spit growth by long-shore transport. Most of the increase in specific habitats was due to vegetative succession or changes in habitat classification rather than an actual progradation or new land created. The 88.5 acres of bare land created at Grand Terre Island by BUMP during island restoration, for example, replaces 88.5 acres of marsh and beach that existed in 1985.

Figure 26 shows the shoreline change history of the Grand Terre Island BUMP study area between December 1985 and October 1997.

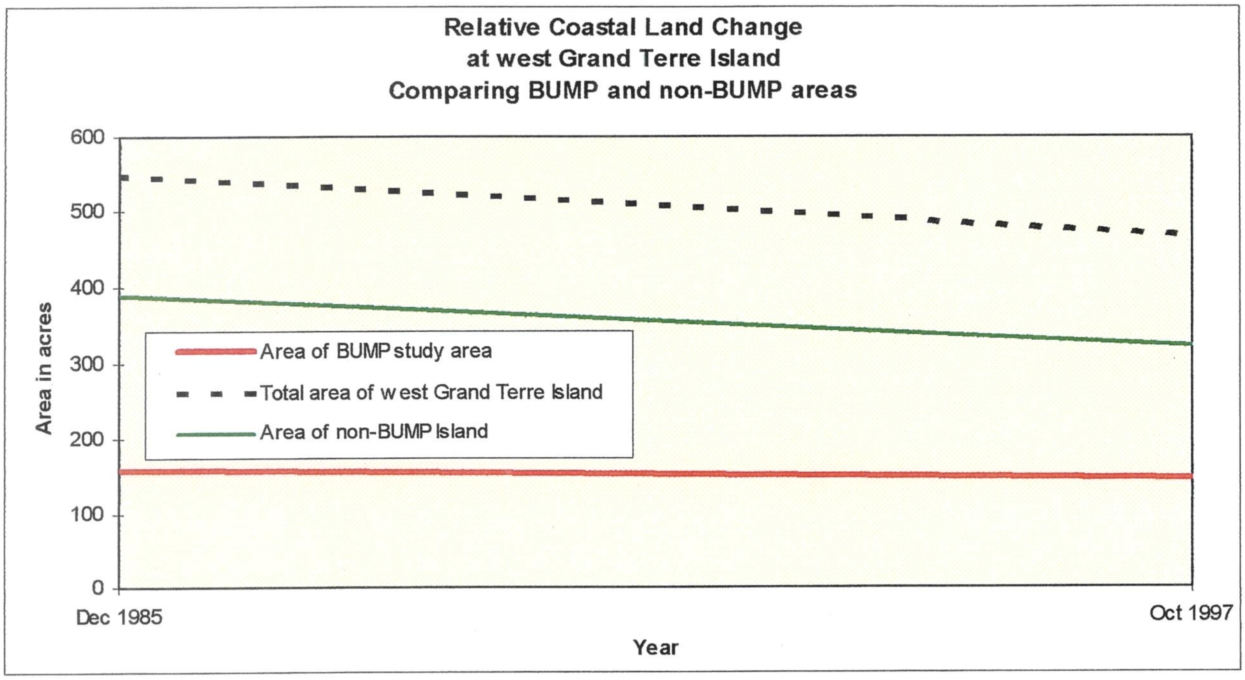


Figure 25. Graph of the area of the west Grand Terre Island over time, comparing land change trends of the BUMP study area with the non-BUMP study area.

TABLE 5
Grand Terre Island Area: 1985-1997

Grand Terre Island BUMP study area	Dec 1985	Oct 1997
Natural Areas	151.7	58.0
BUMP Man-made Areas	0.0	88.5
Other Man-made Areas	6.9	0.6
Total BUMP study area	158.6	147.1

Total West Grand Terre Island area	547.9	468.7

Note: Habitat Statistics are for BUMP delineated area only.

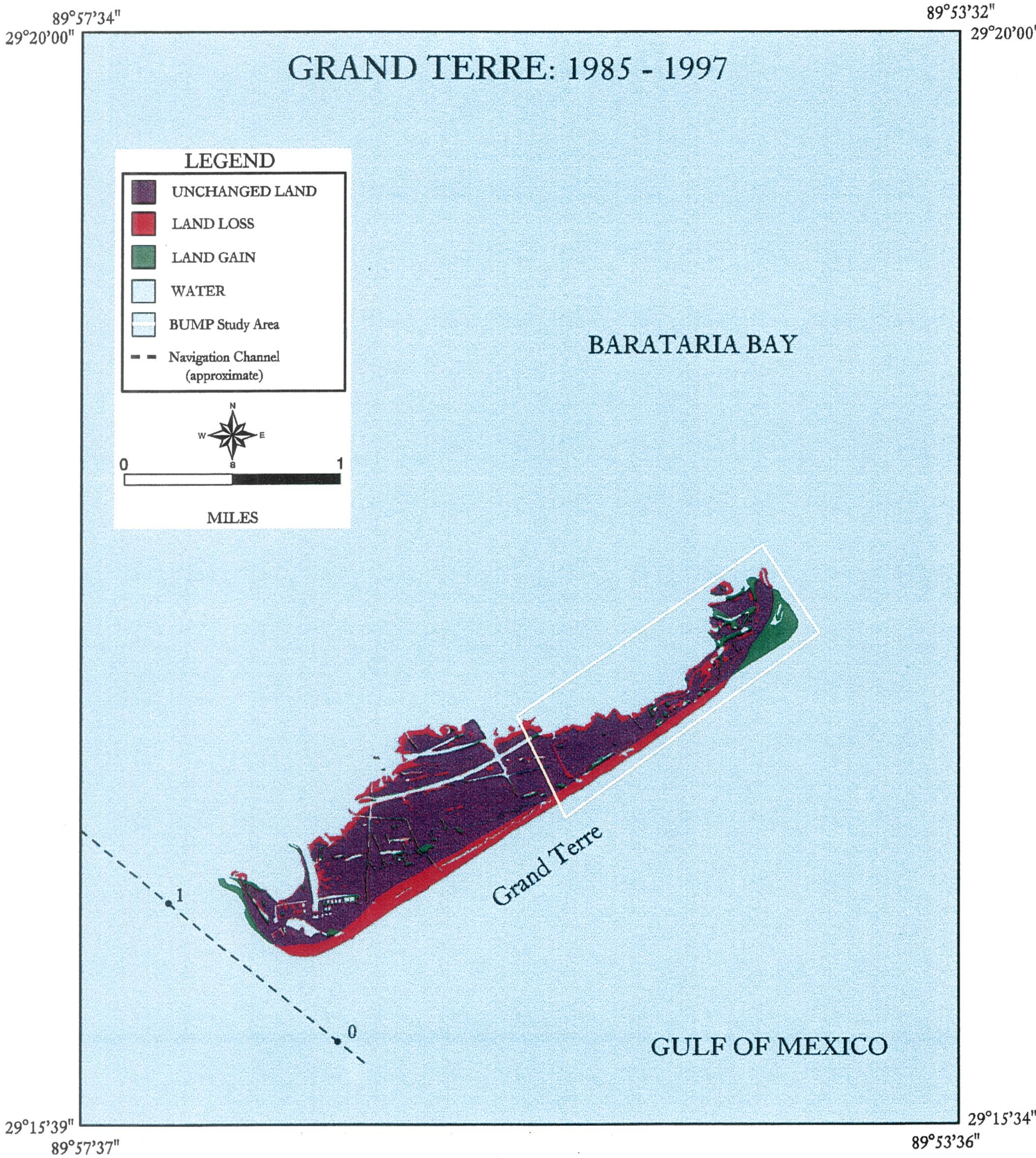


Figure 26. Shoreline changes of the Grand Terre Island BUMP study areas between December 1985 and October 1997.

Habitat Inventory of Grand Terre Island BUMP study area

The aerial photographic interpretation combined with field surveys identified six major habitat types in this Barataria Bay Waterway study area. These habitats are further classified as natural and man-made. The natural class identifies natural deltaic and coastal processes as responsible for habitat creation. The BUMP man-made (BUMP-made) class identifies the habitats created by the beneficial use of dredged material. The non-BUMP man-made (other-made) class identifies areas created as a result of activities other than BUMP, such as areas associated with the oil industry access and pipeline canals, or general channel maintenance. On the habitat maps presented in this report, an intertidal class is included to indicate nearshore topography. Because the seaward extent of these areas is not clearly defined, the area of this class is not calculated or included in the inventory.

Grand Terre Island BUMP study area- 1985

Table 6 lists the areas of the five habitat types found in the GTI study area in December 1985, illustrated in Figure 27. The total area of the GTI study area in December 1985 was 158.6 acres. Of this total, 151.7 acres or 95.6 percent were natural and 6.9 acres or 4.4 percent were man-made. There was no acreage classified as BUMP-made in 1985. In order of decreasing size and importance, the largest habitat found was natural marsh (96.7 acres) followed by natural beach (36.5 acres), natural bare land (15.7 acres), other-made shrub/scrub (6.9 acres), and natural upland (2.8 acres).

In terms of habitat totals, marsh (96.7 acres or 61.0%) dominated the Grand Terre Island BUMP study area landscape.

TABLE 6
December 6, 1985 Habitat Inventory of the Grand Terre Island BUMP Study Area

HABITAT	TOTAL	NATURAL	OTHER-MADE	BUMP-MADE
Marsh	96.7	96.7	0.0	0.0
Upland	2.8	2.8	0.0	0.0
Shrub/Scrub	6.9	0.0	6.9	0.0
Bare Land	15.7	15.7	0.0	0.0
Beach	36.5	36.5	0.0	0.0
Habitat Total	158.6	151.7	6.9	0.0

Note: Statistics are for BUMP delineated areas only.

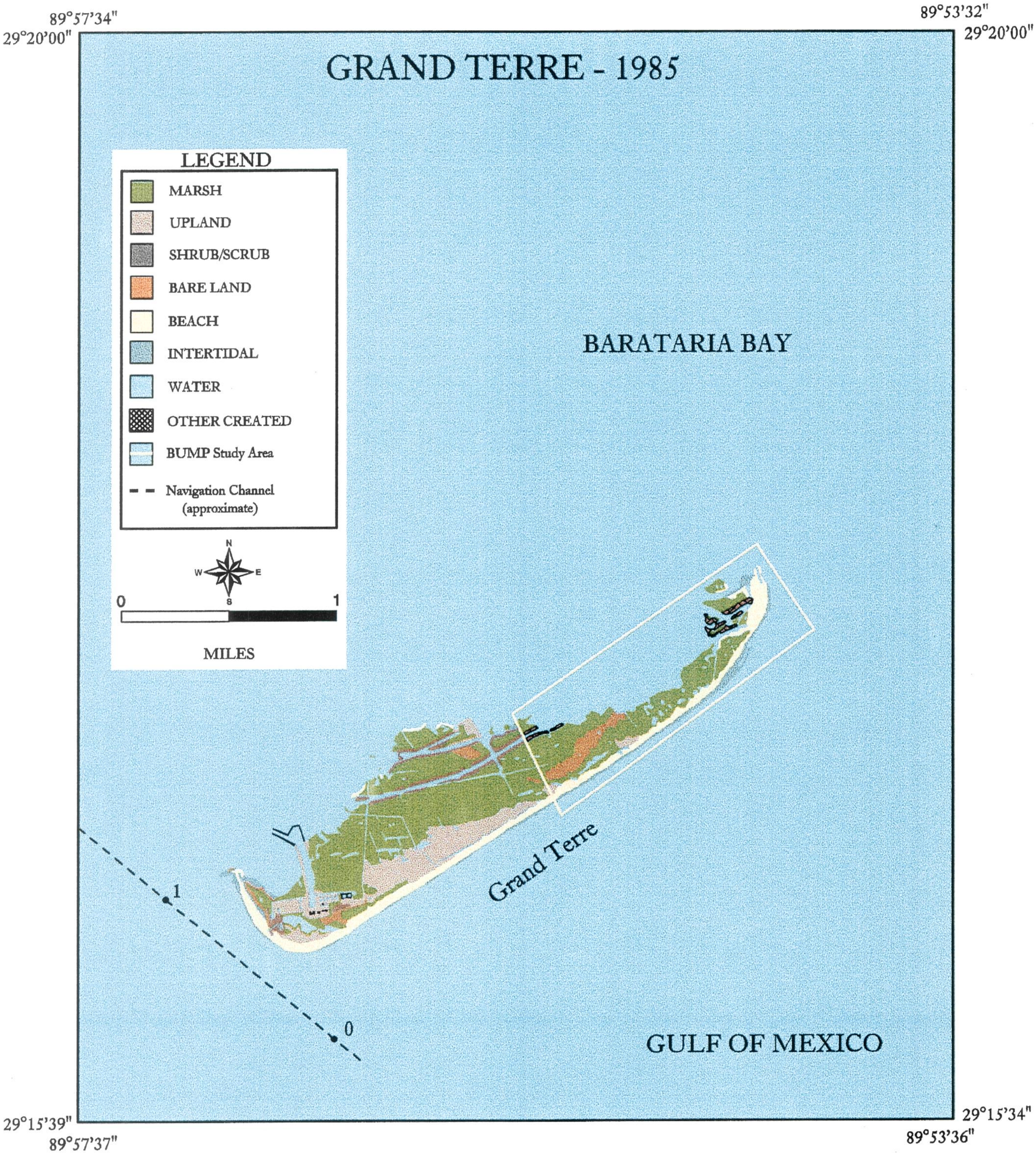


Figure 27. Habitat inventory map of the Grand Terre Island BUMP study areas in December 1985. Only the area delineated in yellow was used for statistical analysis.

Grand Terre Island BUMP study area- 1997

Table 7 lists the areas of the six habitat types found in the GTI study area in October 1997. The location and arrangement of these habitats are presented in figure 28. The total area of the GTI study area in October 1997 was 147.1 acres. Of this total, 58 acres or 39.4 percent were natural and 89.1 acres or 60.6 percent were man-made including 0.6 acres other-made and 88.5 acres BUMP-made. In order of decreasing size and importance, the largest habitat found was BUMP-made bare land (88.5 acres) followed by natural marsh (25.5 acres), natural beach (19.6 acres), natural bare land (6.2 acres), natural upland (5.6 acres), natural shrub/scrub (1.1 acres), and other-made shrub/scrub (0.6 acres).

In terms of habitat totals, bare land (94.7 acres or 64.4%) dominated the Grand Terre Island BUMP study area landscape.

TABLE 7
October 5, 1997 Habitat Inventory of the Grand Terre Island BUMP Study Areas

HABITAT	TOTAL	NATURAL	OTHER-MADE	BUMP-MADE
Marsh	25.5	25.5	0.0	0.0
Upland	5.6	5.6	0.0	0.0
Shrub/Scrub	1.7	1.1	0.6	0.0
Bare Land	94.7	6.2	0.0	88.5
Beach	19.6	19.6	0.0	0.0
Habitat Total	147.1	58.0	0.6	88.5

Note: Statistics are for BUMP delineated areas only.

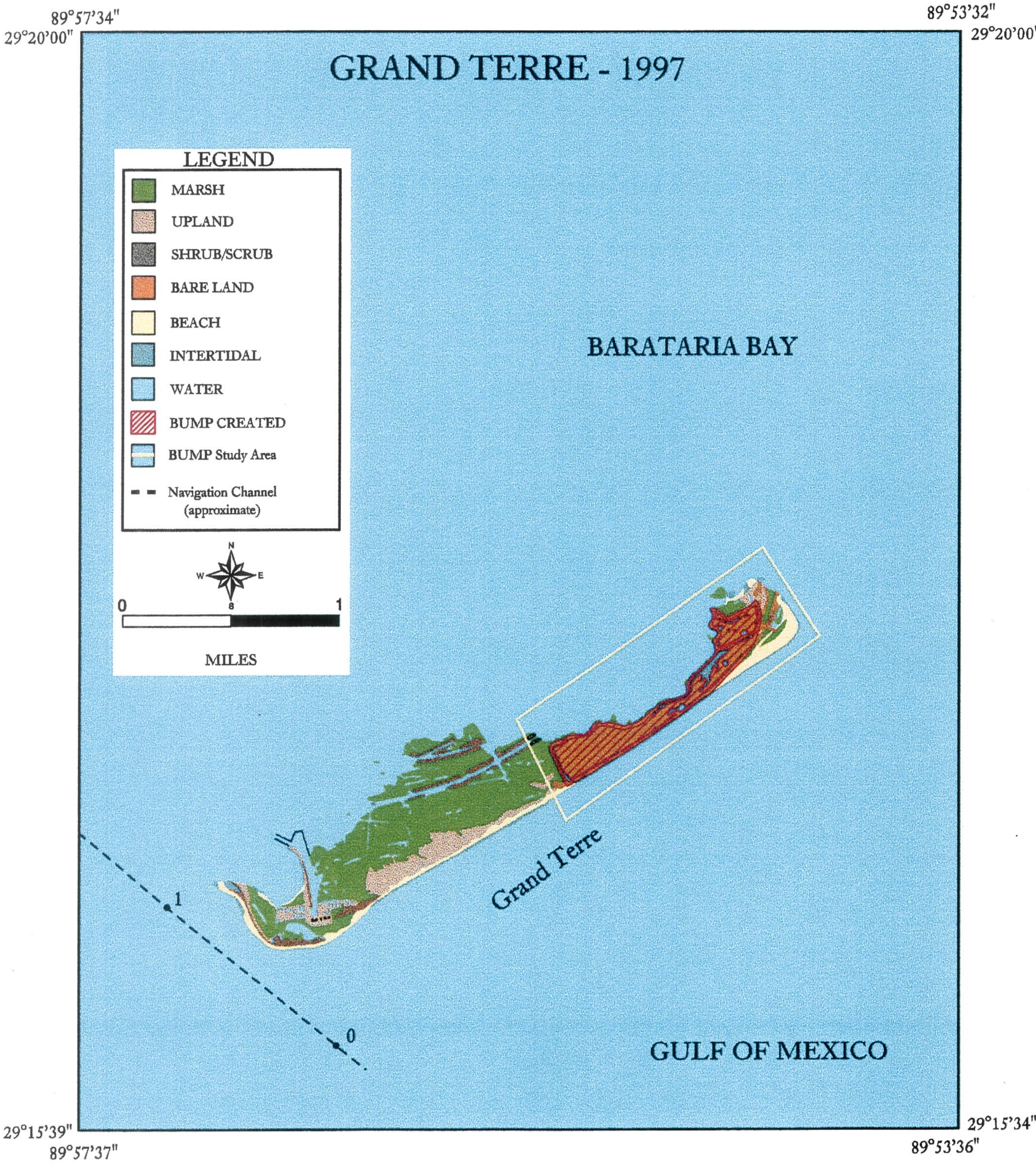


Figure 28. Habitat inventory map of the Grand Terre Island BUMP study areas in October 1997. Only the area delineated in yellow was used for statistical analysis.

Habitat Changes of the Grand Terre Island BUMP study area

Shoreline erosion due to natural processes dominates the processes of this area. Figure 29 shows the relative changes in total area of the natural, other-made and BUMP landscapes in relation to the total study area. Figure 30 shows the cumulative creation of new habitat, including natural, other-made and BUMP-made, in the Grand Terre Island BUMP study area between December 1985 and October 1997. Table 8 lists the major habitat changes during the period between December 1985 and October 1997. The total area decreased by -11.5 acres between 1985 and 1997 which represents a -7.3 percent decrease in area at a rate of -1.0 acres/yr for this 11.83 year period. There was an overall -93.7 acres of decrease of the natural habitats and a -6.3 acre decrease of other-made habitats, offset by an overall +88.5 acres of increase in BUMP-made habitats.

The major change in habitat was the decrease of natural salt marsh (-71.2 acres) due to the placement of dredged material intended to increase the elevation of the island and its resistance to erosion. There was also a decrease of natural beach (-16.9 acres) and bare land (-9.5 acres), and an increase in natural upland (+2.8 acres), and in natural shrub/scrub (+1.1) for an overall loss of -93.7 acres of natural habitat at a rate of -7.9 acres/yr.

The major habitat change by man-made processes occurred in the BUMP-made habitat with an increase of +88.5 acres of bare land in the form of barrier sand flats. For other-made habitats, the only change in habitat documented was the -6.3 acres of loss of other-made shrub/scrub along old pipeline canals.

Figure 31 shows a time series of habitat changes at the Grand Terre Island BUMP study area. Figure 31A graphs the natural habitat changes over time. Natural shoreline erosion dominates the processes affecting the natural habitat class. Figure 31B graphs man-made habitats. In terms of the beneficial use process, the only areas of new habitat creation was +88.5 acres of bare land that replaced former habitats as indicated by the most recent inventory of October 5, 1997.

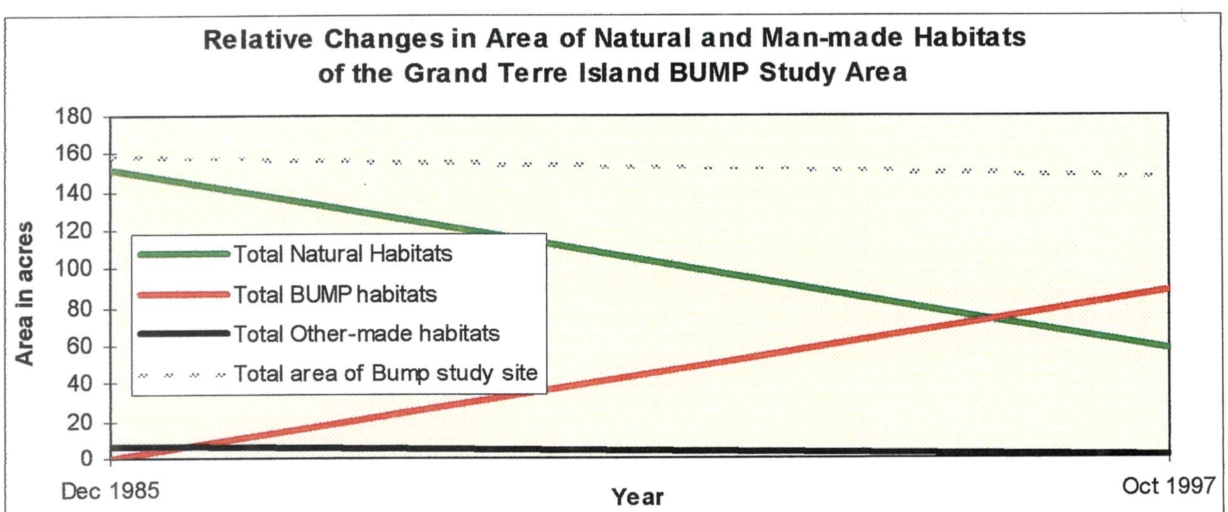


Figure 29. Graph showing the relative changes in total area of the natural, other-made and BUMP-made habitats of the Grand Terre Island BUMP study area.

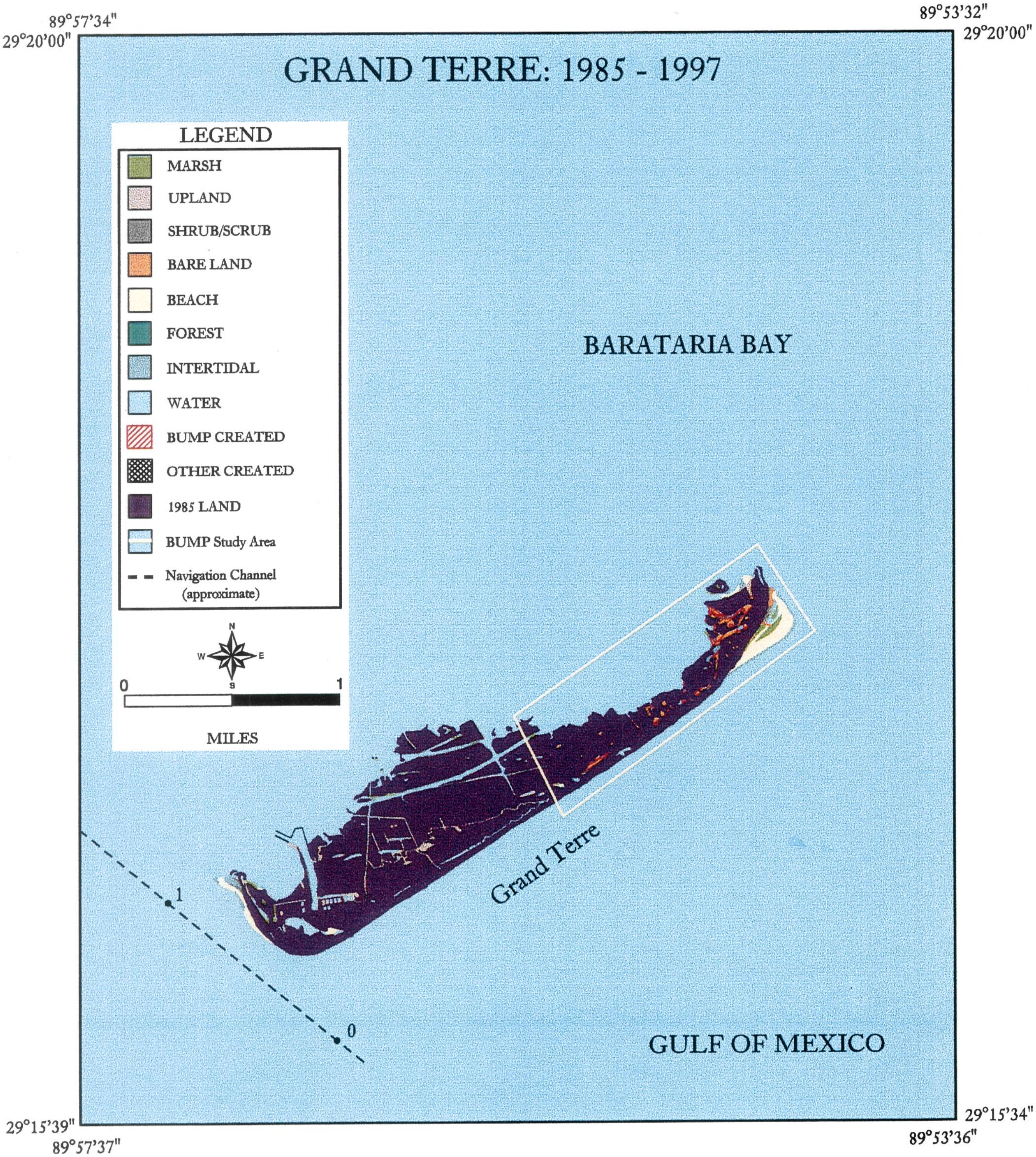


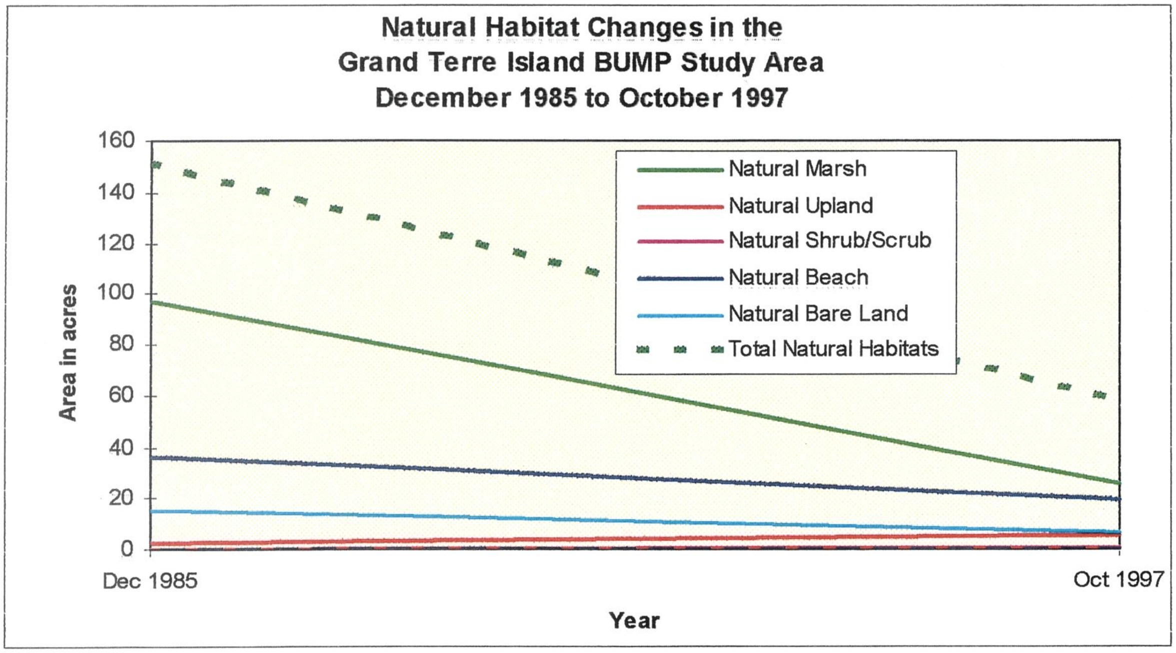
Figure 30. Map of the Grand Terre Island BUMP study area showing the new habitats that developed between December 1985 and October 1997.

TABLE 8
Grand Terre Island BUMP study site
Cumulative Change in Total Acres of each Habitat
Between December 1985 and November 1997

HABITAT	1985	1997	Dec 1985-Oct 1997 (acres)	Rate of Change (acres/yr)
Natural Marsh	96.7	25.5	-71.2	-6.0
Natural Upland	2.8	5.6	+2.8	+0.2
Natural Shrub/Scrub	0.0	1.1	+1.1	+0.1
Natural Bare Land	15.7	6.2	-9.5	-0.8
Natural Beach	36.5	19.6	-16.9	-1.4
Total Natural Habitats	151.7	58.0	-93.7	-7.9
Other-made Marsh	0.0	0.0	--	--
Other-made Upland	0.0	0.0	--	--
Other-made Shrub/Scrub	6.9	0.6	-6.3	-0.5
Other-made Bare Land	0.0	0.0	--	--
Other-made Beach	0.0	0.0	--	--
Total Other-made	6.9	0.6	-6.3	-0.5
BUMP-made Marsh	0.0	0.0	--	--
BUMP-made Upland	0.0	0.0	--	--
BUMP-made Shrub/Scrub	0.0	0.0	--	--
BUMP-made Bare Land	0.0	88.5	+88.5	+7.5
BUMP-made Beach	0.0	0.0	--	--
Total BUMP-made Habitats	0.0	88.5	+88.5	+7.5
HABITAT TOTAL	158.6	147.1	-11.5	-1.0

Note: Statistics are for BUMP delineated areas only.

A



B

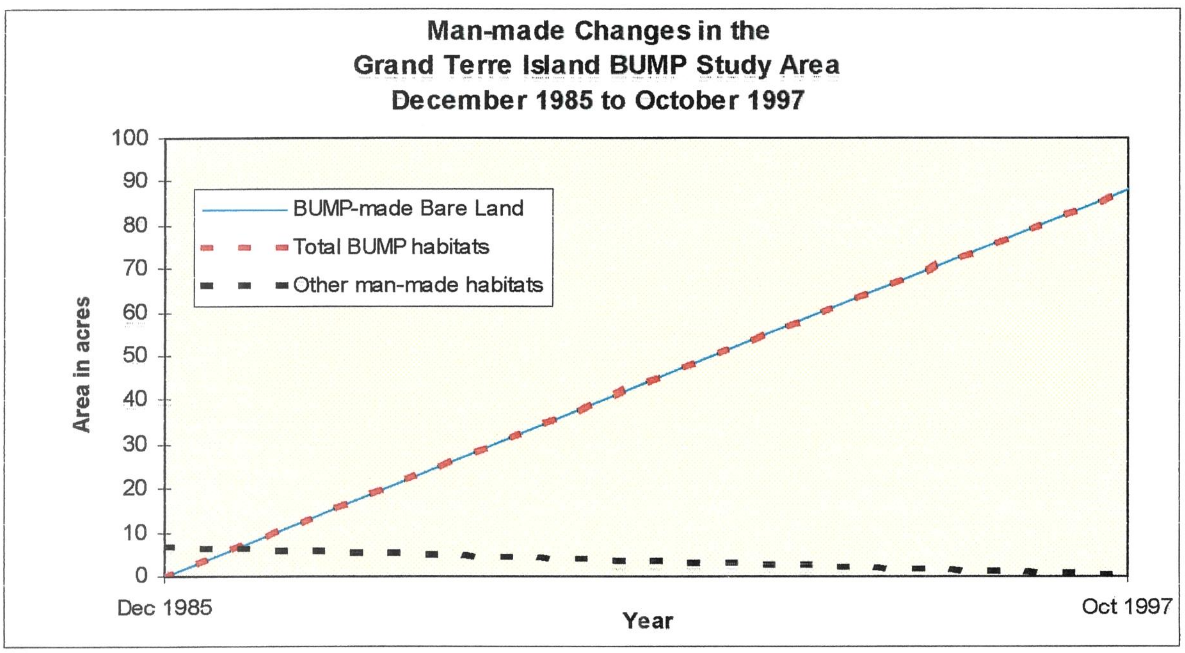


Figure 31. Time series showing the changes in total area of each habitat in the Grand Terre Island BUMP study area between December 1985 and October 1997. A) natural habitat changes. B) Man-made habitat changes.

CONCLUSIONS

1. The lower Barataria Bay Waterway BUMP study areas are dominated by saltwater marshes that are experiencing marsh erosion and degradation. Field surveys documented that the elevation of the substrate for existing salt marsh in the BBW area were between 1.8 and 3.8 ft MLG (1.0 and 3.0 ft NGVD) at the Barataria Bay Vicinity Mile 14 site and between 1.3 and 2.3 ft MLG (0.5 and 1.5 ft NGVD) at the Grand Terre Island sites.

2. At the Barataria Bay Reach, the beneficial use of dredged material created 8.8 acres of marsh and 8.8 acres of bare land at the Queen Bess Island study site. No other beneficial use of dredged material was documented within the Barataria Bay Reach BUMP study area.

3. At west Grand Terre Island, the beneficial use of dredged material has replaced +88.5 acres of natural and other-made habitats with BUMP-made habitats between 1985 and 1997 as part of barrier island restoration. There was an overall decrease in area of the Grand Terre Island BUMP study site of only -11.5 acres.

4. Looking at west Grand Terre Island as a whole, the total decrease in island area was -79.2 acres, which corresponds to a decrease in area of -14.5 percent at an overall rate of -6.7 acres/yr. The western area (excluding the BUMP study area) lost -67.7 acres which is a decrease in area of -17.4 percent at an overall rate of -5.7 acres/yr. The eastern BUMP study area, however, experienced a decrease of only -11.5 acres or a decrease in area of -7.3 percent at an overall rate of -1.0 acres/yr.

5. In the Barataria Bay Waterway BUMP study areas including both Bay and Bar Reaches, the natural habitats have decreased by -550.5 acres and other-made habitats decreased by -101.9 acres. The apparent total decrease in area of the Barataria Bay Waterway BUMP study areas is -652.4 acres. However, only -546.3 acres is a result of erosion and subsidence, since the total loss was offset by the creation or substitution of +106.1 acres of BUMP-made habitat.

6. The habitat inventory documented that the Barataria Bay Waterway BUMP study areas are primarily dominated by natural habitats. In 1985, the study areas contained 1978.5 acres of which 81.8% was natural and 18.2% was man-made. In 1997, the study areas contained 1431.8 acres of which 74.6% was natural and 25.4% was man-made.

APPENDIX 1A
LIST OF VEGETATIVE SPECIES
OF THE BARATARIA BAY WATERWAY
BARATARIA BAY AND GRAND TERRE ISLAND REACHES
BUMP STUDY AREAS

LIST OF VEGETATIVE SPECIES
IN THE BARATARIA BAY WATERWAY BUMP STUDY AREAS

An alphabetical list of observed and collected plant species follows. This list is not complete, but is meant to establish vegetative character and indicate dominant species observed. The list includes the year of observation, species name, alternate scientific names, common names, and general habitat description for each plant. The habitat information was taken from the Manual of the Vascular Flora of the Carolinas, The Smithsonian Guide to Seaside Plants of the Gulf and Atlantic Coasts, or Common Vascular Plants of the Louisiana Marsh.

Atriplex arenaria Nuttall. . . . . Seabeach orach
annual herb; seashores, active dunes, overwash areas, edge of brackish or saline marshes

Baccharis halimifolia L. . . . . Groundselbush
shrub; elevated sites in fresh to saline marshes

Batis maritima L. . . . . saltwort
succulent subshrub; open brackish marshes

Borrichia frutescens (L.) . . . . sea ox-eye
rhizomatous shrub; brackish marsh or upper zones of salt marsh

Cakile geniculata . . . . sea rocket
annual succulent; coastal sand dunes

Croton punctatus Jacquin. . . . . beach tea
woody perennial; sand dunes

Cuscuta indecora . . . . dodder, love-vine
rootless, leafless, parasitic annual; yellow filiform stems; on woody marsh hosts

Cynanchum palustre (Pursh) Heller . . . . milkweed vine
perennial twining vine; saltmarshes and coastal hammocks

Cynodon dactylon (L.) Persoon. . . . . Bermuda grass
rhizomatous repent perennial grass; fields, roadsides, waste places; valuable as forage

Distichlis spicata (L.) Greene . . . . salt grass
rhizomatous perennial; brackish marshes and flats

Fimbristylis castanea (Michaux) . . . . sandrush
rhizomatous perennial; brackish marshes, savannahs, meadows

Heliotropium curassavicum L. . . . . seaside heliotrope
annual succulent; seashores and borders of fresh to saline marsh

Hydrocotyle bonariensis Comm. ex Lam. . . . . sea-side pennywort
low perennial; among beach dunes and in moist, open sandy areas - swales, sandy marshes, swamps, sand flats,

Ipomoea pes-caprae (L.) R.Br. . . . . Railroad vine, goat's foot morning glory
trailing vine; drift area of beach, dunes, overwash flats

Iva frutescens L. . . . . marsh elder
shrub; brackish marshes, upper zones of salt marsh

Melia azedarach (L.) . . . . China-berry tree
small to medium size tree; commonly cultivated, often naturalized woodland borders and in disturbed habitats.

Philoxerus vermicularis (L.) R.Br. . . . . silverhead
fleshy perennial; saline or brackish places--coastal sand dunes, damp shores, flats, lagoon shores, margins of marshes

Physalis pubescens L. . . . . ground cherry
annual herb; fields, woodlands. Roadsides, waste places, disturbed areas

Phytolacca americana L. . . . . pokeweed, pigeonberry
robust perennial herb 1-3m tall; waste ground, pastures, disturbed habitats

Salicornia bigelovii Torrey. . . . . glasswort
annual succulent; brackish marshes, salt flats, low sand flats

Sesbania drummondii (Ry6db.) Cory. . . . . Rattlebox
shrub; elevated areas in fresh to brackish marshes, backdunes, waste places

Solidago sempervirens L. . . . . seaside goldenrod
perennial; brackish marsh or saline sand

Spartina alterniflora Loisel. . . . . oyster grass
rhizomatous perennial; salt and brackish marshes

Spartina patens (Aiton) Muhl. . . . . marshhay cordgrass
tufted rhizomatous perennial; brackish marshes, low dunes and sand flats

Sporobolus virginicus (L.) Kunth. . . . . coastal dropseed
Extensively creeping rhizomatous perennial; brackish marshes, low sandy areas, low dunes

Vigna luteola (Jacquin) Bentham. . . . . Deer pea, beach pea
perennial herbaceous vine; waste places, borders of marshes and low fields