

**BENEFICIAL USE OF DREDGED MATERIAL
MONITORING PROGRAM
2001 ANNUAL REPORT
(Base year through FY2000)**

Part I:

Results of Monitoring the Beneficial Use of Dredged Material at the
Mississippi River, Baton Rouge to the Gulf of Mexico, Louisiana -
Southwest Pass
Base Year 1985 thru Fiscal Year 2000

Part II:

Results of Monitoring the Beneficial Use of Dredged Material
at the
Calcasieu River and Pass, Louisiana
Base Year 1985 thru Fiscal Year 2000

U.S. Army Corps of Engineers
New Orleans District

Prepared by:
Coastal Research Laboratory
University of New Orleans
New Orleans, Louisiana

Contract DACW29-98-D-0008

**BENEFICIAL USE OF DREDGED MATERIAL
MONITORING PROGRAM
2000 ANNUAL REPORT**

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

Base Year 1985 thru Fiscal Year 2000

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

TABLE OF CONTENTS

INTRODUCTION	1-1
Beneficial Use of Dredged Material Monitoring Program (BUMP)	1-1
BUMP at Southwest Pass and Pass a Loutre	1-2
NAVIGATION, DREDGING, AND BENEFICIAL USE OF DREDGED MATERIAL DISPOSAL HISTORY	1-6
MISSISSIPPI RIVER, BATON ROUGE TO THE GULF OF MEXICO, LA SOUTHWEST PASS.....	1-6
BASIC METHODOLOGY.....	1-13
Aerial Photographic Analysis and Habitat Determination.....	1-13
Field Program.....	1-15
Geographic Information System (GIS) Analysis.....	1-15
World Wide Web Site.....	1-16
SOUTHWEST PASS NAVIGATION CHANNEL	1-17
FIELD SURVEY RESULTS	1-17
Methodology.....	1-17
Profiles at Southwest Pass	1-20
Vegetative Character of Southwest Pass.....	1-42
GIS ANALYSIS RESULTS FOR THE SOUTHWEST PASS NAVIGATION CHANNEL	1-43
Shoreline Changes of Southwest Pass: 1985-2001	1-43
Habitat Inventory	1-46
Habitat Change.....	1-50
PASS A LOUTRE	1-54
FIELD SURVEY RESULTS	1-54
Methodology.....	1-54
Profiles at Pass a Loutre.....	1-58
Vegetative Character of the Pass a Loutre BUMP study area	1-65
GIS ANALYSIS RESULTS FOR THE PASS A LOUTRE BUMP STUDY AREA.....	1-66
Shoreline Changes of Pass a Loutre: 1985-2001	1-66
Habitat Inventory	1-69
Habitat Change.....	1-73
CONCLUSIONS.....	1-78
REFERENCES	1-78
APPENDIX 2A.....	1-A1

LIST OF FIGURES

Figure 1	Locations of the beneficial use of dredged material monitoring areas.	1-1
Figure 2	Location map of Southwest Pass and Pass a Loutre BUMP study areas.....	1-3
Figure 3A	The Mississippi River - Southwest Pass BUMP study area showing the minimum coverage of the aerial photo-mosaic and the limits of the area digitized.....	1-4
Figure 3B	The Mississippi River - Pass a Loutre BUMP study area showing the minimum coverage of the aerial photo-mosaic and the limits of the area digitized.....	1-5
Figure 4A	The dredged material disposal history for the Mississippi River - Southwest Pass BUMP study area, showing FY 1985 through FY 1995 disposal in detail.	1-10
Figure 4B	The dredged material disposal history for the Mississippi River - Southwest Pass BUMP study area, showing the FY 1996 through FY 2000 disposal in detail. There was no cutterhead dredging, and therefore no beneficial use disposal, in FY 2000.	1-11
Figure 4C	The dredged material disposal history for the Pass a Loutre BUMP study area, showing disposal through FY 2000. The last disposal in this area was FY 1998...	1-12
Figure 5	Location of the four elevation and vegetation transects at the Southwest Pass - BUMP study area.....	1-19
Figure 6	Infrared vertical aerial photography taken on October 16, 1997 of the Head of Passes area at Southwest Pass, showing the approximate location of the transect SW1.....	1-21
Figure 7	Oblique aerial photograph taken in June 2001 with approximate location of the transect indicated by the yellow line. (Photo from <i>The Aerial Videotape Survey of Coastal Louisiana -- 2001</i> , LSU Aerial Videotape Survey Program).....	1-21
Figure 8	A) Photograph taken on February 24, 1999 at the end of transect SW1 at the Southwest Pass - Head of Passes BUMP study site. B) Same shot taken April 6, 2001, showing the difference that can occur because of short-term, opportunistic vegetation.....	1-22
Figure 9	A) Photograph taken on February 24, 1999 along transect SW1 at the Southwest Pass - Head of Passes BUMP study site showing a pond with associated marsh vegetation. B) Same shot taken April 6, 2001, showing the difference that can occur because of short-term, opportunistic vegetation.	1-23
Figure 10	Photograph taken on April 6, 2001 near transect SW1 at the Southwest Pass - Head of Passes BUMP study site, showing grassland and small acacia tree.....	1-24

Figure 11	Photograph taken on April 6, 2001 along transect SW1 at the Southwest Pass - Head of Passes BUMP study site showing extensive grasslands used for grazing cattle.....	1-24
Figure 12	Photograph taken on March 19, 2001 along transect SW1 at the Southwest Pass - Head of Passes BUMP study site showing the dewberry or southern blackberry terrace.....	1-25
Figure 13	Elevation profile SW1 at the of the Southwest Pass - Head of Passes BUMP study site with vegetation data illustrated.	1-26
Figure 14	Vertical aerial photograph of the transect SW2 at the Southwest Pass - Central West Bay BUMP study site on October 16, 1997.	1-28
Figure 15	Photograph taken on April 5, 2001 along transect SW2 - Central West Bay showing shrub, upland, and fresh marsh habitats and a pond. This view is in line with the transect toward West Bay, from the instrument placed over stake 1 on the ridge.	1-28
Figure 16	Photograph taken April 5, 2001 along transect SW2 - Central West Bay, showing wide area of <i>Spartina alterniflora</i> toward the end of the transect, looking toward West Bay.....	1-29
Figure 17	Photograph taken April 5, 2001 along the central part of transect SW2 - Central West Bay, showing the extensive grassland with old Sesbania shrubs.	1-29
Figure 18	Photographs taken along transect SW2 - Central West Bay, looking past the former location of stake 2 to the instrument placed over stake 1 on the ridge next to the access canal. Notice the log on the left side of the picture for reference, and the difference in vegetative cover and the shrub thicket that now appears in front of the fence line. A) December 15, 1998. B) April 5, 2001.....	1-30
Figure 19	Photographs taken of the cliff at the instrument end of transect SW2 - Central West Bay. A) December 15, 1998. B) April 5, 2001.....	1-31
Figure 20	Elevation profile SW2 of the Southwest Pass - Central West Bay BUMP study site with vegetation data illustrated.	1-32
Figure 21	Vertical aerial photograph taken on October 16, 1997 of the area containing the SW3 transect (black line) at the Southwest Pass - Southern West Bay BUMP study site. The old lighthouse can be seen as a dot indicated by the arrow.	1-34
Figure 22	Oblique photograph taken in June 2001 of the area containing the SW3 transect (approximately represented by the yellow line). From the <i>Aerial Videotape Survey of Coastal Louisiana -- 2001</i> , LSU Aerial Videotape Survey Program.	1-34
Figure 23	Photograph of transect SW3 at the Southwest Pass - Southern West Bay BUMP study site on March 19, 2001. Stake 1 was placed near the old lighthouse.....	1-35

Figure 24	Photograph of transect SW3 at the Southwest Pass - Southern West Bay BUMP study site on March 19, 2001. The transect began in the well established salt marsh east of the lighthouse. The view is looking southeast toward the Mississippi River.....	1-35
Figure 25	Photograph taken on March 19, 2001 along transect SW3 at the Southwest Pass - Southern West Bay BUMP study site. The newer deposits were only sparsely vegetated with Bermuda grass on the slightly higher areas and Spartina on the lower.	1-36
Figure 26	Photograph taken on March 19, 2001 at the western end of transect SW3 at the Southwest Pass - Southern West Bay BUMP study site. Washover flat now occupies what was once a dune habitat.....	1-36
Figure 27	Elevation profile SW3 - Southern West Bay of the Southwest Pass BUMP study site with vegetation data illustrated. This site received dredged material in FY96 and FY97 and was only sparsely vegetated.	1-37
Figure 28	Vertical aerial photograph taken January 4, 2001 containing the transect SW4 of the Southwest Pass - East Bay BUMP study site. The orange line illustrates the approximate location of transect SW4.....	1-38
Figure 29.	Photograph taken March 19, 2001 of transect SW4 - East Bay at the Southwest Pass BUMP study site. This view is of the well-established mixed marsh on the southern side of the south lobe.....	1-39
Figure 30	Photograph of transect SW4 - East Bay at Southwest Pass BUMP study site on February 24, 1999. This view is of the tall shrub/scrub habitat on the southern lobe of the transect.	1-39
Figure 31	Photograph taken on March 19, 2001 along transect SW4 - East Bay at the Southwest Pass BUMP study site, showing the mixed Spartina and Sagittaria marsh along the south shore of the north lobe. The south lobe is visible in the distance.	1-40
Figure 32	Photograph taken on March 19, 2001 along transect SW4 - East Bay at the Southwest Pass BUMP study site. This view is of fresh marsh approaching the instrument and other stake on the northern lobe of the transect.	1-40
Figure 33	Elevation profile SW4 - East Bay of the Southwest Pass BUMP study site with vegetation data illustrated.	1-41
Figure 34	Graph of the area of the Mississippi River - Southwest Pass BUMP study area over time, showing the contribution of the beneficial use of dredged material.....	1-44
Figure 35	Shoreline changes of the Mississippi River - Southwest Pass BUMP study area between December 1985 and January 2001.....	1-45

Figure 36	Habitat inventory map of the Mississippi River - Southwest Pass BUMP study area in December 1985.	1-47
Figure 37	Habitat inventory map of the Mississippi River Southwest Pass BUMP study area in January 2001.	1-49
Figure 38	Graph showing the relative change in total area of the major habitat categories: natural, other-made, and BUMP-made, between 1985 and 2001	1-50
Figure 39	Map of the Mississippi River - Southwest Pass BUMP study area showing the new habitats created by beneficial use of dredged material or formed by natural processes between December 1985 and January 2001.	1-51
Figure 40	Time series showing the changes in total area of each habitat in the Mississippi River - Southwest Pass BUMP study area between December 1985 and January 2001. A) natural habitat changes. B) Other-made habitat changes. C) BUMP-made habitat changes	1-53
Figure 41	Location of the two elevation and vegetation transects at the Pass a Loutre - BUMP study area.	1-56
Figure 42	Oblique aerial photography taken on November 19, 1998 of the Pass a Loutre BUMP study site showing the low relief of the newly placed bare land.	1-57
Figure 43	Vertical aerial photography taken on January 11, 1999 of the Pass a Loutre BUMP study site. The approximate locations of the transects are represented by the orange lines.	1-59
Figure 44	Photograph taken on April 6, 2001 along transect A-A' at the Pass a Loutre BUMP study site, showing the platform within the upland/shrub habitat where the survey instrument was placed.	1-59
Figure 45	Photograph taken on September 23, 1999 from the navigation marker platform showing both transects, A-A' and B-B', at the Pass a Loutre BUMP study site.	1-60
Figure 46	Photograph taken on April 6, 2001 toward the eastern extent of transect A-A' at the Pass a Loutre BUMP study site showing the colonizing fresh marsh of bulrush, cattails and willow trees. The view is along the transect looking west toward the instrument.	1-60
Figure 47	Photograph taken on April 6, 2001 along transect B-B' at the Pass a Loutre BUMP study site, showing fresh marsh of almost solid cattails.	1-61
Figure 48	Photograph taken on April 6, 2001 along transect A-A' at the Pass a Loutre BUMP study site, showing the dense fringe of elephant ears that lines the older shoreline. The view is to the north of the transect.	1-61

- Figure 49 Photograph taken on April 6, 2001 along transect A-A' at the Pass a Loutre BUMP study site, showing the complex fresh marsh covering the older sediment. 1-62
- Figure 50 Photograph taken on April 6, 2001 along transect B-B' at the Pass a Loutre BUMP study site, showing the rattlebox canopy over upland grass and composites. The view is along the transect approaching the platform and instrument. Willow trees in the background are beyond the end of the transect.... 1-62
- Figure 51 Elevation profile A-A' at the of the Pass a Loutre BUMP study site with vegetation data illustrated. 1-63
- Figure 52 Elevation profile B-B' at the of the Pass a Loutre BUMP study site with vegetation data illustrated. 1-64
- Figure 53 Graph of the area of the Pass a Loutre BUMP study area over time, showing the contribution of the beneficial use of dredged material. 1-67
- Figure 54 Shoreline changes of the Pass a Loutre BUMP study area between December 1985 and January 2001. 1-68
- Figure 55 Habitat inventory map of the Pass a Loutre BUMP study area in December 1985. 1-70
- Figure 56 Habitat inventory map of the Pass a Loutre BUMP study area in January 2001..... 1-72
- Figure 57 Graph showing the relative change in total area of the major habitat categories: natural, other-made, and BUMP-made, between 1985 and 2001. 1-73
- Figure 58 Map of the Pass a Loutre BUMP study area showing the new habitats created by beneficial use of dredged material or formed by natural processes between December 1985 and January 2001. 1-74
- Figure 59 Time series showing the changes in total area of each habitat in the Pass a Loutre BUMP study area between December 1985 and January 2001. A) natural habitat changes. B) Other-made habitat changes. C) BUMP-made habitat changes. 1-76

LIST OF TABLES

TABLE 1	Mississippi River - Southwest Pass Area: 1985-2001	1-44
TABLE 2	December 1985 Habitat Inventory of the Mississippi River - Southwest Pass BUMP Study Area.....	1-46
TABLE 3	January 2001 Habitat Inventory of the Mississippi River - Southwest Pass BUMP Study Area.....	1-48
TABLE 4	Cumulative Change in Total Area of each Habitat in the Southwest Pass Study Area between 1985 and 2001.....	1-52
TABLE 5	Mississippi River - Pass a Loutre Area: 1985-2001	1-67
TABLE 6	December 1985 Habitat Inventory of the Pass a Loutre BUMP Study Area.....	1-69
TABLE 7	January 2001 Habitat Inventory of the Pass a Loutre BUMP Study Area.....	1-71
TABLE 8	Cumulative Change in Total Area of each Habitat in the Pass a Loutre Study Area between 1985 and 2001.....	1-75

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 navigational 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).

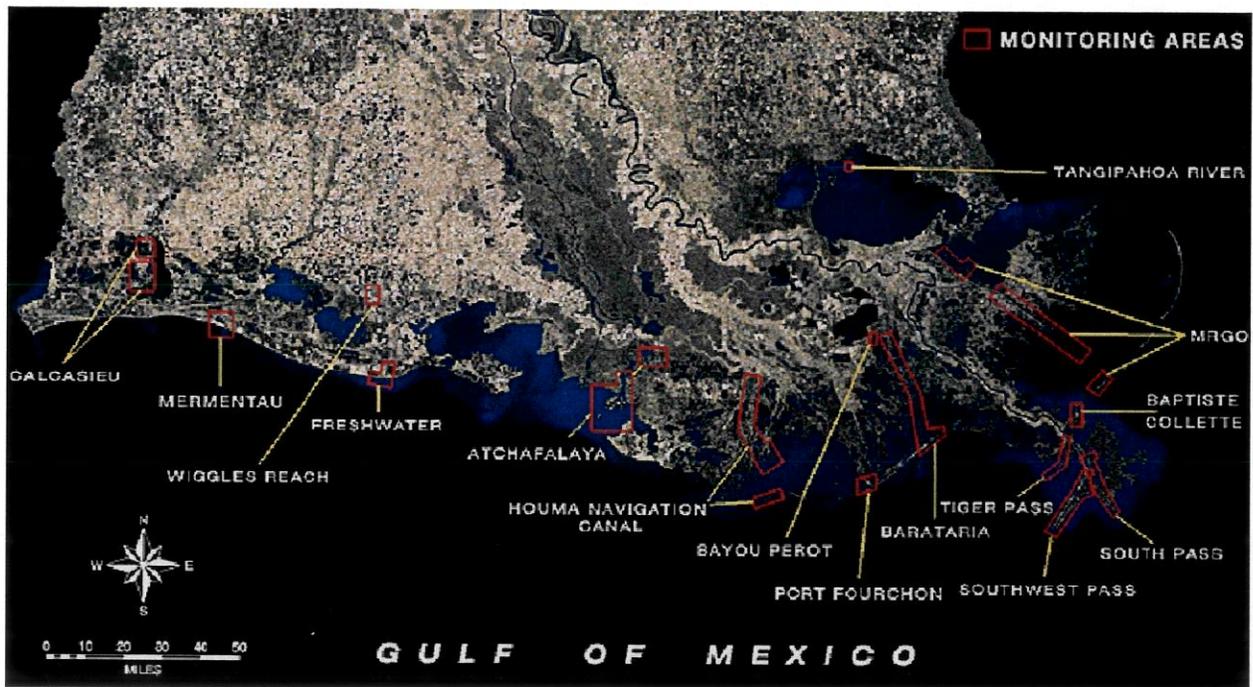


Figure 1. Locations of the beneficial use of dredged material monitoring areas.

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 that maximize beneficial use.

This is the first part of the Beneficial Use of dredged material Monitoring Program (BUMP), 2000 Final Report.

BUMP at Southwest Pass and Pass a Loutre

Southwest Pass is the main distributary of the Mississippi River that currently carries the majority of the river's flow and is used for national and international shipping traffic (Figure 2). The Mississippi River drains 1.25 million square miles of the North American continent and flows over 3,900 miles from its headwaters to the Gulf of Mexico. Its sediment load of 300,000,000 tons annually has fashioned much of the state of Louisiana, adding some 15,000 square miles of land in the last 6000 years. The Mississippi River deltaic plain is the third largest in the world. The early appearance of the delta with only three major channels prior to extensive crevasse sedimentation led investigators to refer to the modern river mouth as the *birdfoot* delta (Morgan 1977). The major passes of the modern delta used for navigation include Tiger Pass, Southwest Pass, South Pass, Southeast Pass, Northeast Pass, Pass a Loutre, North Pass, Main Pass, and Baptiste Collette Bayou.

Characteristically only a few channels within a delta system will carry the majority of the flow at any one time. These channels advance slowly seaward, while the remainder of the delta system subsides and deteriorates. Subsidence of the natural levees and interlevee basins by compaction of underlying unconsolidated prodelta clays results in rapid enlargement of ponds and lakes within the subdeltas. Crevasse, or breaks in the levees, divert sediment and can result in extensive land building over varying time periods, forming small splays or large subdeltas.

Artificial modifications of the Mississippi River and its delta have contributed to lower rates of land formation and higher rates of deltaic deterioration in recent years. Artificial levees and revetments have reduced the occurrence of natural crevasse and their associated land-building processes. Lower rates of land progradation at the mouth of major distributaries is the result of channelization and sediment deposition in deeper waters. Artificially created crevasse and the beneficial use of dredged materials by the U.S. Army Corps of Engineers has imitated the role of natural crevasse in diverting sediment from the channels into shallow water for marsh and other habitat creation.

In this report, UNO/LSU presents the results of the continuation of monitoring along the Southwest Pass navigational channel (Figure 3a) and Southwest Pass - Pass a Loutre disposal area (Figure 3b) through the USACE-NOD Fiscal Year (FY) 2000 maintenance event.

The natural and man-made habitats in the study area were classified using aerial photography. Photography acquired December 1985 and January 4, 2001 was used for Southwest Pass and for Pass a Loutre. Through GIS analysis, these areas were measured and changes calculated. Field surveys were conducted in March and April 2001 on the beneficial use areas created through FY00 at Southwest Pass, and in April 2001 at areas created in FY98 at Pass a Loutre. Habitats were ground truthed and survey transects established to document vegetation species and stacking elevations, and as a base for measuring compaction.

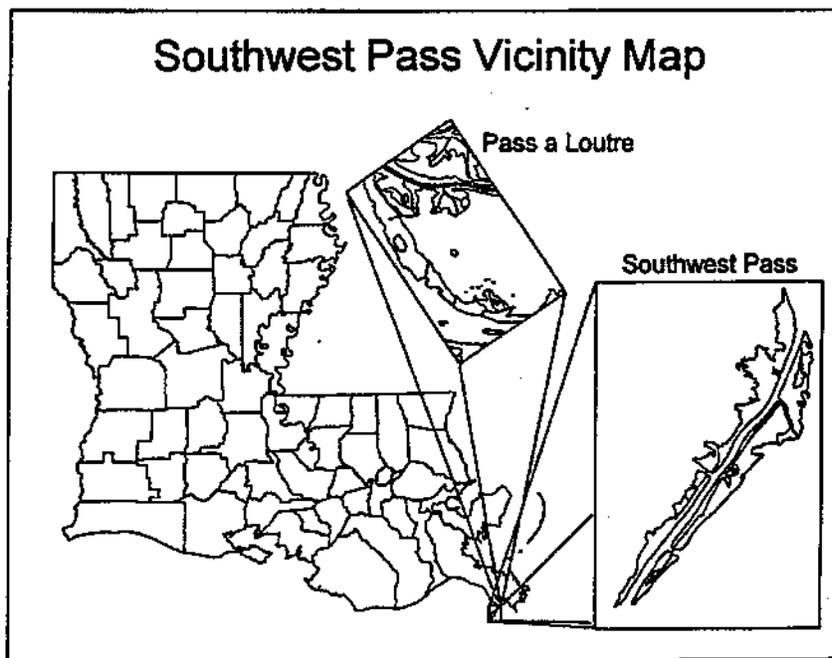


Figure 2. Location map of Southwest Pass and Pass a Loutre BUMP study areas.

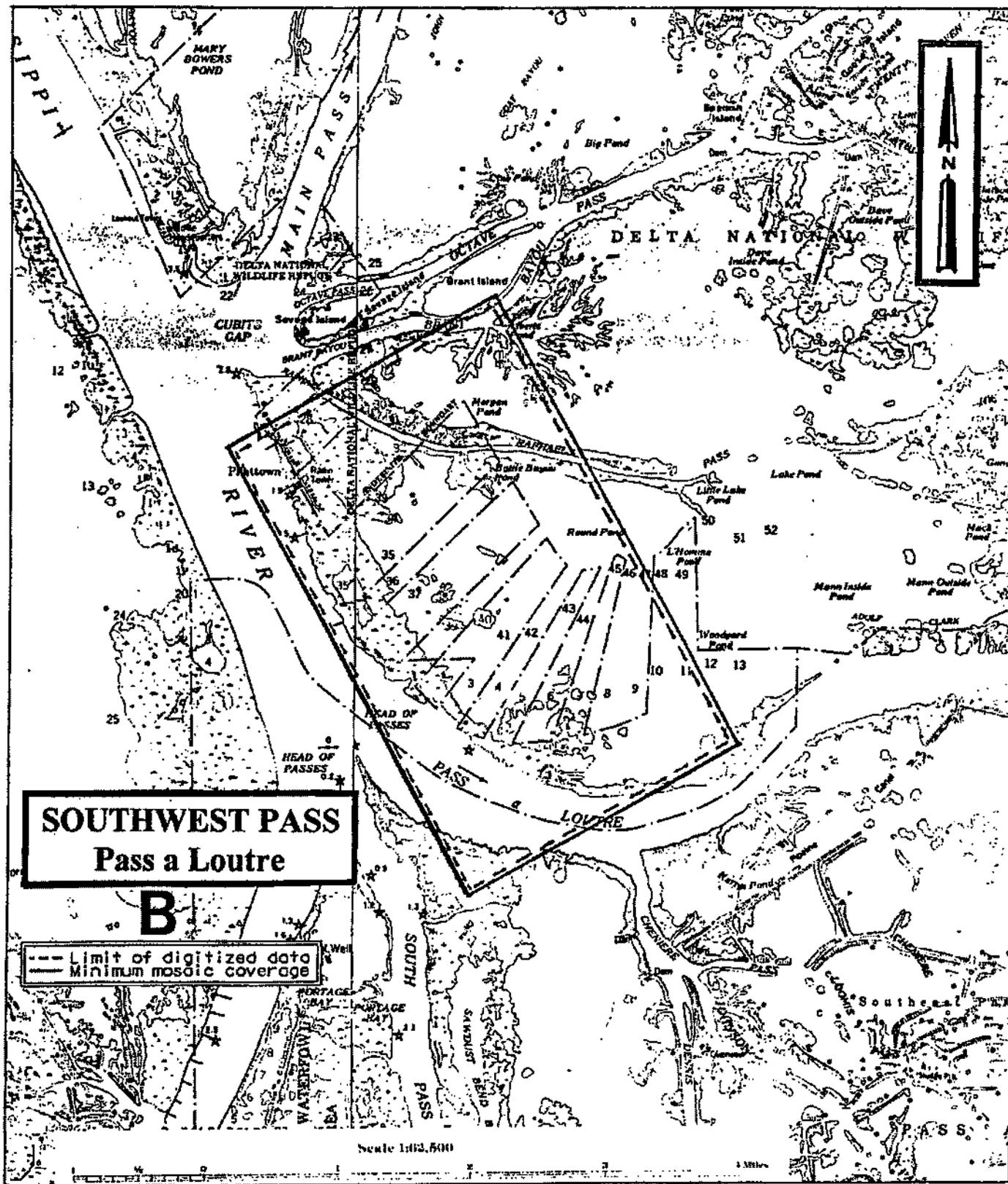


Figure 3B. The Mississippi River - Pass a Loutre BUMP study area showing the minimum coverage of the aerial photo-mosaic and the limits of the digitized area.

**NAVIGATION, DREDGING, AND
BENEFICIAL USE OF DREDGED MATERIAL DISPOSAL HISTORY
MISSISSIPPI RIVER, BATON ROUGE TO THE GULF OF MEXICO, LA
SOUTHWEST PASS
Through FY 2000**

The natural distributaries of the Mississippi River have been used as navigational channels by Europeans since 1682 when La Salle explored the mouth of the river. The site of New Orleans was selected in the early 1700s, and levee construction began as early as 1717 at New Orleans to control flooding. By 1726 a levee 5400 feet long, 18 feet wide and 3 feet high had been constructed. By 1735, levees extended on both sides of the river from 30 miles above New Orleans to 12 miles below, and by 1858 extended to the Ohio River. The effect of the levee system was largely to contain floodwaters within the river channel. Although the levees decreased the number of crevasses that occurred during flood stage of the river, they increased the intensity of the crevasses which did occur, and the modern delta experienced an overall growth in area between 1890s to the mid 1920s.

In 1720, only South Pass of the Mississippi River was utilized for navigation. However, since most commerce came from an easterly direction, a pilot station known as *Balize* was established on an island off of Balize Bayou which was a distributary of Northeast Pass. The Balize settlement was destroyed before 1767 by a flood and the pilot station was moved to the north shore of Northeast Pass. By the late 1700s, Northeast Pass was being surpassed by Pass a Loutre as a main navigational channel, and South Pass had shoaled considerably. Southwest Pass had the greatest water depth over the distributary mouth bar, and by 1813, had become the major channel. Between 1852 and 1869, attempts to increase the depth of the channel at Southwest Pass and Pass a Loutre included jettying, dredging the channel mouth bar, blasting mudlumps, agitation of the bottom with steam-driven propellers, and dragging iron harrows across the bar. None of these techniques were successful and bar deposits soon reformed when attempts ceased. The building of jetties at Southwest Pass commenced in 1902 and was largely completed in 1908, although work on the project continued for nearly another decade, including damming of upstream subsidiary channels (Morgan 1977).

During the first half of the 1900's, the Mississippi River's Southwest Pass (SWP) navigational channel was maintained to a 35-foot depth. The Rivers & Harbors Act of 1945 authorized a 40-foot deep by 800-foot wide navigational channel, and in 1961 the SWP navigational channel was enlarged to achieve a 40-foot depth. The Rivers & Harbors Act of 1985 authorized a 55-foot deep channel. The SWP navigational channel is currently maintained by the USACE-NOD at a 45-foot depth and 750-foot width between Mile 4.0 Above Head of Passes (AHP) to Mile 17.5 Below Head of Passes (BHP). Between Mile 17.5 BHP and Mile 22.0 BHP the navigational channel is maintained to a 45-foot depth and 600-foot width. Construction to enlarge the channel dimensions to the current 45-foot maintained depth began in 1987. The 45-foot channel was completed from SWP to Mile 181 in 1988. Construction of the 45-foot channel from Mile 181 to Baton Rouge (Mile 232.4) was initiated in 1994 and completed in the same year.

Although dredging records prior to 1956 are sketchy, records indicate that SWP has been dredged annually in discontinuous reaches since at least 1945. Currently, SWP is dredged annually in discontinuous reaches from Mile 4.0 AHP to Mile 22.0 BHP. Both hopper and hydraulic cutterhead dredges are used to maintain the upper Mile 4.0 AHP to Mile 18.8 BHP

reach, and hopper dredges are used to maintain the lower Mile 18.8 BHP to Mile 22.0 BHP reach. Hopper dredged material from the lower part of the reach including the lower jetty and bar channel reach of the river is either agitation dredged or deposited in a designated ocean dredged material disposal site. Hopper dredged material from the upper part of the reach is deposited in an open water disposal area, the Hopper Dredge Disposal Area (HDDA), at the entrances to Pass a Loutre and South Pass. Historically, this disposal area has been dispersive and shoal material has been scoured from the site during high river flows. Hydraulically dredged Southwest Pass shoal material historically has been placed into one of three different categories of disposal areas: 1) unconfined into the open waters located on either side of Southwest Pass (including East Bay and West Bay), 2) behind existing foreshore dikes for bank stabilization purposes, and 3) shallow open water areas for wetland creation.

Since 1975, material hydraulically dredged from Southwest Pass has been utilized to create marsh. The 1976 Mississippi River, Baton Rouge to the Gulf of Mexico Final Environmental Impact Statement (FEIS) Supplement, and the 1982 Deep-Draft Access to the Ports of New Orleans and Baton Rouge, Louisiana FEIS, both outlined placement of dredged material in open water habitats for marsh creation purposes. In 1975, a marsh creation experiment was conducted at East Bay. In coordination with the Louisiana Department of Wildlife and Fisheries, the NOD developed a plan in which approximately 4,000,000 cubic yards (CY) of dredged material was placed into the open water of East Bay to create marsh.

The 1985 Mississippi River, Baton Rouge to the Gulf of Mexico FEIS Supplement 2 discussed the utilization of material dredged from Mile 11.6 AHP to Mile 20.1 BHP for bank nourishment and marsh creation. Placement of dredged material behind foreshore dikes for bank nourishment between Mile 11.6 AHP to Mile 0.0 would be to a maximum initial height of +8.3 feet Mean Low Gulf (MLG) (+7.5 feet National Geodetic Vertical Datum (NGVD)) to achieve a maximum final height of +5.3 feet MLG (+4.5 feet NGVD). Between Mile 0.0 and Mile 20.1 BHP, dredged material placed for bank nourishment would be discharged to a maximum initial height of +7.8 feet MLG (+7.0 feet NGVD) to achieve a final height of +4.8 feet MLG (+4.0 feet NGVD). This maximum initial height restriction of dredged material was changed to +6.0 feet MLG (+5.2 feet NGVD) in 1987. Material excavated during maintenance dredging that was not used for bank nourishment would be discharged unconfined into open water habitats for marsh creation.

Since 1975, and probably earlier, open water placement of dredged material into East Bay was restricted to a maximum initial discharge height of +10.0 feet MLG (+9.2 feet NGVD) to offset the erosive effects of the high energy wave environments. Placement of dredged material into other open water habitats was restricted to a maximum initial height of +6.0 feet MLG (+5.2 feet NGVD). Subsequent consultation with the U.S. Fish and Wildlife Service led to the determination that dredged material placed at these heights did not result in the formation of intertidal marshland. In 1988, the maximum height restriction was changed to +6.0 feet MLG (+5.2 feet NGVD) for East Bay disposal and to +4.5 feet MLG (+3.7 feet NGVD) with an expected final height of +3.0 feet MLG (+2.2 feet NGVD) for other open water disposal areas to facilitate intertidal marsh formation. Further consultation with various state and Federal resource agencies resulted in another modification of the initial height restriction for material placed in these other open water areas to +4.0 feet MLG (+3.2 feet NGVD) in 1996.

Open water disposal areas dedicated to wetland creation were established in 1992 at specific locations in the West Bay (West Bay Mandatory Disposal Area (WBMDA) at Mile 14.5 BHP) and in the East Bay (East Bay Mandatory Disposal Area (EBMDA) at Mile 9.5 BHP) of Southwest Pass. Initial plans for the WBMDA called for a crescent-shaped design to extend into West Bay in order to help retain dredged material from subsequent placements. Prior to 1996, a maximum discharge height for dredged material placed at the West Bay site was +6.0 feet MLG (+5.2 feet NGVD) with an expectation that, following dewatering and compaction, a final height of +3.0 feet MLG (+2.2 feet NGVD) would be achieved. This maximum elevation height restriction was chosen to offset the erosive effects of the high energy wave environment present in West Bay. The WBMDA design plan was altered in 1996 to create a continuous spit to be angled away from the existing shoreline. The maximum initial height of dredged material placed at this site was also changed to +4.5 feet MLG (+3.7 feet NGVD) with an expected final height of +3.0 feet MLG (+2.2 feet NGVD). Approximately 2,291,200 cy of dredged material have been placed at the WBMDA since 1992, including 274,200 cy in FY 99.

The EBMDA was authorized under Section 150 of the Water Resources Development Act of 1976. Prior to 1996, material placed at the EBMDA was not to exceed a maximum initial height of +4.5 feet MLG (+3.7 feet NGVD). This maximum height restriction was changed to +4.0 feet MLG (+3.2 feet NGVD) in 1996. Approximately 827,000 cy of dredged material have been placed at this site since 1992. Once this site had been filled to capacity, plans called for placing material into the open water of East Bay. The EBMDA was determined to be filled to capacity in 1996.

During FY 2000, no cutterhead dredging was performed in Southwest Pass due to the low water conditions experienced in the Mississippi River.

Figure 4A illustrates the dredged material disposal history for the Southwest Pass study area in detail between FY 1985 and FY 1995. Figure 4B illustrates the more recent dredged material disposal history up to FY 2000, showing FY 1996 through FY 2000 disposal in detail.

Approximately 7,000,000 cubic yards of material are discharged annually into the HDDA at the Head of Pass a Loutre and South Pass. The disposal material in the HDDA usually is scoured from the site during high river flows. However, on occasion, extensive shoaling in Southwest Pass results in the rapid temporary filling of this disposal area. In FY 1998, the New Orleans District implemented a management plan for the HDDA in order to insure continuous availability of the site for hopper dredge disposal. The management plan included dredging within the existing HDDA and placement of the dredged material into a 298-acre, shallow, open water area, the Pass a Loutre Disposal Area (PALDA) (Figure 4C), on the east side of the Mississippi River north of Pass a Loutre within the Delta National Wildlife Refuge in a manner conducive to wetlands development.

In FY 1998 (November 21, 1997 - February 21, 1998), approximately 1,051,661 CY of material were hydraulically dredged from the HDDA and placed unconfined in shallow open water in the northern one-third of the designated PALDA (Figure 4C). The specified maximum initial height of the dredged material was +3.0 feet MLG (+2.2 NGVD); however, during construction, the material was stacked too high and had to be washed down. At the project's completion, the

elevation of most of the dredged material placed in the PALDA was +3.0 feet MLG (+2.2 feet NGVD) or less. Following compaction and de-watering, final elevations of +1.0 to +0.5 feet MLG (+0.2 feet NGVD) are expected.

Southwest Pass Dredged Material Disposal History Through FY 1995

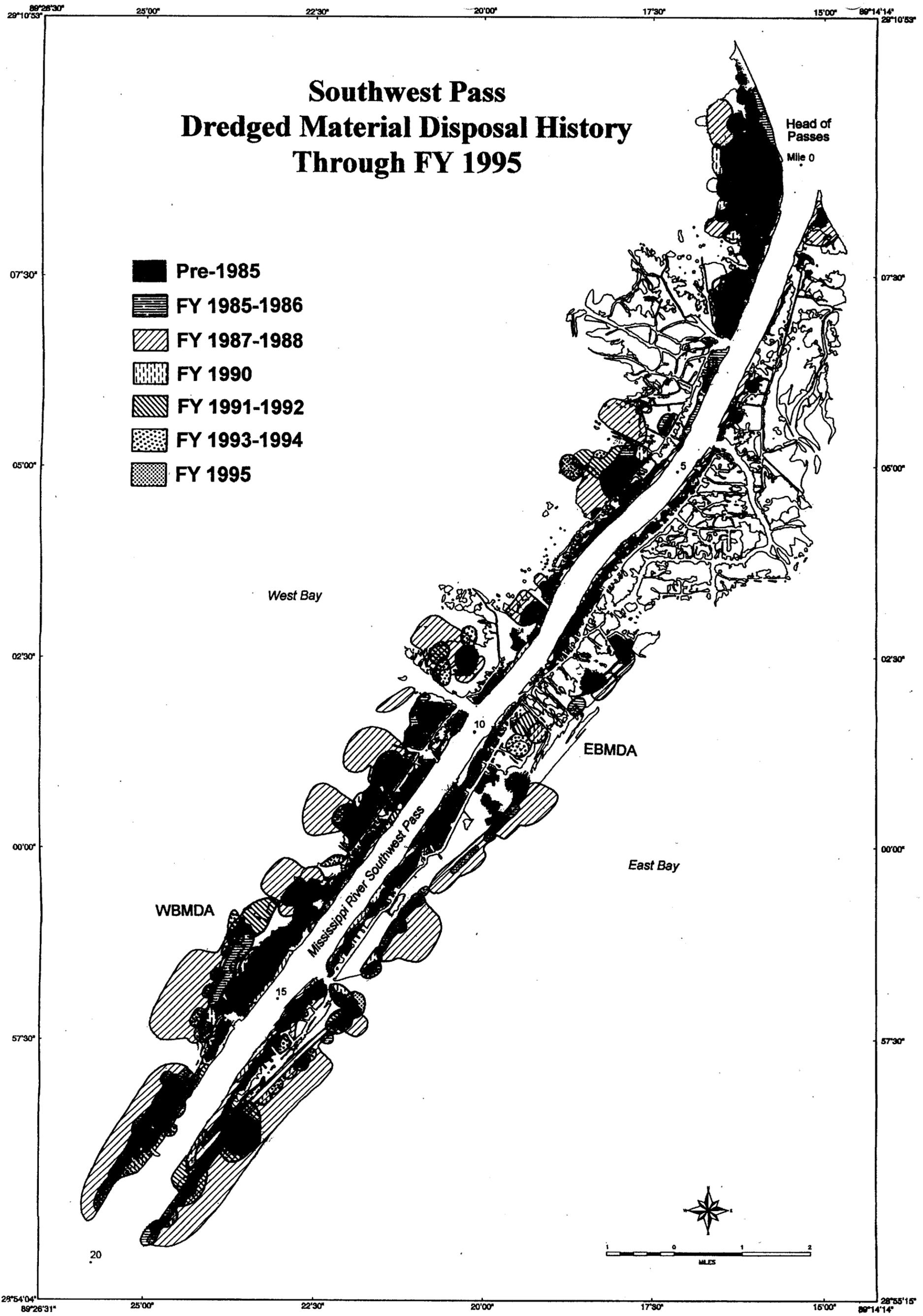


Figure 4A. The dredged material disposal history for the Mississippi River - Southwest Pass BUMP study area, showing FY 1985 through FY 1995 disposal in detail

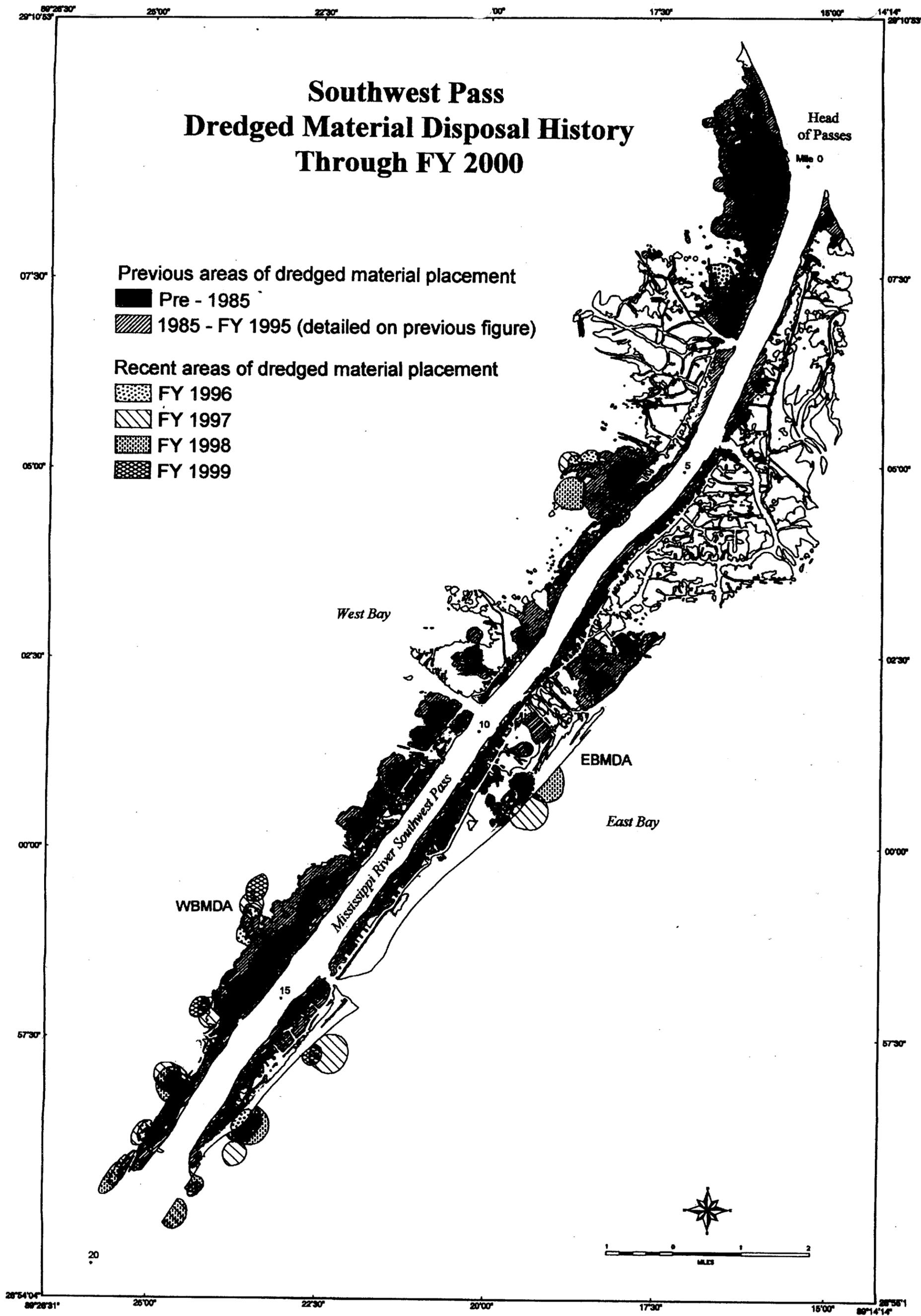


Figure 4B.

The dredged material disposal history for the Mississippi River - Southwest Pass BUMP study area, showing the FY1996 through FY2000 disposal in detail. There was no cutterhead dredging, and therefore no beneficial use disposal, in FY2000.

Dredged Material Disposal History Pass a Loutre Disposal Area

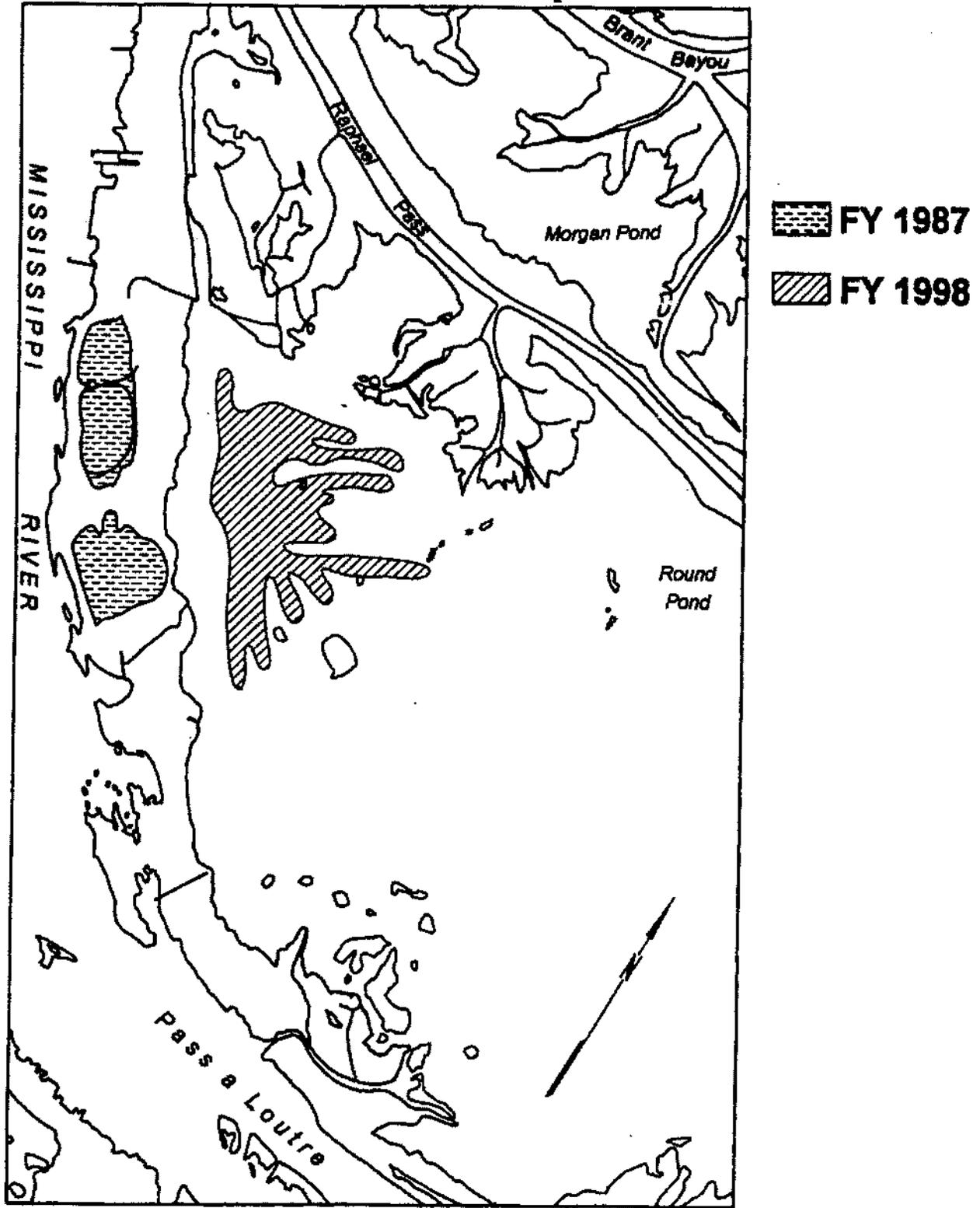


Figure 4C. The dredged material disposal history for the Pass a Loutre BUMP study area showing disposal through FY2000. The last disposal in this area was FY1998.

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 Southwest Pass navigation channel and for Pass a Loutre was 1985 and the historical 1985 aerial photography was acquired from the U.S. Geological Survey Earth Resources Observation Systems (EROS) Data Center. Photography was acquired by UNO's air photo contractor during October 1997 at Southwest Pass and during January 1999 at Pass a Loutre. Color infrared photography was acquired at a scale of 1:24,000. There was a 60 percent forward overlap of the photography that 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 UNO/LSU. A second set of color infrared photography was provided to the USACE-NOD.

From base year to FY1999, study areas were interpreted and mapped from the base year photography and the color infrared aerial photography using a Bausch and Lomb zoom transfer cope. USGS quadrangle maps were used for the initial ground control to set the interpretations in the state plane coordinate system. The absolute accuracy is $\pm 50'$ and the relative accuracy is $\pm 10'$. Beginning in FY2000, habitats were interpreted using Erdas ImagineTM remote sensing software. The current FY photo-mosaic was interpreted by a supervised classification of spectral reflectance, texture and tone. Shorelines were 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 both Pass a Loutre and Southwest Pass BUMP study sites was done by floatplane on November 19, 1999. 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. The current field monitoring for Southwest Pass was conducted on March 19 and April 5-6, 2001. Field monitoring for Pass a Loutre was conducted on April 6, 2001.

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://www.coastal.uno.edu/coastal/research/bump/>

SOUTHWEST PASS NAVIGATION CHANNEL

Southwest Pass (SWP) is the main distributary of the Mississippi River. It carries the majority of the river's flow and is used for national and international shipping traffic. The Southwest Pass BUMP study area encompasses both sides of the navigational channel, approximately Mile 2 Above Head of Passes (AHP) to Mile 18.5 Below Head of Passes (BHP) (Figure 3b). Head of Passes is the location where the lower Mississippi River abruptly divides into several major distributaries. Most of the SWP landscape has been created or altered by the placement of dredged material.

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 in 1998 by discussion with the USACE-NOD, reviewing vertical aerial photography, and reviewing dredging schedules and history. Based on these factors, four areas were selected: three on the west side of the channel and one on the east. Gaining access to the selected sites proved to be somewhat difficult. On November 19, 1998, access was not possible because the floatplane could not land in shallow waters with unknown obstacles. An airboat could not traverse the expanse of open water on the west side of the sites because of weather, and crossing the foreshore rock dikes from the riverside was too dangerous with the probability of high wakes from passing ships. On December 15, 1998, one transect line was successfully positioned on the west-central site utilizing a boat for access, and on February 24, 1999, one transect line was positioned on each of the other sites utilizing a helicopter for access (Figure 5). Two stakes were placed to define each transect line, recording secondary features such as towers, navigation markers, or cattle enclosures 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.

Phase-II involved the actual collection of profile data. On December 15, 1998 and February 24, 1999, the initial profile surveys were conducted along the transects defined by the stakes during phase-I. On March 19, 2001, profile data was successfully re-collected at the East Bay site, the southern West Bay site, and half of the profile at Head of Passes by helicopter before weather became too dangerous to fly. On April 5, 2001, the Central West Bay site was revisited by boat, and new data acquired. On April 6, 2001 we returned to the Head of Passes by airboat to complete the profile begun in March, and revisited the Pass a Loutre site. The stakes were located and new profile data were collected.

One transect profile was collected from each of the sites. Survey data 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 ∇ 0.0125 ft., with a vertical accuracy of 0.45 ft ∇ 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 - Southwest Pass Mississippi River station #4593, Louisiana (28E56' N / 89E 26' W). The mean diurnal tidal range for the Southwest Pass study area is published as 1.3 ft.

Field monitoring for vegetative species composition and habitat verification was done initially on December 15, 1998 and February 24, 1999; and were revisited on March 19, 2001 and April 5, 2001. 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. Revisited transects can exhibit differences in species composition due to the large number of opportunistic annual species that can occur in an area for a short period of time, or due to the discovery of the identity of a formerly unidentifiable species (such as grasses).

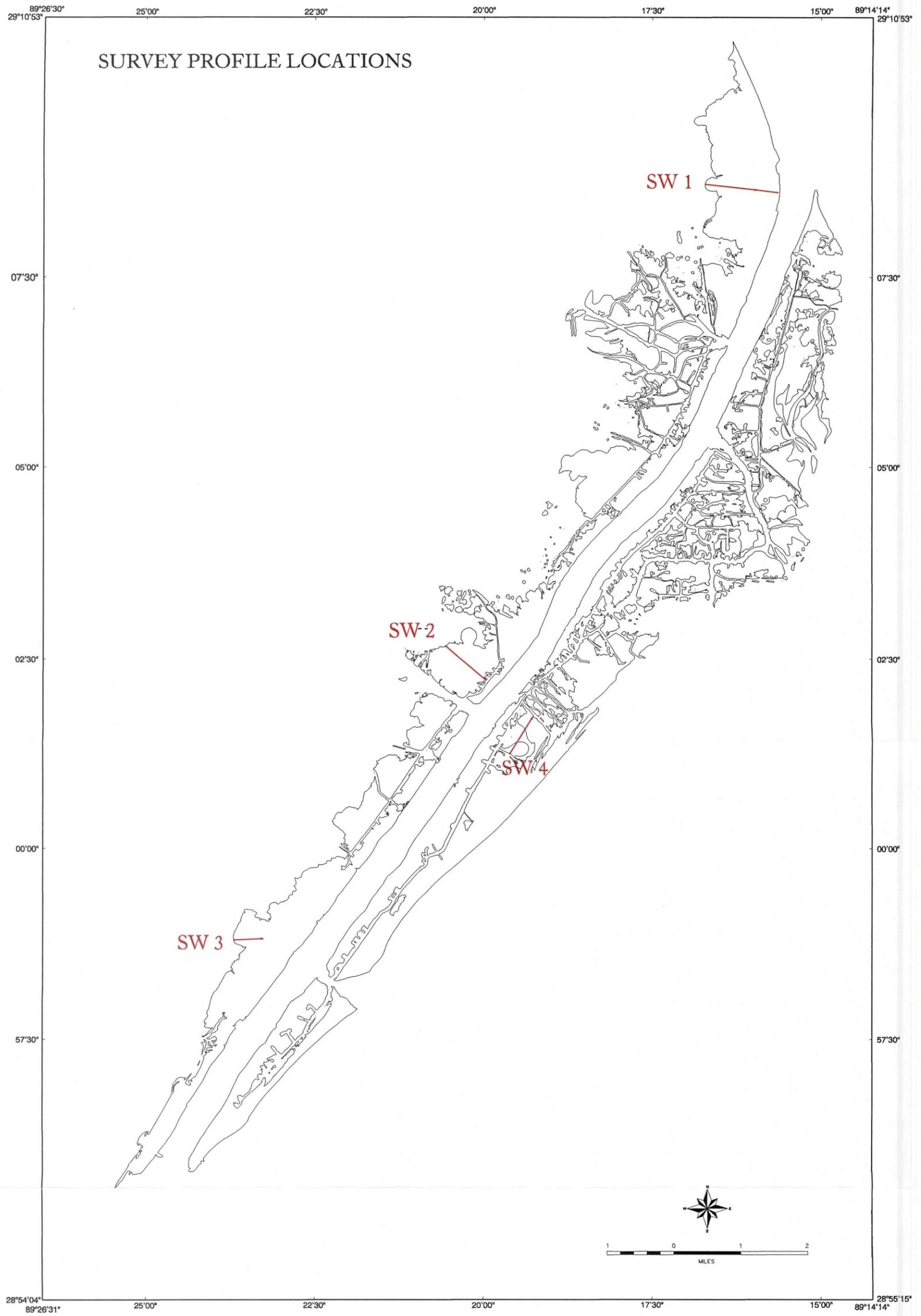


Figure 5

Location of the four elevation transects at the Southwest Pass - BUMP study area.

Profiles at Southwest Pass

The 1998/99 profiles were established with two metal poles (stakes) partially buried and anchored with concrete, and extending 2-3 feet from the sediment surface. In 2001, several of the poles were bent or missing, and those transects had to be re-established. It is theorized that the cattle in the area may have pushed some of the poles over while scratching against them.

Southwest Pass - Head of Passes

The Southwest Pass - Head of Passes site is located on the west side of the channel just south of the Head of Passes near Mile 0.6 BHP (Figure 5). This area along the channel has been used for disposal during maintenance dredging for many years prior to 1985. The last disposal within this area was along the outer shoreline in FY90 (Figures 4A & 4B).

The previous elevation and vegetation data were acquired February 24, 1999. The site was revisited on March 19, 2001 by helicopter and April 6, 2001 by airboat. The transect SW1 was oriented to cross recent disposal in the area and crossed the entire width of land between the river bank behind the foreshore rock dike and West Bay (Figure 6). The transect was delineated by 1 stake north of a cattle enclosure between two isolated trees, and a second stake set 270 ft away across a fence toward the west (Figure 7). "Stake 1" had to be replaced in 2001 which caused a slight shift in the far reaches of the transect. Changes were observed in vegetative cover as annuals and opportunistic species changed between profile periods (Figures 8 & 9) The landscape was dominated by upland habitats and included elevated ponds and freshwater marshes. Trees observed in the area were large willow (*Salix nigra*) and small acacia (*Acacia farnesiana*) (Figure 10). The area is currently used for the grazing of cattle which encourages the stability and development of extensive grasslands (Figure 11). The higher elevations were occupied by extensive, clumpy blackberry thickets separated by cattle trails and grassland (Figure 12). The disposal material was made up of fine silty sand.

The profile was over a mile long and had a length of 5691 ft (Figure 13). The maximum relief along the axis was 14.5 ft MLG (13.7 NGVD), at the location of stake 1, with an average relief of 6.6 ft MLG (5.8 NGVD). The published tidal range for Southwest Pass is 1.3 ft.

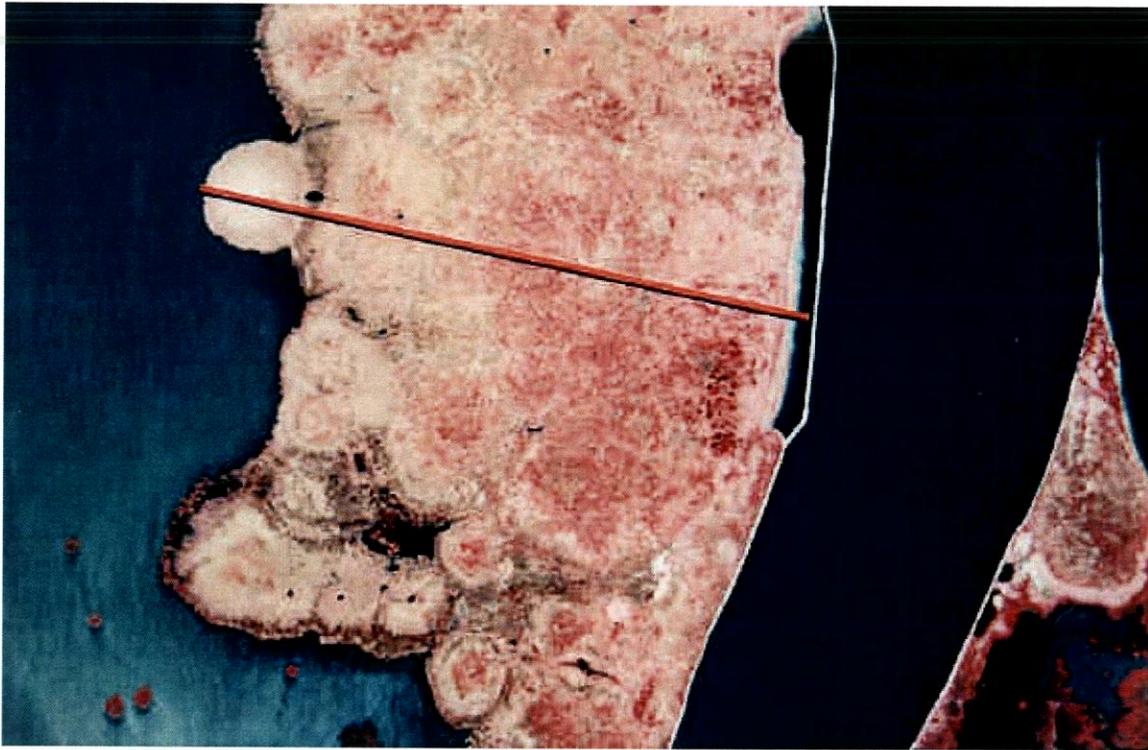


Figure 6. Infrared vertical aerial photography taken on October 16, 1997 of the Head of Passes area at Southwest Pass, showing the approximate location of the transect SW1.

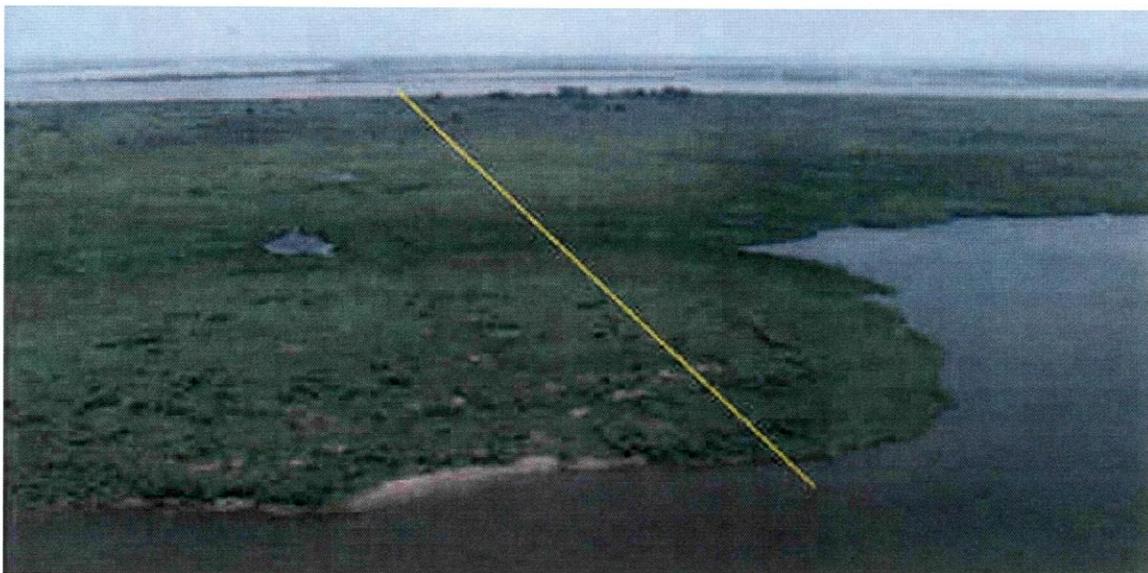


Figure 7. Oblique aerial photograph taken in June 2001 with approximate location of the transect indicated by the yellow line. (Photo from *The Aerial Videotape Survey of Coastal Louisiana -- 2001*, LSU Aerial Videotape Survey Program).

A)



B)



Figure 8. A) Photograph taken on February 24, 1999 at the end of transect SW1 at the Southwest Pass - Head of Passes BUMP study site. B) Same shot taken April 6, 2001, showing the difference that can occur because of short-term, opportunistic vegetation.

A)



B)



Figure 9. A) Photograph taken on February 24, 1999 along transect SW1 at the Southwest Pass - Head of Passes BUMP study site showing a pond with associated marsh vegetation. B) Same shot taken April 6, 2001, showing the difference that can occur because of short-term, opportunistic vegetation.



Figure 10. Photograph taken on April 6, 2001 near transect SW1 at the Southwest Pass - Head of Passes BUMP study site, showing grassland and small acacia tree.



Figure 11. Photograph taken on April 6, 2001 along transect SW1 at the Southwest Pass - Head of Passes BUMP study site showing extensive grasslands used for grazing cattle.



Figure 12. Photograph taken on March 19, 2001 along transect SW1 at the Southwest Pass - Head of Passes BUMP study site showing the dewberry or southern blackberry terrace.

SOUTHWEST PASS, LA

Head of Passes

March 19 & April 6, 2001

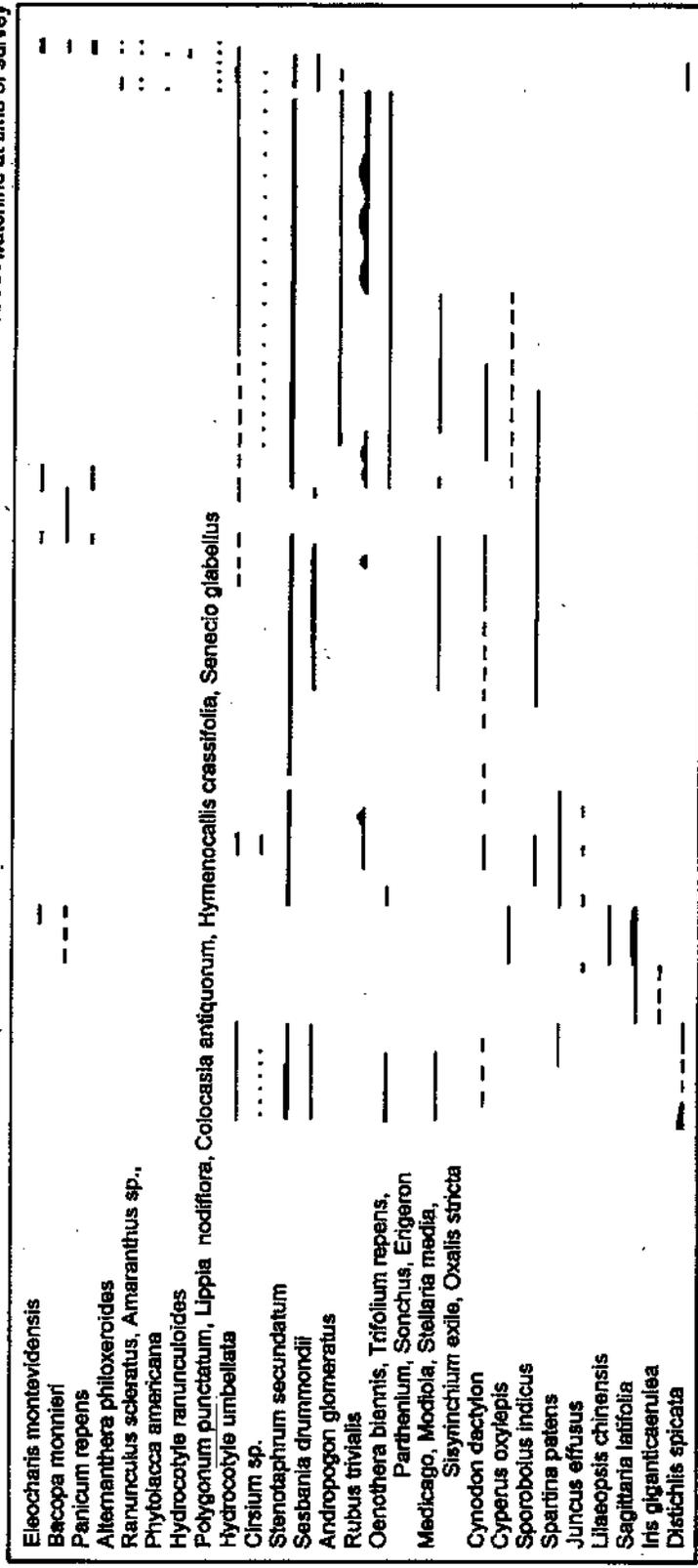
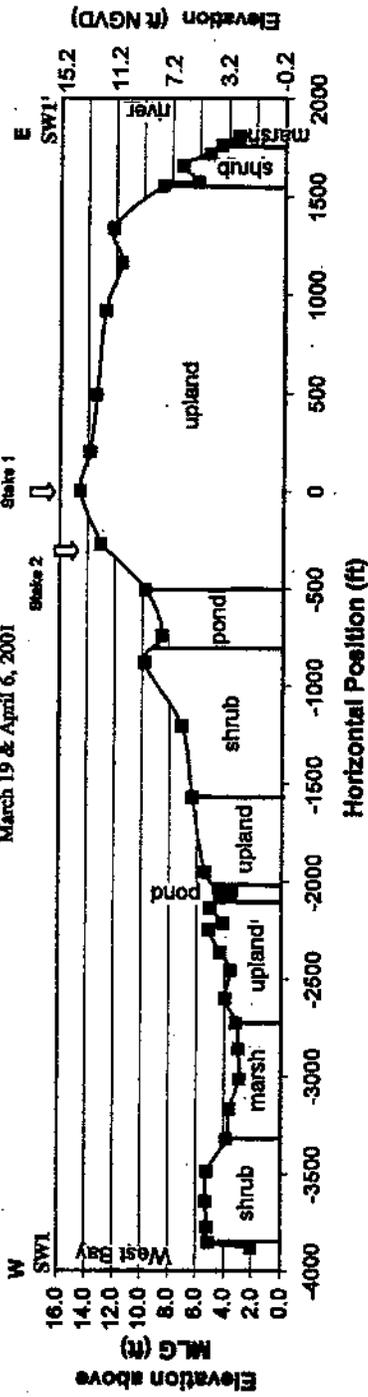


Figure 13. Elevation profile SW1 at the of the Southwest Pass - Head of Passes BUMP study site with vegetation data illustrated.

Southwest Pass - Central West Bay

The site at Central West Bay is located along the west side of the Southwest Pass channel near Mile 9.5 BHP (Figure 5). It was accessed by boat through a navigation break in the foreshore rock dike along the river and by the access canals to an oil facility. The last disposal within this area was along the outer shoreline in FY93-4 (Figures 4A & 4B).

The initial elevation and vegetation data was acquired December 15, 1998, and was revisited on April 5, 2001. The transect SW2 was delineated by two stakes and crossed the width of land between the access canal and the West Bay shoreline (Figure 14). The transect was oriented to cross recent disposal in the area. The first stake was placed near a cattle loading enclosure on the top of an eroding ridge created by maintenance of the access canal. The second stake was placed 406 ft away on the other side of a fenced cattle run. "Stake 2" had to be replaced in 2001 which caused a slight shift in the far reaches of the transect, so that no trees were recorded on the 2001 profile.

The landscape was dominated by upland habitats and included ponds and fresh marshes (Figure 15). The marsh at the end of the transect into West Bay was salt marsh dominated by *Spartina alterniflora* (Figure 16). The upland habitats are dominated by grasses and low forbes, sometimes with an open canopy of *Sesbania* shrubs (Figure 17). The area is currently used for the grazing of cattle which encourages the stability and development of extensive grasslands. Iva shrub thickets have developed on lower areas: bordering newer deposits, ponds and sloughs, and had obscured the fence next to the ridge since 1998 (Figure 18). The erosional face of the ridge next to the access canal had been colonized by an intermediate marsh at the base and grasses with lantana shrubs up the slope (Figure 19). The disposal material was made up of fine silty sand.

The profile here had a length of 3564 ft (Figure 20). The maximum relief along the axis was 15.4 ft MLG (14.6 ft NGVD), at the edge of the ridge next to the navigation channel, with an average relief of 4.9 ft MLG (4.1 ft NGVD). The published tidal range for Southwest Pass is 1.3 ft.

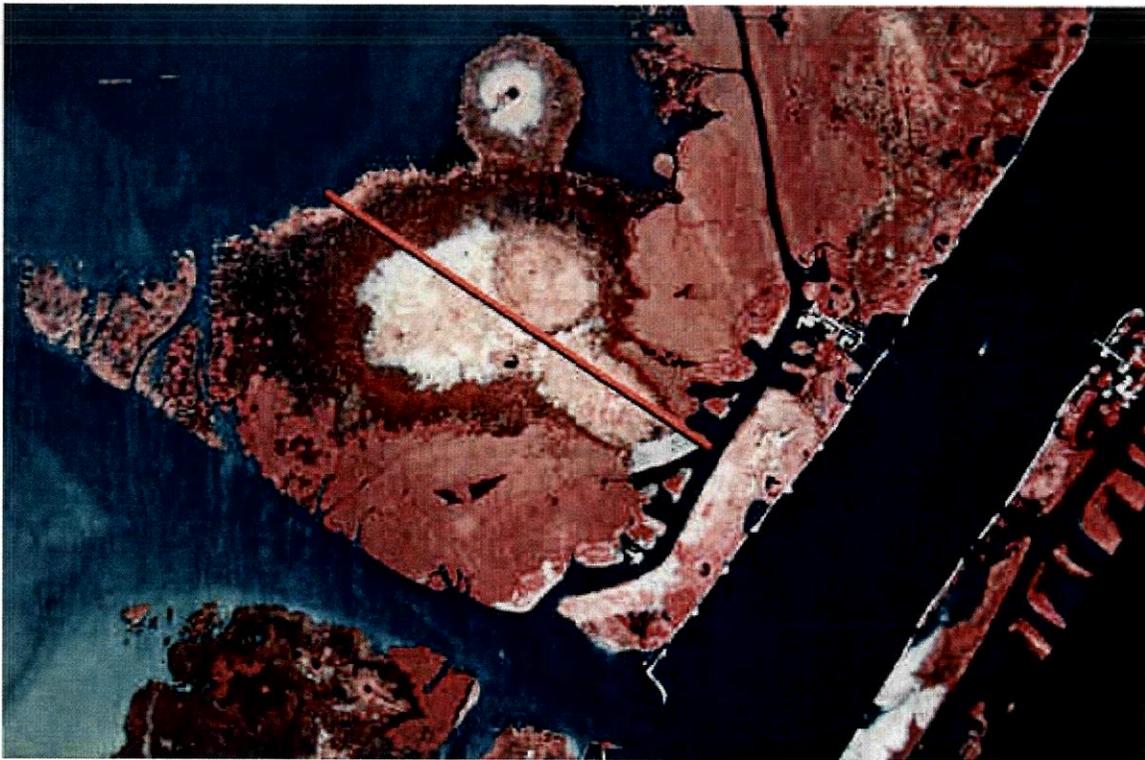


Figure 14. Vertical aerial photograph of the transect SW2 at the Southwest Pass - Central West Bay BUMP study site on October 16, 1997.



Figure 15. Photograph taken on April 5, 2001 along transect SW2 - Central West Bay showing shrub, upland, and fresh marsh habitats and a pond. This view is in line with the transect toward West Bay, from the instrument placed over stake 1 on the ridge.



Figure 16. Photograph taken April 5, 2001 along transect SW2 - Central West Bay, showing wide area of *Spartina alterniflora* toward the end of the transect, looking toward West Bay.



Figure 17. Photograph taken April 5, 2001 along the central part of transect SW2 - Central West Bay, showing the extensive grassland with old Sesbania shrubs.

A)



B)



Figure 18. Photographs taken along transect SW2 - Central West Bay, looking past the former location of stake 2 to the instrument placed over stake 1 on the ridge next to the access canal. Notice the log on the left side of the picture for reference, and the difference in vegetative cover and the shrub thicket that now appears in front of the fence line. A) December 15, 1998. B) April 5, 2001.

A)



B)



Figure 19. Photographs taken of the cliff at the instrument end of transect SW2 - Central West Bay. A) December 15, 1998. B) April 5, 2001.

Southwest Pass - Southern West Bay

The Southwest Pass - Southern West Bay site is located on the west side of the channel adjacent to the old lighthouse near Mile 14.5 BHP (Figure 5). This area along the channel has been used for disposal during maintenance dredging for many years prior to 1985. The last disposal within this area was along the outer shoreline in FY97 (Figures 4A & 4B).

The initial elevation and vegetation data was acquired February 24, 1999, and was revisited for new data on March 19, 2001. Access to the area was by helicopter. The transect SW3 was oriented to cross the most recent disposal in the area. The transect crossed the width of land between the lighthouse and West Bay (Figure 21 & 22). The transect was delineated by 1 stake north of the old lighthouse, and a second stake set 149 ft away toward the west (Figure 23).

The eastern end of the transect was in a well established *Spartina alterniflora* saltmarsh (Figure 24). The remainder of the transect crossed bare to sparsely vegetated, low relief mudflats dominated by saltgrass (*Distichlis spicata*) and oyster grass (*Spartina alterniflora*) in the lower areas and Bermuda grass (*Cynodon dactylon*) in the higher areas (Figures 25). Glasswort (*Salicornia bigelovii*) occurred throughout the transect. The area is frequented by cattle which encourages the development of grasslands. The western end of the transect has been eroded to form a beach and washover flat which was previously dune and incipient upland (figure 26). The rest of the transect was slightly more vegetated than what was found in 1998.

The profile had a length of 1983 ft (Figure 27). The maximum relief along the axis was 4.5 ft MLG (3.8 ft NGVD), at the berm along the outer shore, with an average relief of 3.0 ft MLG (2.3 ft NGVD). The published tidal range for Southwest Pass is 1.3 ft.



Figure 21. Vertical aerial photograph taken on October 16, 1997 of the area containing the SW3 transect (black line) at the Southwest Pass - Southern West Bay BUMP study site. The old lighthouse can be seen as a dot indicated by the arrow.



Figure 22. Oblique photograph taken in June 2001 of the area containing the SW3 transect (approximately represented by the yellow line). From the *Aerial Videotape Survey of Coastal Louisiana -- 2001*, LSU Aerial Videotape Survey Program.

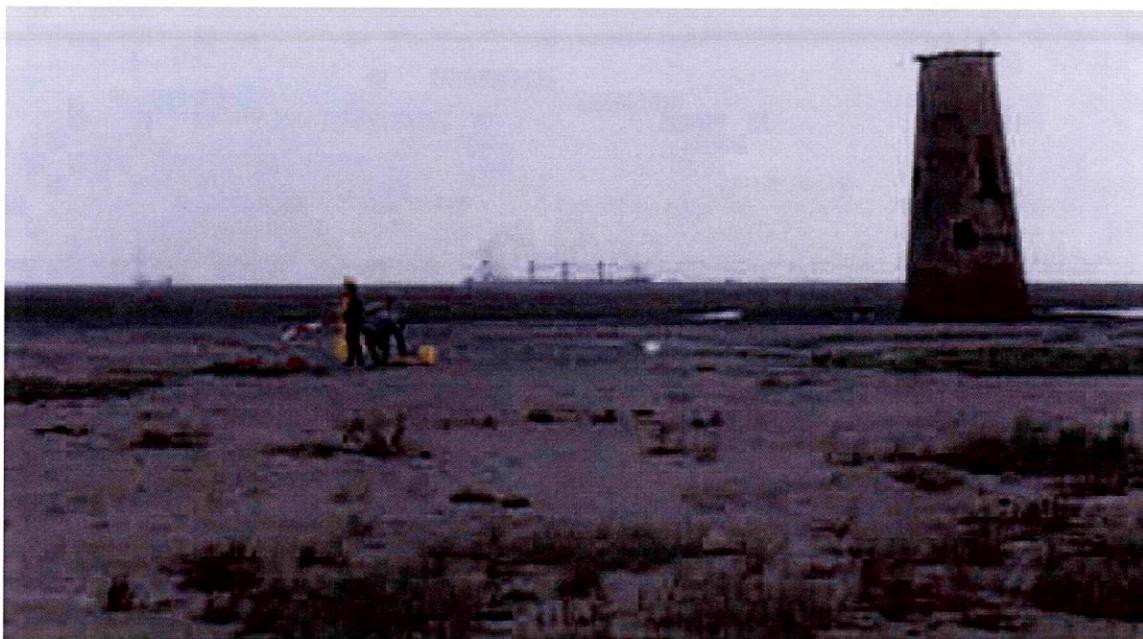


Figure 23. Photograph of transect SW3 at the Southwest Pass - Southern West Bay BUMP study site on March 19, 2001. Stake 1 was placed near the old lighthouse.



Figure 24. Photograph of transect SW3 at the Southwest Pass - Southern West Bay BUMP study site on March 19, 2001. The transect began in the well established salt marsh east of the lighthouse. The view is looking southeast toward the Mississippi River.



Figure 25. Photograph taken on March 19, 2001 along transect SW3 at the Southwest Pass - Southern West Bay BUMP study site. The newer deposits were only sparsely vegetated with Bermuda grass on the slightly higher areas and *Spartina* on the lower.



Figure 26. Photograph taken on March 19, 2001 at the western end of transect SW3 at the Southwest Pass - Southern West Bay BUMP study site. Washover flat now occupies what was once a dune habitat.

SOUTHWEST PASS, LA
Southern West Bay
 March 19, 2001

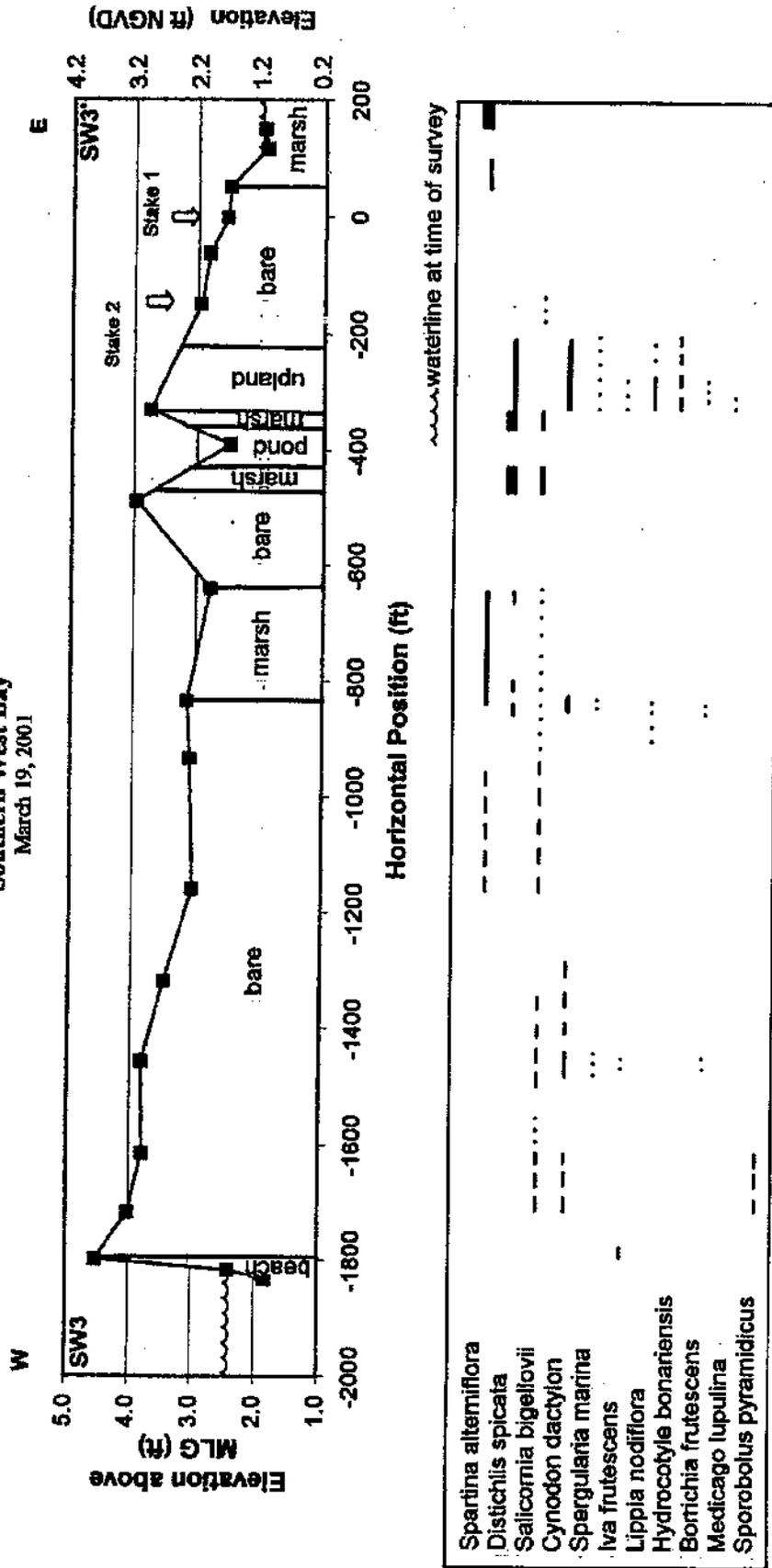


Figure 27. Elevation profile SW3 - Southern West Bay of the Southwest Pass BUMP study site with vegetation data illustrated. This site received dredged material in FY96 and FY97 and was only sparsely vegetated.

Southwest Pass - East Bay

The Southwest Pass - East Bay site is located on the east side of the channel approximately near Mile 10 BHP (Figure 5). This area is designated a wetland creation site and occupies an open area bordered by artificial ridges created during the dredging and maintenance of the surrounding oil and gas access canals (Figure 26). Disposal within this area is designed to result in a substrate conducive to the creation of wetland habitats. The last dredged material disposal within this area was in FY90 and FY93-94 (see Figures 4A & B) and resulted in the formation of two lobes of land.

The initial elevation and vegetation data was acquired February 24, 1999, and was revisited for new data on March 19, 2001. Access to the area was by helicopter. The transect SW4 was delineated by 1 stake set on each lobe of land approximately 2547 ft apart. Stake 1 on the north lobe was missing and the transect had to be re-established. The southern lobe was of lower relief and was dominated by tall, thick vegetation of a mixed marsh and shrubs (Figure 27 & 28). The two lobes were separated by a wide area of shallow water (Figure 29). The northern lobe supported marsh and upland (grassland) utilized and kept short by cattle (Figure 30).

The profile had a length of 3578 ft (Figure 31). The maximum relief along the axis is 1.9 ft MLG (1.1 ft NGVD) on the older, more northern lobe of land, and had an average relief of 0.6 ft MLG (- 0.2 ft NGVD). The water between the two measured parts of the transect was of an unknown depth. The published tidal range for Southwest Pass is 1.3 ft.

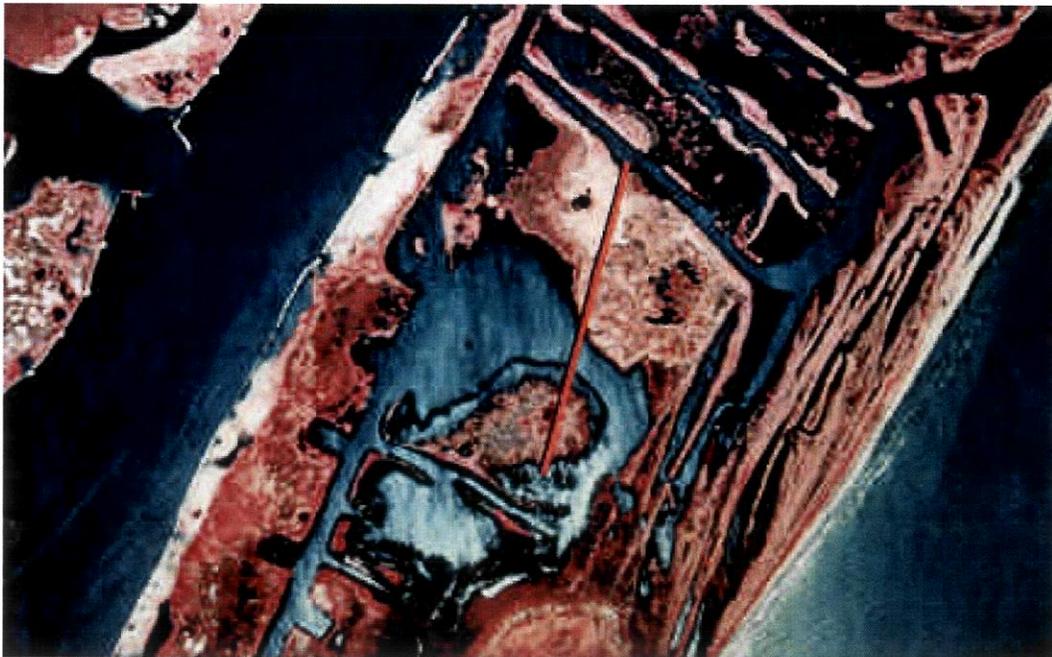


Figure 28. Vertical aerial photograph taken January 4, 2001 containing the transect SW4 of the Southwest Pass - East Bay BUMP study site. The orange line illustrates the approximate location of transect SW4.



Figure 29. Photograph taken March 19, 2001 of transect SW4 - East Bay at the Southwest Pass BUMP study site. This view is of the well-established mixed marsh on the southern side of the south lobe.



Figure 30. Photograph of transect SW4 - East Bay at Southwest Pass BUMP study site on February 24, 1999. This view is of the tall shrub/scrub habitat on the southern lobe of the transect.



Figure 31. Photograph taken on March 19, 2001 along transect SW4 - East Bay at the Southwest Pass BUMP study site, showing the mixed *Spartina* and *Sagittaria* marsh along the south shore of the north lobe. The south lobe is visible in the distance.



Figure 32. Photograph taken on March 19, 2001 along transect SW4 - East Bay at the Southwest Pass BUMP study site. This view is of fresh marsh approaching the instrument and other stake on the northern lobe of the transect.

SOUTHWEST PASS, LA

East Bay
March 19, 2001

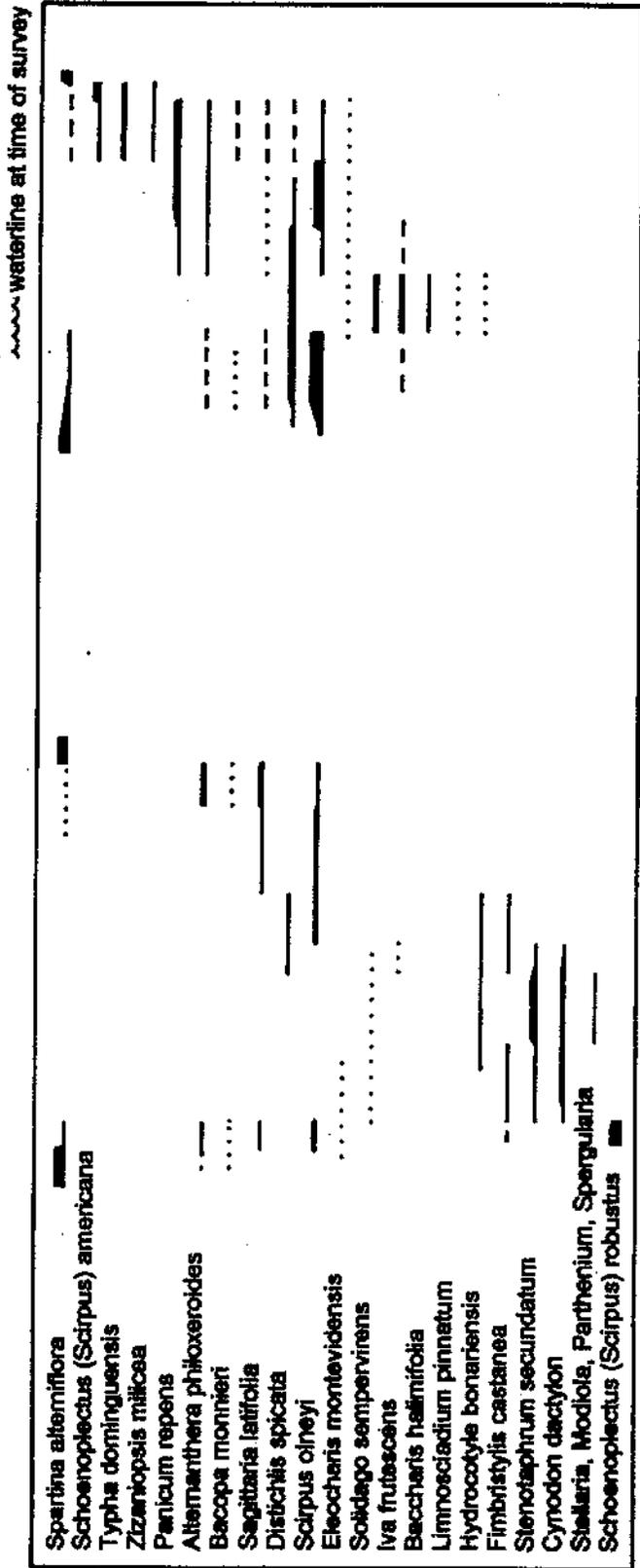
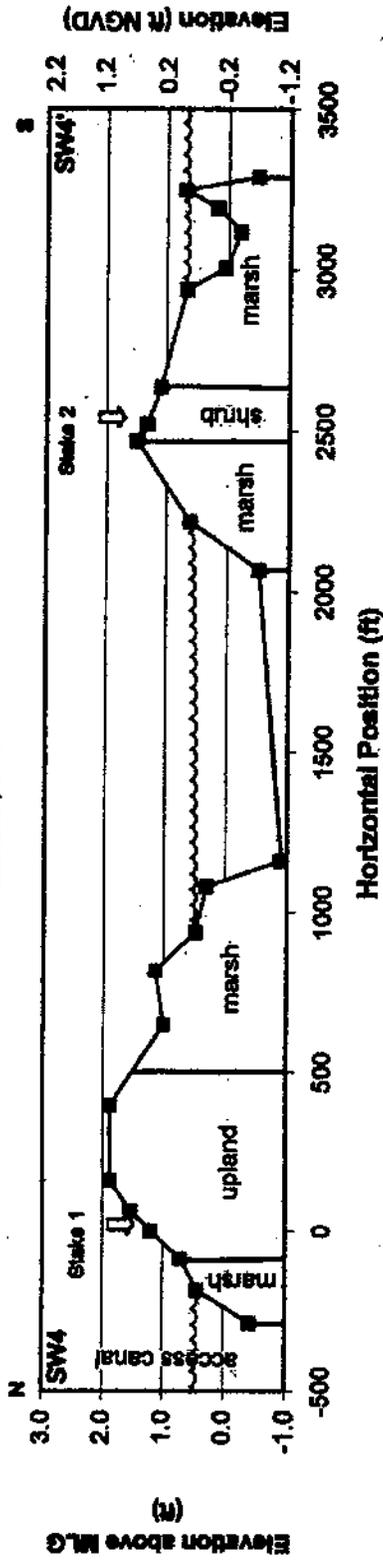


Figure 33. Elevation profile SW4 - East Bay of the Southwest Pass BUMP study site with vegetation data illustrated.

Vegetative Character of Southwest Pass

General Description

Most of the Southwest Pass topography has been created by disposal of dredged material over many years of channel maintenance or has been altered by oil and gas access canals. The older areas were created by multiple disposal events that created elevated areas supporting upland habitats such as grasslands, scattered forest, and shrub/scrub thickets. Uneven placement of the material has led to uneven relief, perched fresh marshes and multiple ponds. Narrow beaches of fine sand or organics occur along the outer shorelines of the Southwest Pass area.

Beneficial use along Southwest Pass navigational channel consisted of placing dredged material along the outer shorelines of existing land, between the foreshore rock dike and the land along the river channel, or in sheltered open water areas for wetland creation.

Southwest Pass is a riverine dominated system that is acted upon by the salt waters of the Gulf of Mexico. There is a great interaction between the seasonal levels of fresh water of the river and the tidal forces of the Gulf of Mexico. The marshes tend to be fresh adjacent to the river channel and toward the upriver reaches of the channel because of the high freshwater flow of the Mississippi River. Saline marshes predominate toward the southern reaches of the channel and toward the outer shorelines more affected by the Gulf. Mixed marshes occur frequently because of the rapidly changing salinity regimes. Erosion of the shoreline is primarily from ship wakes and high flood waters along the channel margins, and primarily from wave action and storms along the outer shores.

Vegetative community types

The overall marsh type for this area ranges between fresh marsh typified by Roseau Cane (*Phragmites communis*), elephants ear (*Colocasia antiquorum*), cattail (*Typha dominguensis*) and bull-tongue (*Sagittaria sp.*), and salt marsh typified by Oyster grass (*Spartina alterniflora*) and salt grass (*Distichlis spicata*). There is much mixed marsh marked by a mixture of the two where the conditions change too rapidly to preclude either.

Cattle are run on the somewhat isolated islands created by the topography of the channel. The cattle take advantage of the grasslands that have formed on the elevated areas and also create them by the constant removal of young shrubs and saplings during grazing. The grasslands are mostly vegetated by Bermuda and St. Augustine grass on the elevated areas and saltgrass and rushes on the lower, wetter areas, with a multitude of other grass species present (see Appendix). A multitude of upland composites are also present.

The forested wetlands are represented by willow trees (*Salix nigra*) along the transects and cypress trees (*Taxodium distichum*) further upriver along the channel. Acacia trees (*Acacia farnesiana*) occur on the higher elevations near Head of Passes. Shrub/scrub habitats are represented by the yellow rattlebox (*Sesbania drummondii*) and marsh elder (*Iva frutescens*).

GIS ANALYSIS RESULTS FOR THE SOUTHWEST PASS NAVIGATION CHANNEL

Shoreline Changes of Southwest Pass: 1985-2001

Figure 34 graphs the spatial history of the Mississippi River - Southwest Pass BUMP study area between December 1985 and January 2001. Table 1 documents the changes and Figure 35 illustrates the changes that took place at Southwest Pass between 1985 and 2001.

In December 1985, the Southwest Pass study area was measured at 9,389.5 acres. The study area in January 2001 measured 19,967.5 acres. This is a cumulative area increase of +10,578.0 acres at a rate of +700.5 acres per year for this 15.1 year period. This represents a total area increase of the Southwest Pass BUMP study site by 53 percent between 1985 and 2001. There was an overall increase in the area of Southwest Pass of +7,352.7 acres in the natural areas. The contribution of BUMP related and other man-made areas accelerated the rate of growth by +3,225.3 acres. BUMP-made land totaled +7,771.7 acres in 2001, with +2,711.0 acres of increase between 1985 and 2001. Other man-made land totaled +1,515.6 acres, with +514.3 acres created between 1985 and 2001. The BUMP-made habitats accounted for 26 percent of the increase in area of the Southwest Pass Study area between 1985 and 2001.

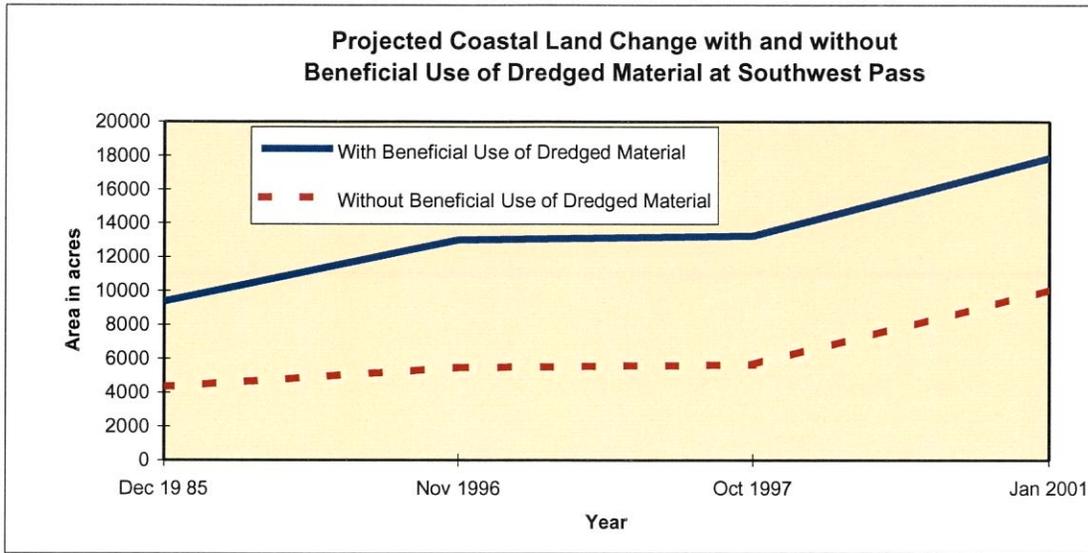


Figure 34. Graph of the area of the Mississippi River - Southwest Pass BUMP study area over time, showing the contribution of the beneficial use of dredged material.

TABLE 1
Mississippi River - Southwest Pass Area: 1985-2001

Area (acres)	Dec 1985	Oct 1997	Jan 2001	Area Change 1985-1997	Area Change 1985-2001
Natural Areas	3,327.5	4,111.7	10,680.2	+784.2	+7,352.7
Other-made Areas	1,001.3	1,541.7	1,515.6	+540.4	+514.3
BUMP-made Areas	5,060.7	7,596.8	7,771.7	+2536.1	+2,711.0
Total	9,389.5	13,250.2	19,967.5	+3,860.7	+10,578.0

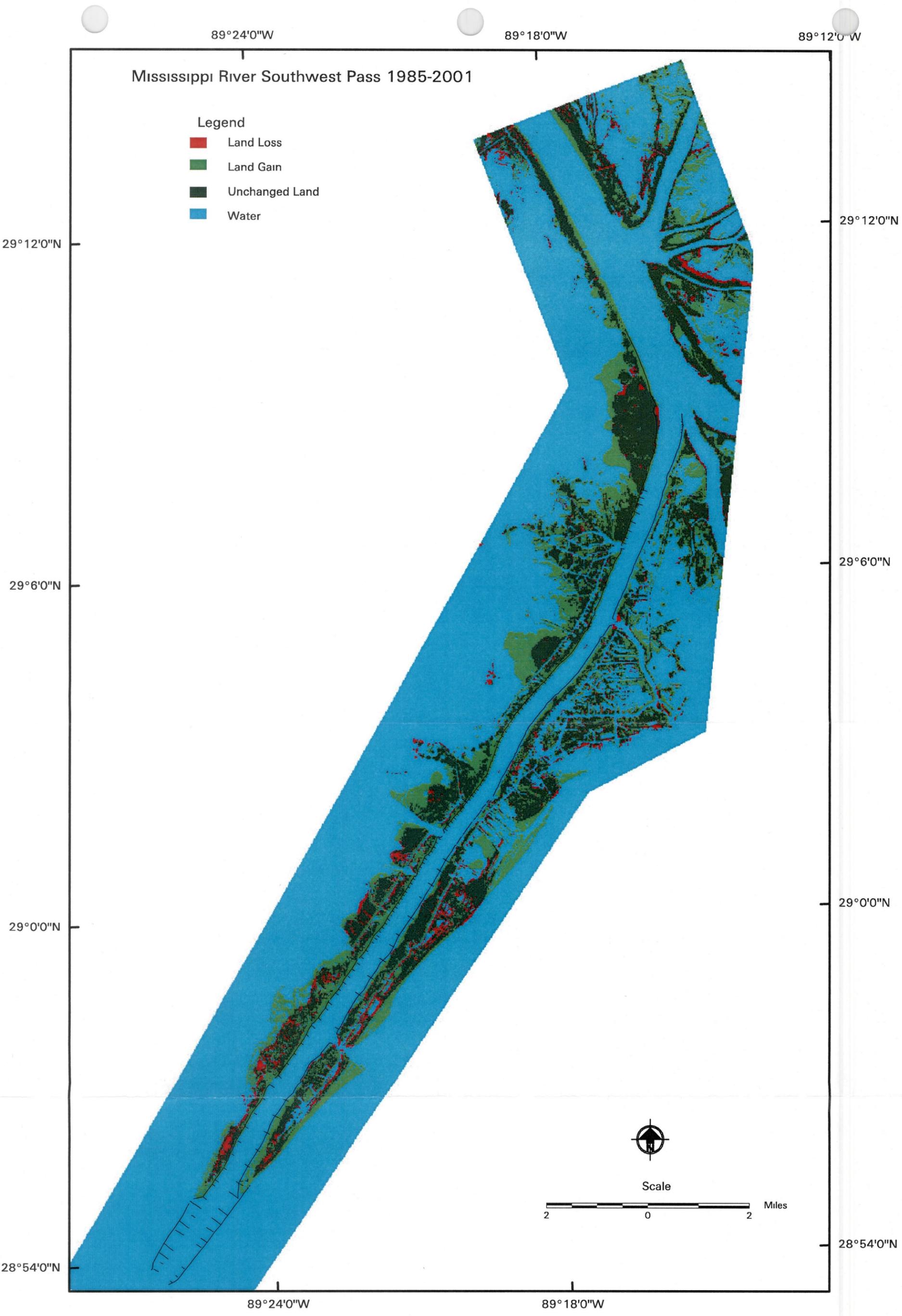


Figure 35 Shoreline changes of the Mississippi River- Southwest Pass BUMP study area between December 1985 and January 2001

Habitat Inventory

The aerial photographic interpretation combined with field surveys identified six major habitat types in the Mississippi River - Southwest Pass BUMP study area. These habitats are further classified as natural and man-made. The natural class identifies natural deltaic processes as responsible for habitat creation. The BUMP man-made (BUMP-made) class identifies the habitats created by the beneficial-placement of dredged material. The non-BUMP man-made class (Other-made) separates areas created that were not related to the beneficial use of dredged material such as areas created in association with the oil industry access and pipeline canals. 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.

Table 2 lists the areas of the six habitat types found in the Mississippi River - Southwest Pass BUMP study area in December 1985. The location and arrangement of these habitats is presented in figure 36. The total area of the Southwest Pass study site was 9,389.5 acres. Of this total, 3,327.5 acres were natural and 6,062.0 acres were man-made including 5,060.7 acres of BUMP-made and 1,001.3 acres of other-made. Habitats within the BUMP study site were 35.4 percent natural, 53.9 percent BUMP-made and 10.7 percent other-made.

In order of decreasing size and importance, the largest habitats found were natural marsh (2,964.2 acres) and BUMP-made marsh (2,049.7 acres), followed by BUMP-made upland (1,636.6 acres), BUMP-made bare land (1,250.5 acres), other-made marsh (417.0 acres), and other-made shrub/scrub (326.6 acres). In terms of habitat totals, marsh (5,430.9 acres or 57.8%) dominated the Mississippi River - Southwest Pass landscape.

TABLE 2
December 1985 Habitat Inventory of the
Mississippi River - Southwest Pass BUMP Study Area

HABITAT	TOTAL	NATURAL	OTHER-MADE	BUMP-MADE
Marsh	5430.9	2964.2	417.0	2049.7
Upland	1762.8	68.5	57.7	1636.6
Shrub/Scrub	422.0	3.7	326.6	91.7
Forest	139.8	36.6	78.7	24.5
Bare Land	1388.6	16.8	121.3	1250.5
Beach	245.4	237.7	0.0	7.7
Habitat Total	9389.5	3327.5	1001.3	5060.7

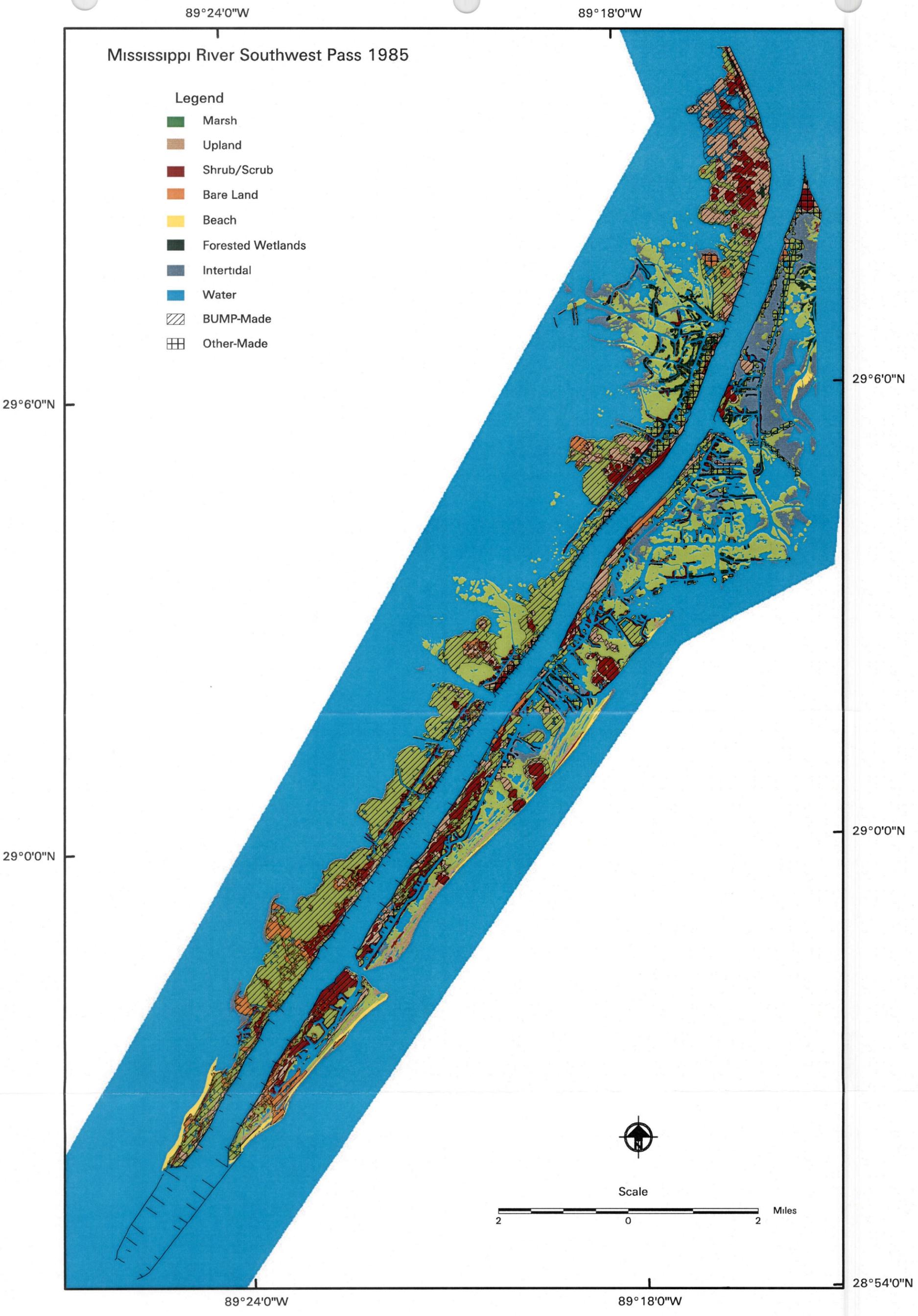


Figure 36 Habitat inventory of the Mississippi River- Southwest Pass BUMP study area in December 1985

Table 3 lists the areas of the six habitats found in the Mississippi River - Southwest Pass BUMP study area in January 2001. The location and arrangement of these habitats is presented in figure 37. In 2001, the total area of the Mississippi River - Southwest Pass BUMP study area was calculated at 19,967.5 acres. Of this total, 10,680.2 acres were natural and 9,287.3 acres were man-made including 7,771.7 acres BUMP-made and 1,515.6 acres other-made. Habitats were 53.5 percent natural, 38.9 percent BUMP-made and 7.6 percent other-made.

In order of decreasing size and importance, the largest habitats found were natural marsh (7,852.1 acres) followed by BUMP-made marsh (3,691.1 acres), BUMP-made upland (2,793.3 acres), natural upland (1,179.6 acres), and BUMP-made shrub/scrub (735.8 acres).

In terms of total area, marsh (12,298.3 acres or 61.6%) dominated the landscape of the Mississippi River - Southwest Pass BUMP study area.

TABLE 3
January 2001 Habitat Inventory of the
Mississippi River - Southwest Pass BUMP Study Area

HABITAT	TOTAL	NATURAL	OTHER-MADE	BUMP-MADE
Marsh	12,298.3	7,852.1	755.1	3,691.1
Upland	4,365.2	1,179.6	392.3	2,793.3
Shrub/Scrub	1,199.2	234.6	228.8	735.8
Forest	755.0	649.2	98.4	7.4
Bare Land	1,104.5	580.8	40.3	483.4
Beach	245.3	183.9	0.7	60.7
Habitat Total	19,967.5	10,680.2	1,515.6	7,771.7

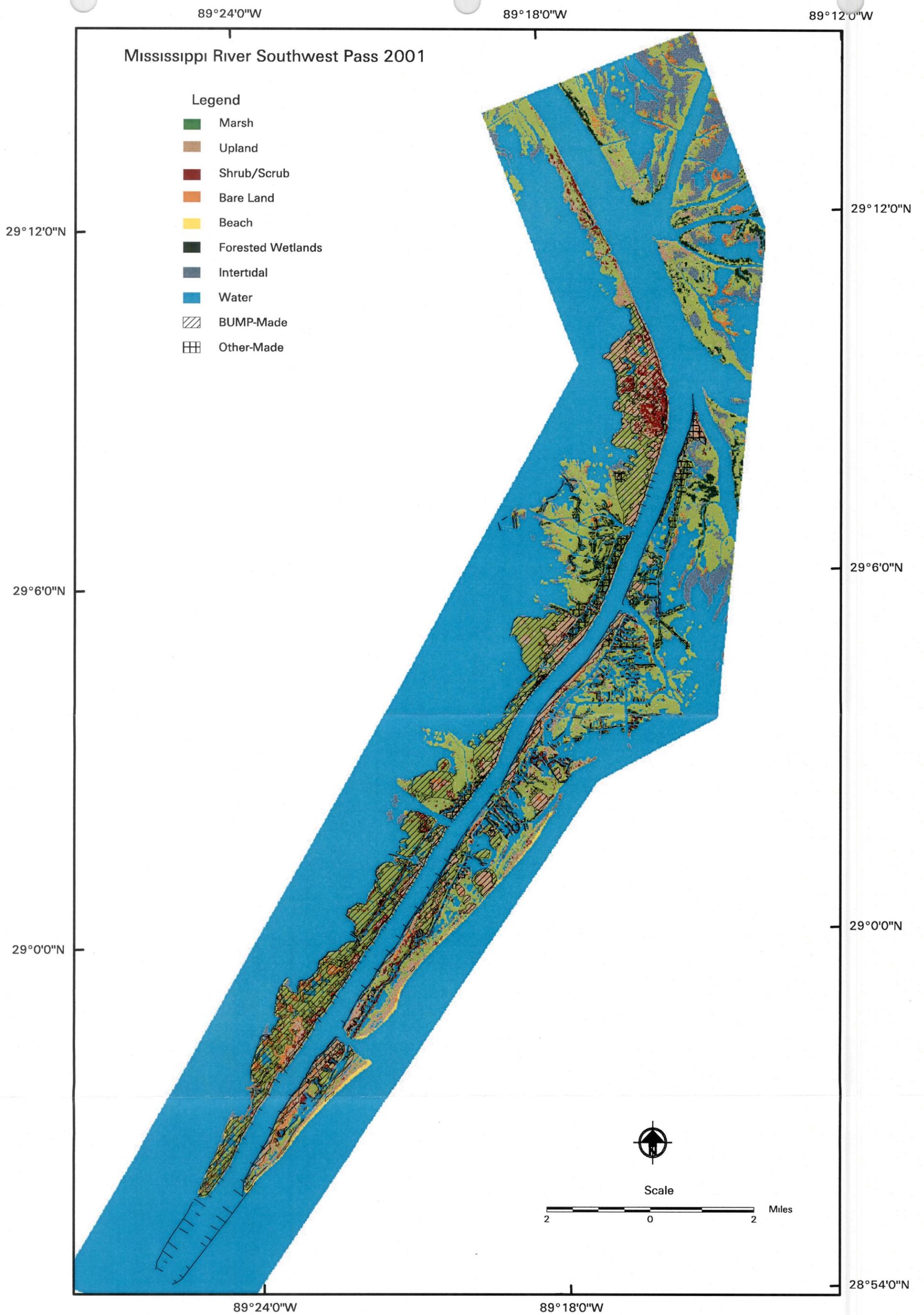


Figure 37 Habitat inventory of the Mississippi River- Southwest Pass BUMP study area in January 2001

Habitat Change

Figure 38 shows changes over time of the major habitat categories: natural, other-made and BUMP-made. Figure 39 shows the creation of new habitat, both natural and man-made, along the Mississippi River - Southwest Pass BUMP study area by comparing December 1985 and January 2001. The total area increased by +10,578.0 acres that represents a +53 percent increase in area between 1985 and 2001. There was an overall increase of +7,352.7 acres of the natural habitats, an increase of +514.3 acres in other-made habitats, and an increase of +2,711.0 acres of BUMP-made habitats. Table 4 lists the major habitat changes during the period between December 1985 and January 2001.

The greatest cumulative habitat changes between 1985 and 2001 were the increases of natural marsh (+4,293.9 acres) and BUMP-made marsh (+1,641.4 acres). Other significant increases include a gain of +1,156.7 acres of BUMP-made upland, +1,111.1 natural upland and +644.1 acres of BUMP-made shrub/scrub. The overall change in natural and man-made habitats was an increase of +10,578.0 acres.

Figure 40 shows a time series of habitat changes along the Mississippi River - Southwest Pass BUMP study area. Figure 38A graphs the natural habitat changes over time. Natural land building and erosion dominates the processes affecting the natural habitat class. Figure 38B graphs the other-made habitat changes over time. Figure 38C graphs the BUMP-made changes over time.

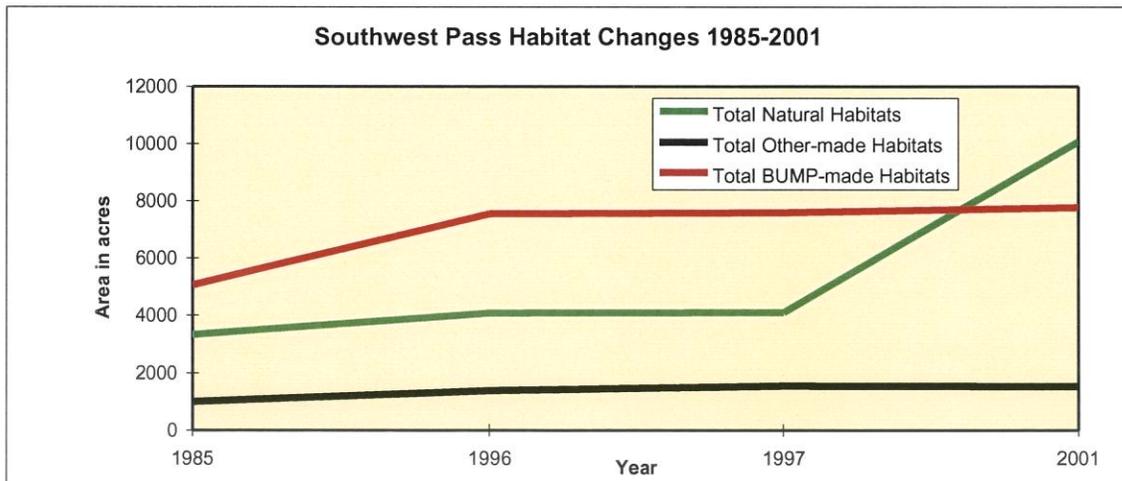


Figure 38. Graph showing the relative change in total area of the major habitat categories: natural, other-made, and BUMP-made, between 1985 and 2001.

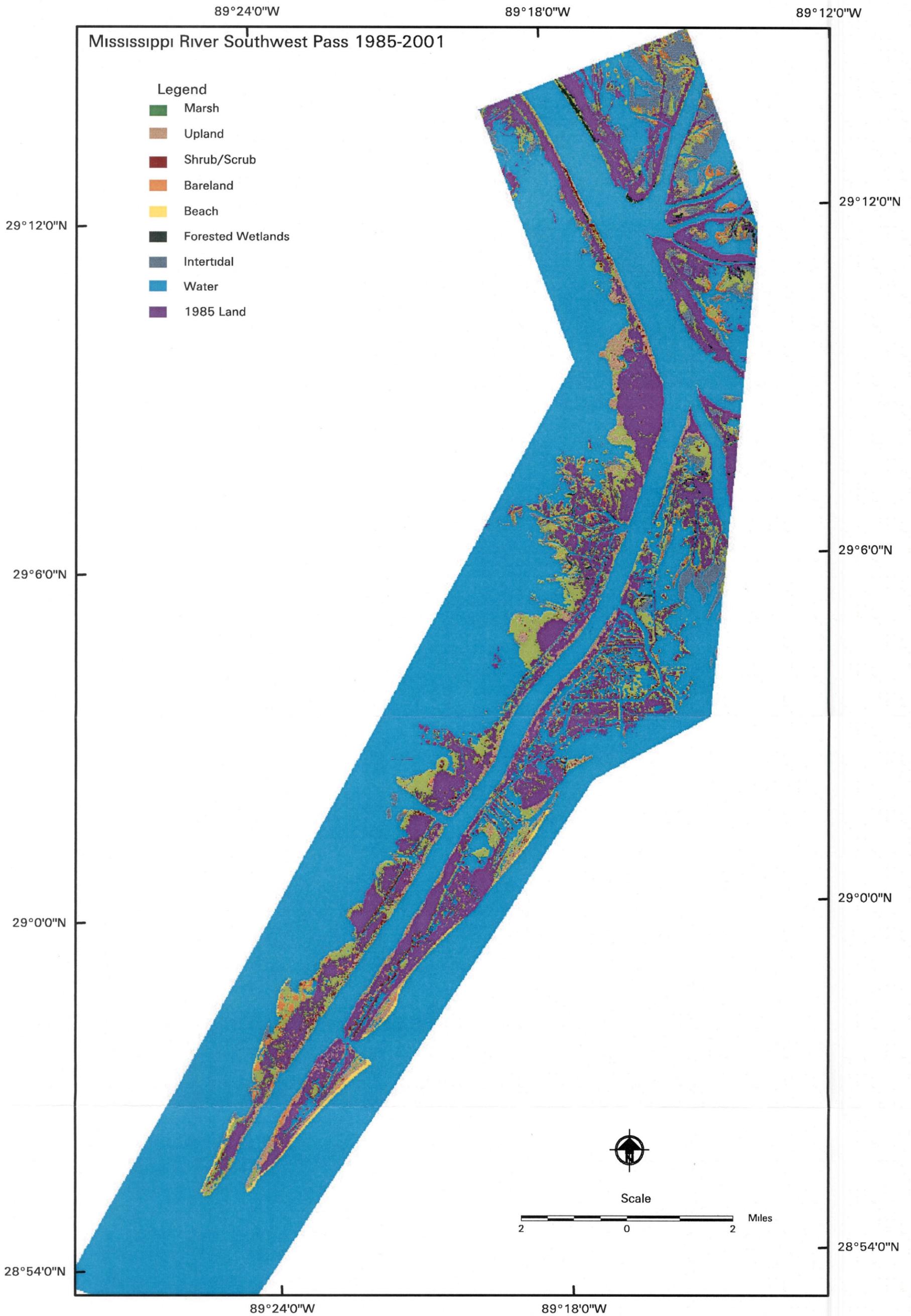


Figure 39 New habitats of the Mississippi River- Southwest Pass BUMP study area between December 1985 and January 2001

TABLE 4
 Cumulative Change in Total Area of each Habitat
 in the Southwest Pass Study Area between 1985 and 2001¹

HABITAT	Dec 1985	Jan 2001	AREA CHANGE
Natural Marsh	2,964.2	7,258.1	+4,293.9
Natural Upland	68.5	1,179.6	+1,111.1
Natural Shrub/Scrub	3.7	234.6	+230.9
Natural Forest	36.6	649.2	+612.6
Natural Bare Land	16.8	580.8	+564.0
Natural Beach	237.7	183.9	-53.8
Total Natural Habitats	3,327.5	10,680.2	+7,352.7
Other-made Marsh	417.0	755.1	+338.1
Other-made Upland	57.7	392.3	+334.6
Other-made Shrub/Scrub	326.6	228.8	-97.8
Other-made Forest	78.7	98.4	+19.7
Other-made Bare Land	121.3	40.3	-81.0
Other-made Beach	0	0.7	+0.7
Total Other-made Habitats	1,001.3	1,515.6	+514.3
BUMP-made Marsh	2,049.7	3,691.1	+1,641.4
BUMP-made Upland	1,636.6	2,793.3	+1,156.7
BUMP-made Shrub/scrub	91.7	735.8	+644.1
BUMP-made Forest	24.5	7.4	-17.1
BUMP-made Bare Land	1,250.5	483.4	-767.1
BUMP-made Beach	7.7	60.7	+53.0
Total BUMP-made Habitats	5,060.7	7,771.7	+2,711.0
HABITAT TOTAL	9,389.5	19,967.5	+10,578.0

¹ in acres

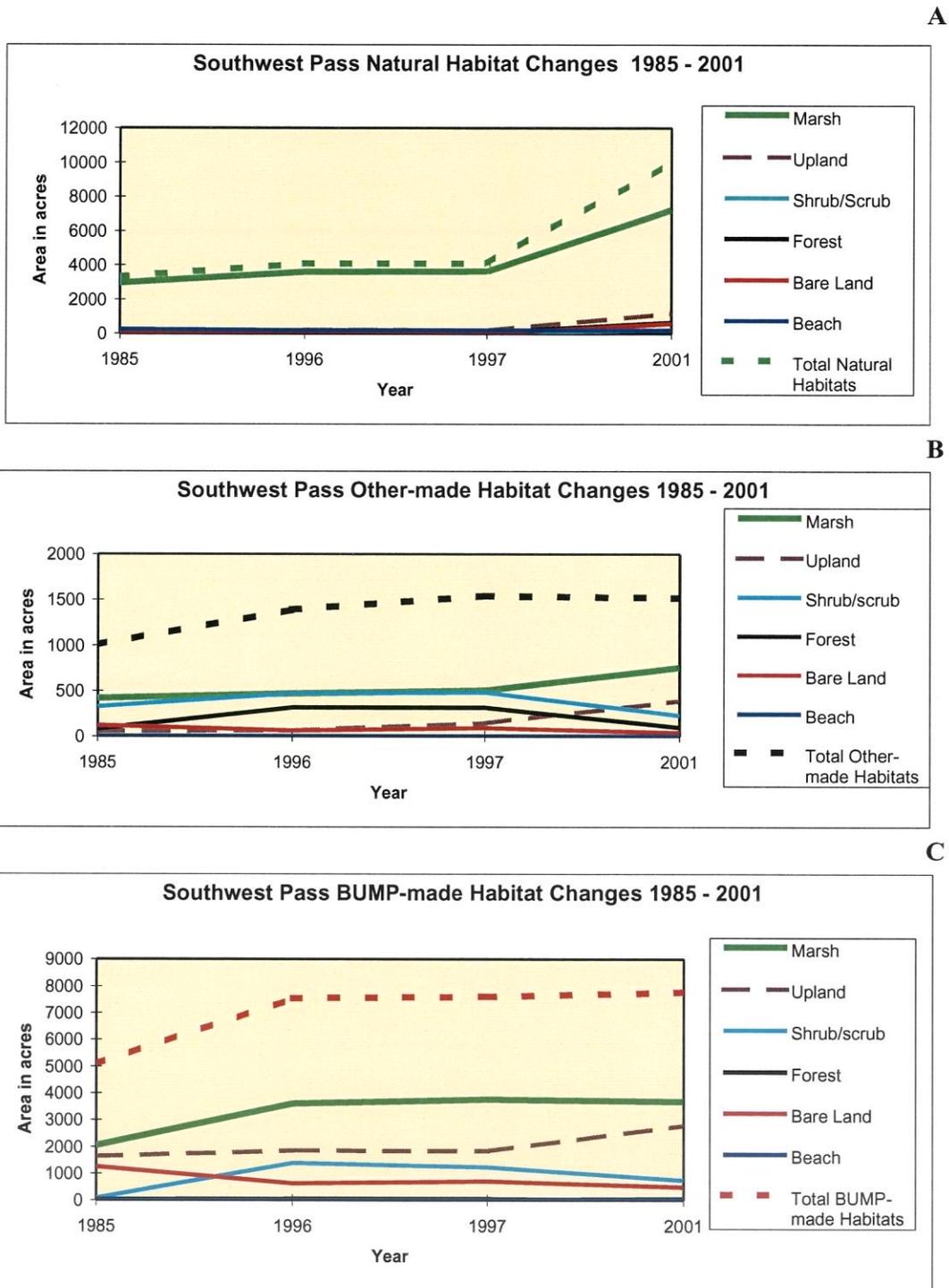


Figure 40. Time series showing the changes in total area of each habitat in the Mississippi River - Southwest Pass BUMP study area between December 1985 and January 2001. A) natural habitat changes. B) Other-made habitat changes. C) BUMP-made habitat changes.

PASS A LOUTRE

The Pass a Loutre BUMP study site (PAL) is located on the east side of the Mississippi River navigational channel, north of the Pass a Loutre channel, upriver of Southwest Pass, within the Delta National Wildlife Refuge. Most of what remains of the Pass a Loutre topography was created by natural deposition by the Mississippi River. The part that borders the navigational channel has been augmented by the disposal of dredged material during channel maintenance and supports a small community named Pilottown. The remaining area is undergoing rapid landloss due to high rates of subsidence in this geologically young area of the Mississippi River Delta, resulting in large open water areas. Breaks through the northern border of this area created crevasse splays to bring sediment into the area. In 1998 this area was designated a beneficial use disposal area for the creation of wetlands. In FY98, the USACE-NOD placed approximately 1,051,661 CY of dredged material into the area (Figure 6).

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.

Phase-II involved the actual collection of profile data. Gaining access to the selected sites proved to be somewhat difficult. On November 19, 1998, access was not possible because the floatplane did not have enough room to land. It was also determined that the area was too large and open to try access by pirogue. On February 24, 1999, the site was determined to be too unstable for the helicopter to land. Several attempts were made by airboat, but were aborted because of conditions at the Mississippi River that would have been dangerous to a small vessel attempting to cross. On September 23, 1999 two transect lines were successfully positioned across the recently placed dredged material utilizing an airboat for access (Figure 41). Both transects were surveyed from a navigation marker platform because of high water conditions, and one stake was placed at a distance to define each transect line. 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 sighting and re-location easier.

The transects were revisited by airboat for new profile data on April 6, 2001.

Survey data 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.

SURVEY PROFILE LOCATIONS

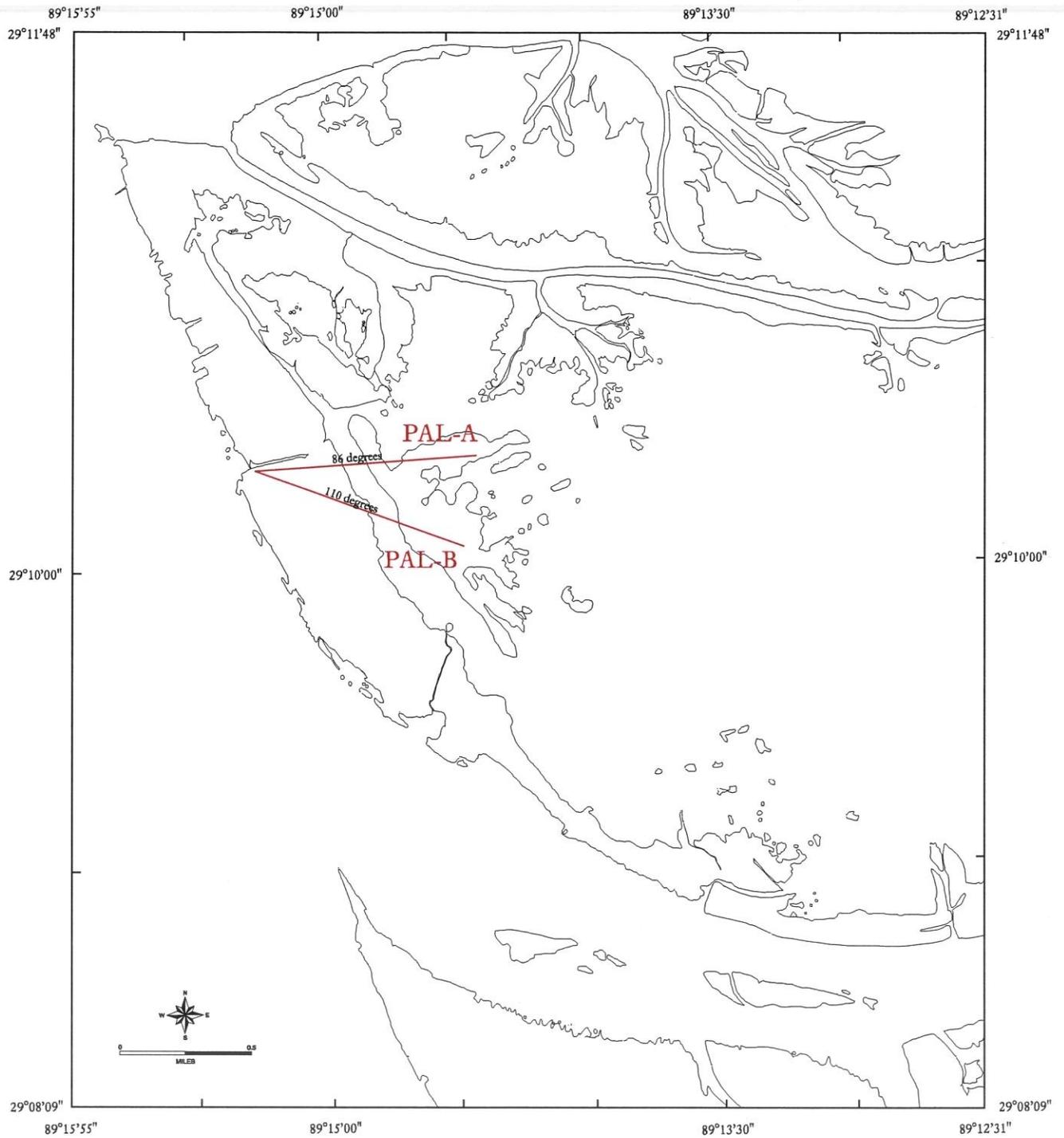


Figure 41 Location of the two elevation and vegetation transects at the Pass a Loutré - BUMP study area.

The topographic profiles for the study area were constructed in reference to Micronautics Tide Table - Southwest Pass Mississippi River station #4593, Louisiana (28° 56' N / 89° 26' W). The mean diurnal tidal range for the Southwest Pass study area is published as 1.3 ft.

Initial ground truthing for habitat verification was done on November 19, 1998 by an overflight in a small plane and showed bare land of low elevation and little relief (Figure 42). This landscape correlates with the aerial photography taken on January 11, 1999 that was used for all statistical analyses. Field monitoring for vegetative species composition and habitat verification was done on September 23, 1999, after a full season of vegetative growth. 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. The percent composition of each species was visually estimated to determine the relative coverage and dominance of species for habitat clarification. 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.



Figure 42. Oblique aerial photography taken on November 19, 1998 of the Pass a Loutre BUMP study site showing the low relief of the newly placed bare land.

Profiles at Pass a Loutre

The profiles were established in 1999 with one metal pole (stake) partially buried and anchored with concrete, and extending 2-3 feet from the sediment surface. The two transects converged at the site of the survey instrument which was placed on a navigation marker platform near the Mississippi River navigational channel at mile 1.4 AHP, just south-east of Pilottown (Figure 43). The platform provided the best vantage-point for surveying the area (Figure 44). The area along the navigational channel has been used for disposal during maintenance dredging for many years prior to 1985. The last disposal within the Pass a Loutre disposal area was in FY98 (Figure 6).

The initial elevation and vegetation data were acquired September 23, 1999, and was revisited for new data on April 6, 2001. Access to the area was by airboat. The Pass a Loutre transect A-A' is oriented east-west to cross recently placed dredged material. One stake defines the transect and was placed 3727 feet from the survey platform, on the highest point of land, still 2-3 inches below the water level. The Pass a Loutre transect B- B' is oriented southeast-northwest to cross recently placed dredged material. One stake defines the transect and was placed 4082 feet from the survey platform, on the highest point of land, still 3 inches below the water level. The western end of both transects terminate at the navigation platform (Figure 45). The navigation platform is located on the Mississippi River natural levee that has been augmented with channel maintenance dredged material for many years and is elevated and well vegetated. The eastern end of each transect terminates with the last bit of marsh into the open water of the bay. The transects crossed multiple lobes of well vegetated marsh separated by water channels and drainage features.

The new material was being colonized by a fresh marsh consisting primarily of cattails (*Typha dominguensis*) and bulrush (*Scirpus americanus*). Other species present on the newer deposits include black rush (*Juncus roemerianus*), wild rice (*Zizaniopsis milicea*), and Walter's millet (*Echinochloa walteri*). Willow trees (*Salix nigra*) were colonizing the few, slightly elevated new areas (Figures 46 & 47). Elephants ear (*Colocasia antiquorum*) outlined the margin of the former shoreline (Figure 48). Bull-tongue (*Sagittaria* sp.), alligator weed (*Alternanthera philoxeroides*), iris, and spikerushes added to the list along the transect of the low lying older deposits (Figure 49). Yellow rattlebox (*Sesbania drummondii*) was found on elevated grassy areas (Figure 50). The disposal material consisted of silty sand.

Profile A - A' had a length of 3753 ft (Figure 51). The maximum relief along the axis was 3.74 ft MLG (3.0 ft NGVD) at the location of survey instrument along the navigational channel, with an average relief of 2.3 ft MLG (1.5 ft NGVD).

Profile B - B' had a length of 4459 ft (Figure 52). The maximum relief along the axis was 3.74 ft MLG (3.0 ft NGVD) at the location of survey instrument along the navigational channel, with an average relief of 2.3 ft MLG (1.5 ft NGVD). The published tidal range for the Southwest Pass area that includes Pass a Loutre is 1.3 ft.



Figure 43. Vertical aerial photography taken on January 11, 1999 of the Pass a Loutre BUMP study site. The approximate locations of the transects are represented by the orange lines.



Figure 44. Photograph taken on April 6, 2001 along transect A-A' at the Pass a Loutre BUMP study site, showing the platform within the upland/shrub habitat where the survey instrument was placed.

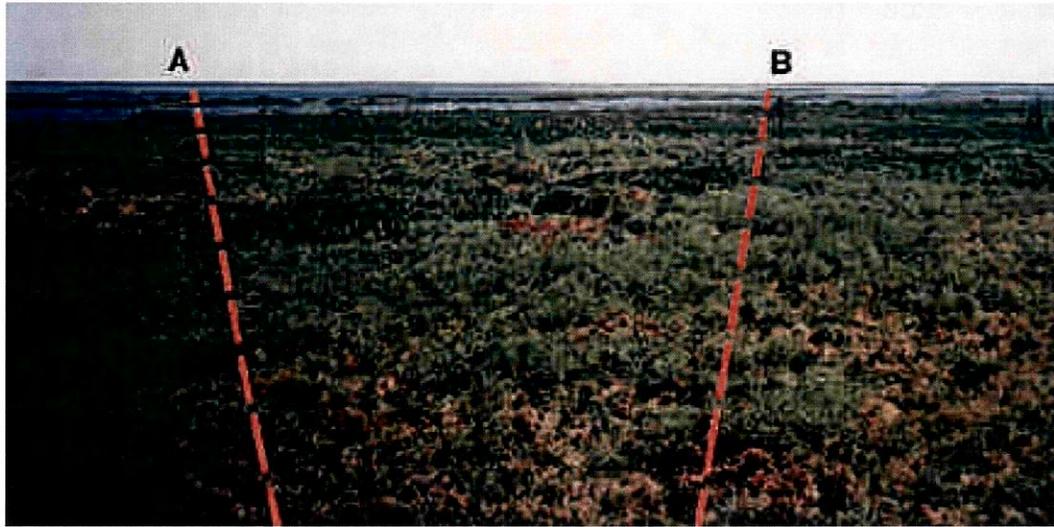


Figure 45. Photograph taken on September 23, 1999 from the navigation marker platform showing both transects, A-A' and B-B', at the Pass a Loutre BUMP study site.



Figure 46. Photograph taken on April 6, 2001 toward the eastern extent of transect A-A' at the Pass a Loutre BUMP study site showing the colonizing fresh marsh of bulrush, cattails and willow trees. The view is along the transect looking west toward the instrument.



Figure 47. Photograph taken on April 6, 2001 along transect B-B' at the Pass a Loutre BUMP study site, showing fresh marsh of almost solid cattails.



Figure 48. Photograph taken on April 6, 2001 along transect A-A' at the Pass a Loutre BUMP study site, showing the dense fringe of elephant ears that lines the older shoreline. The view is to the north of the transect.



Figure 49. Photograph taken on April 6, 2001 along transect A-A' at the Pass a Loutre BUMP study site, showing the complex fresh marsh covering the older sediment.



Figure 50. Photograph taken on April 6, 2001 along transect B-B' at the Pass a Loutre BUMP study site, showing the rattlebox canopy over upland grass and composites. The view is along the transect approaching the platform and instrument. Willow trees in the background are beyond the end of the transect.

PASS A LOUTRE, LA
Transect A-A'
April 6, 2001

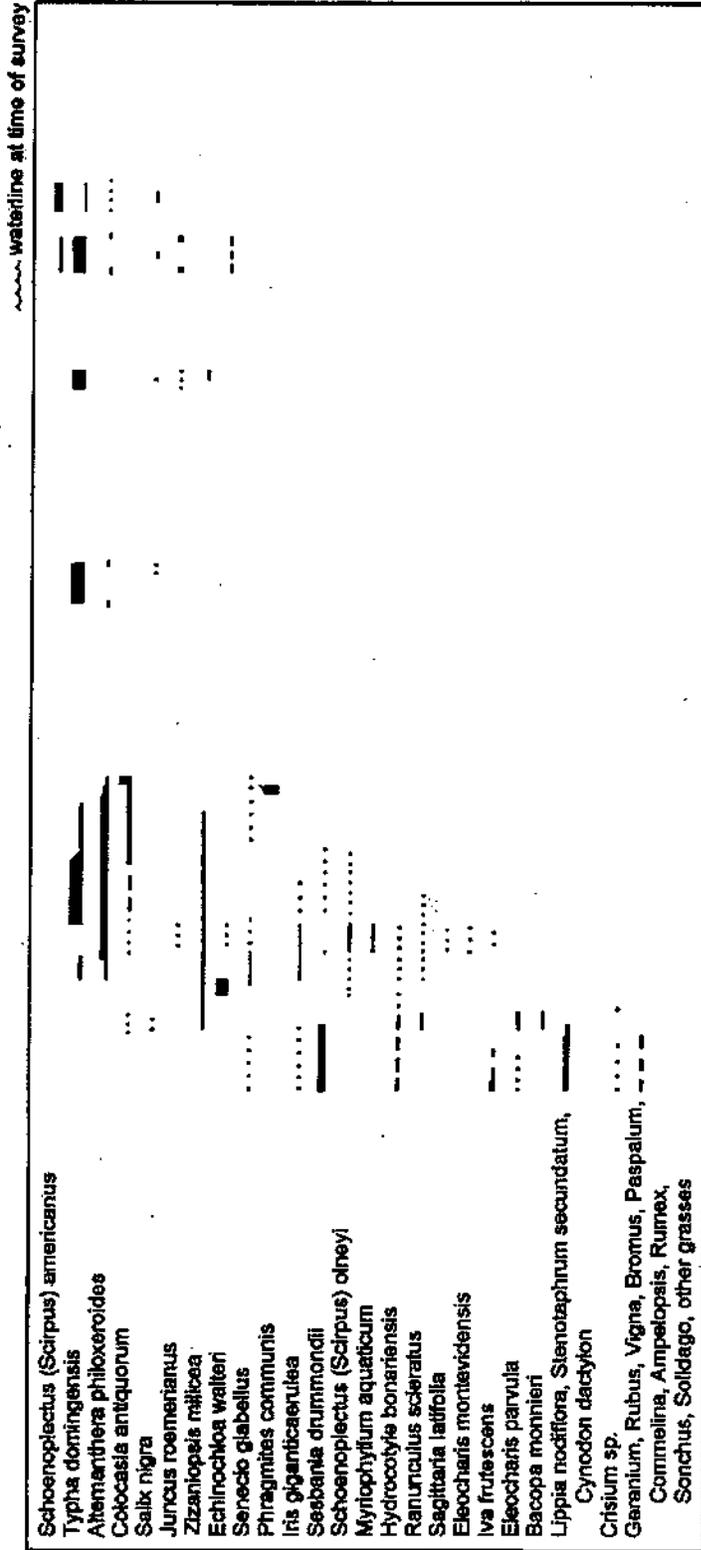
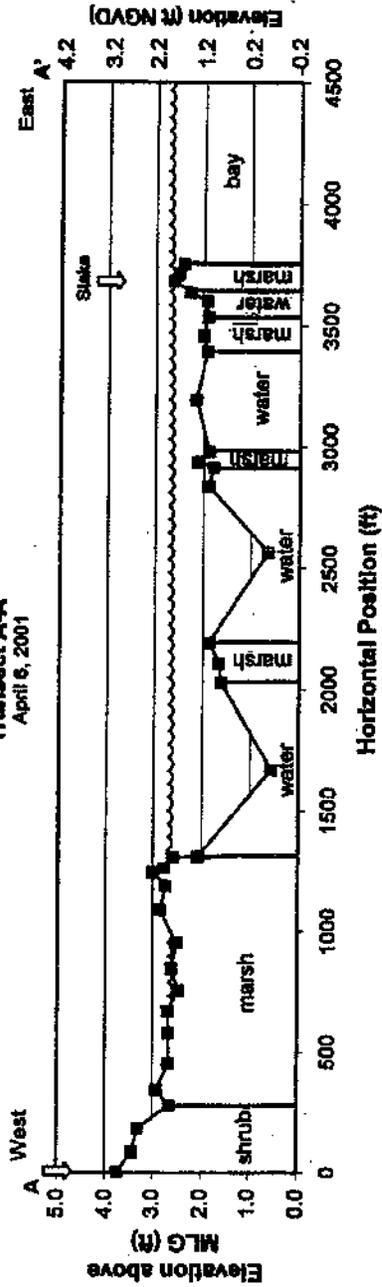


Figure 51. Elevation profile A-A' at the of the Pass a Loure BUMP study site with vegetation data illustrated.

PASS A LOUTRE, LA
Transect B-B'
April 8, 2001

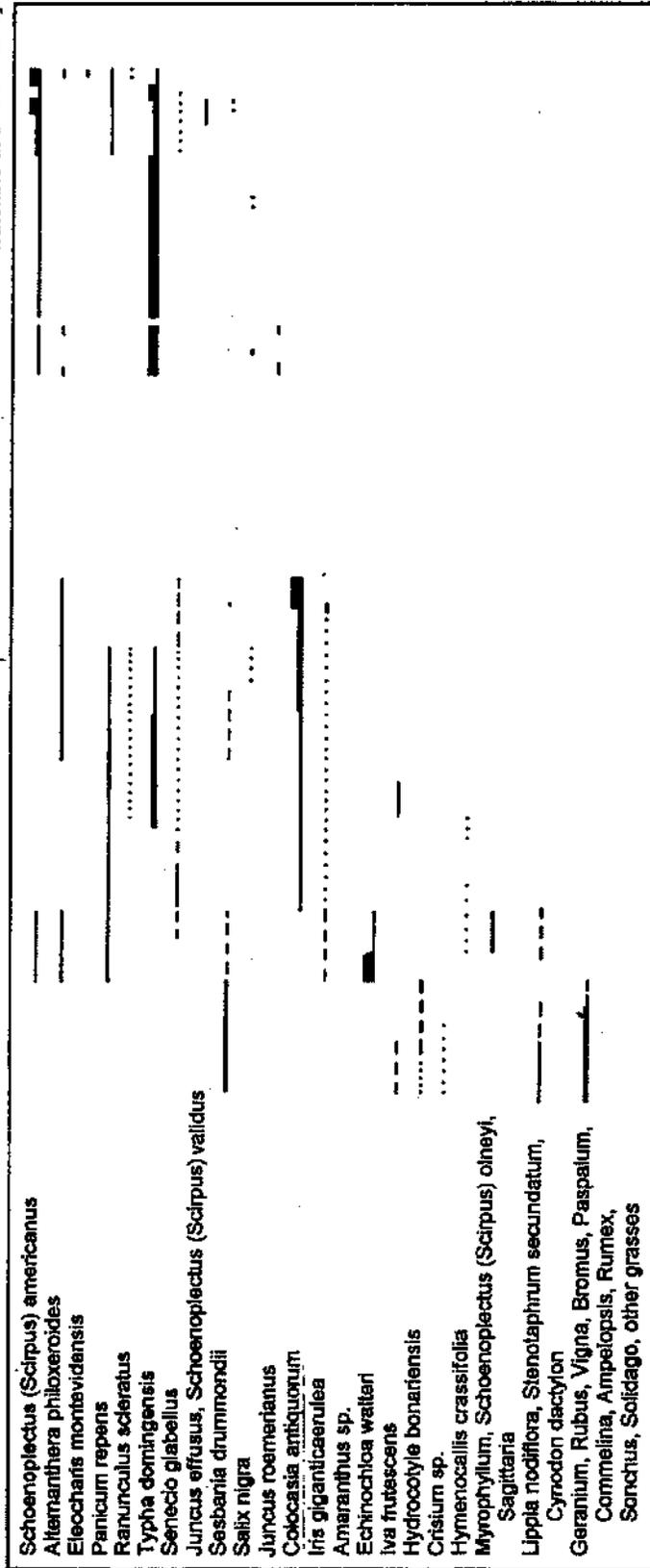
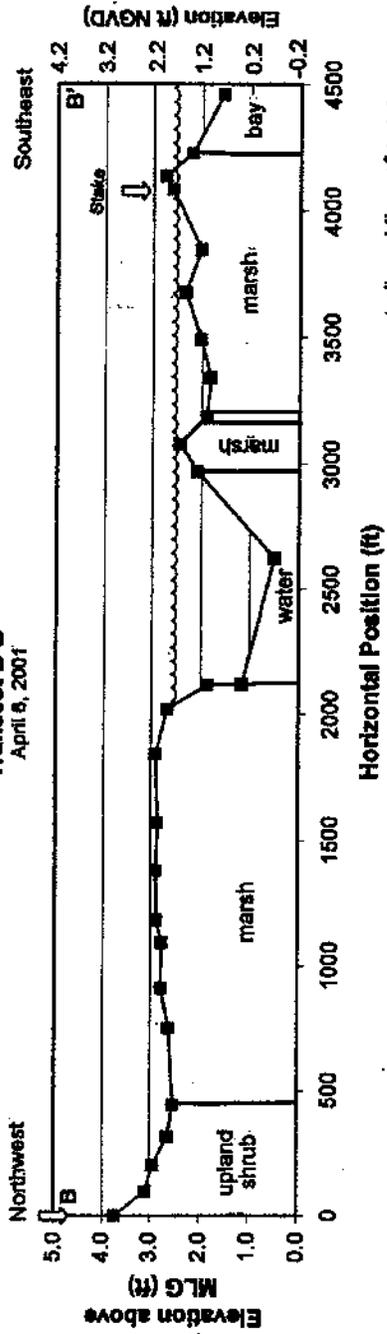


Figure 52. Elevation profile B-B' at the of the Pass a Loutre BUMP study site with vegetation data illustrated.

Vegetative Character of the Pass a Loutre BUMP study area

General Description

The Pass a Loutre BUMP study area is a riverine dominated system that is subjected to flood and tidal forces. There is a great interaction between the seasonal levels of fresh water of the river and the tidal forces of the Gulf of Mexico. The study site is normally sheltered from saline influences by encircling landforms and proximity to the Mississippi River, and the marshes are fresh.

Vegetative community types

The overall marsh type for this area is fresh marsh typified by cat-tail (*Typha dominguensis*), elephantsear (*Colocasia antiquorum*), bulrush (*Scirpus americanus*), black rush (*Juncus roemerianus*), roseau cane (*Phragmites communis*), and bull-tongue (*Sagittaria sp.*).

The upland represented by grassland are mostly vegetated by Bermuda grass and St. Augustine grass, with a multitude of other grass and composite species present (see Appendix). Yellow rattlebox (*Sesbania drummondii*), had colonized in great numbers since the last data was acquired, but were dormant at the time of data collection.

The forested wetland are represented by cypress trees (*Taxodium distichum*) along the channel and willow trees (*Salix nigra*) along the newer river or crevasse splay deposits. Shrub/scrub habitats are represented by the yellow rattlebox (*Sesbania drummondii*), groundsel bush (*Baccharis halimifolia*), Elderberry (*Sambucus canadensis*), and marsh elder (*Iva frutescens*).

GIS ANALYSIS RESULTS FOR THE PASS A LOUTRE BUMP STUDY AREA

Shoreline Changes of Pass a Loutre: 1985-2001

Figure 53 graphs the spatial history of the Pass a Loutre (PAL) BUMP study area between December 1985 and January 2001. Table 5 documents the changes and figure 54 illustrates the changes that took place at PAL between 1985 and 2001.

In December 1985, the PAL BUMP study area was measured at 1,735.9 acres. The study area in January 2001 measured 1,801.8 acres. This is a cumulative area increase of +65.9 acres at a rate of +4.4 acres per year for this 15.1 year period. This represents a total area increase of the PAL BUMP study site by +3.8 percent between 1985 and 2001. There was an overall decrease in the area of PAL of -72.4 acres in the natural areas. The contribution of BUMP related and other man-made areas accelerated the rate of growth by +138.2 acres. BUMP-made land totaled 135.2 acres in 2001 and other man-made land totaled 77.2 acres.

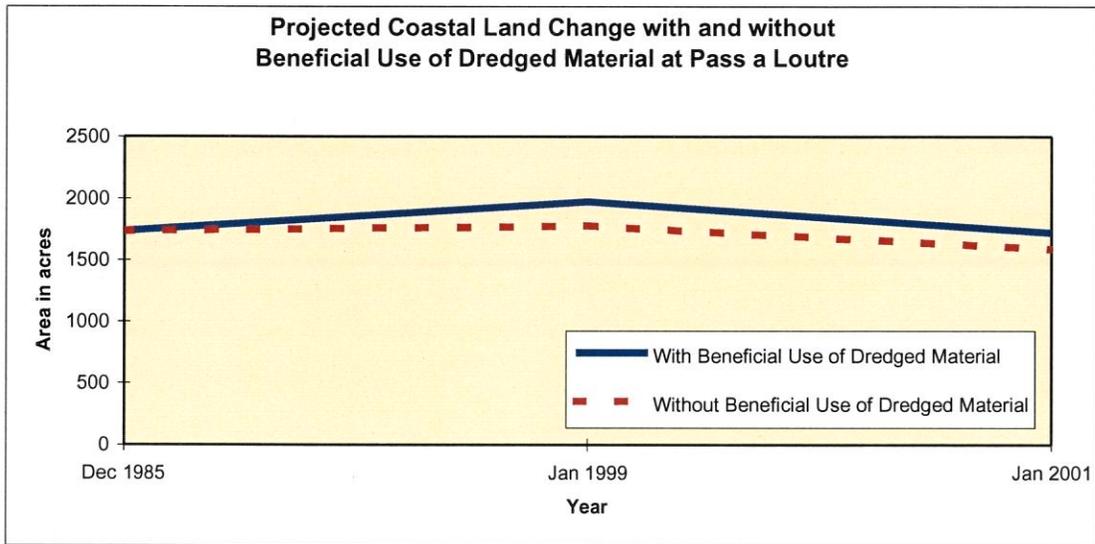


Figure 53. Graph of the area of the Pass a Loutre BUMP study area over time, showing the contribution of the beneficial use of dredged material.

TABLE 5
Mississippi River - Pass a Loutre Area: 1985-2001

Area in acres	Dec 1985	Jan 1999	Jan 2001	Area Change 1985-1999	Area Change 1985-2001
Natural Areas	1,661.7	1,712.8	1,589.4	+51.1	-72.3
Other Man-made Areas	74.2	66.0	77.2	-8.2	+3.0
BUMP-made Areas	0	197.3	135.2	+197.3	+135.2
Total	1,735.9	1,976.1	1,801.8	+240.2	+65.9

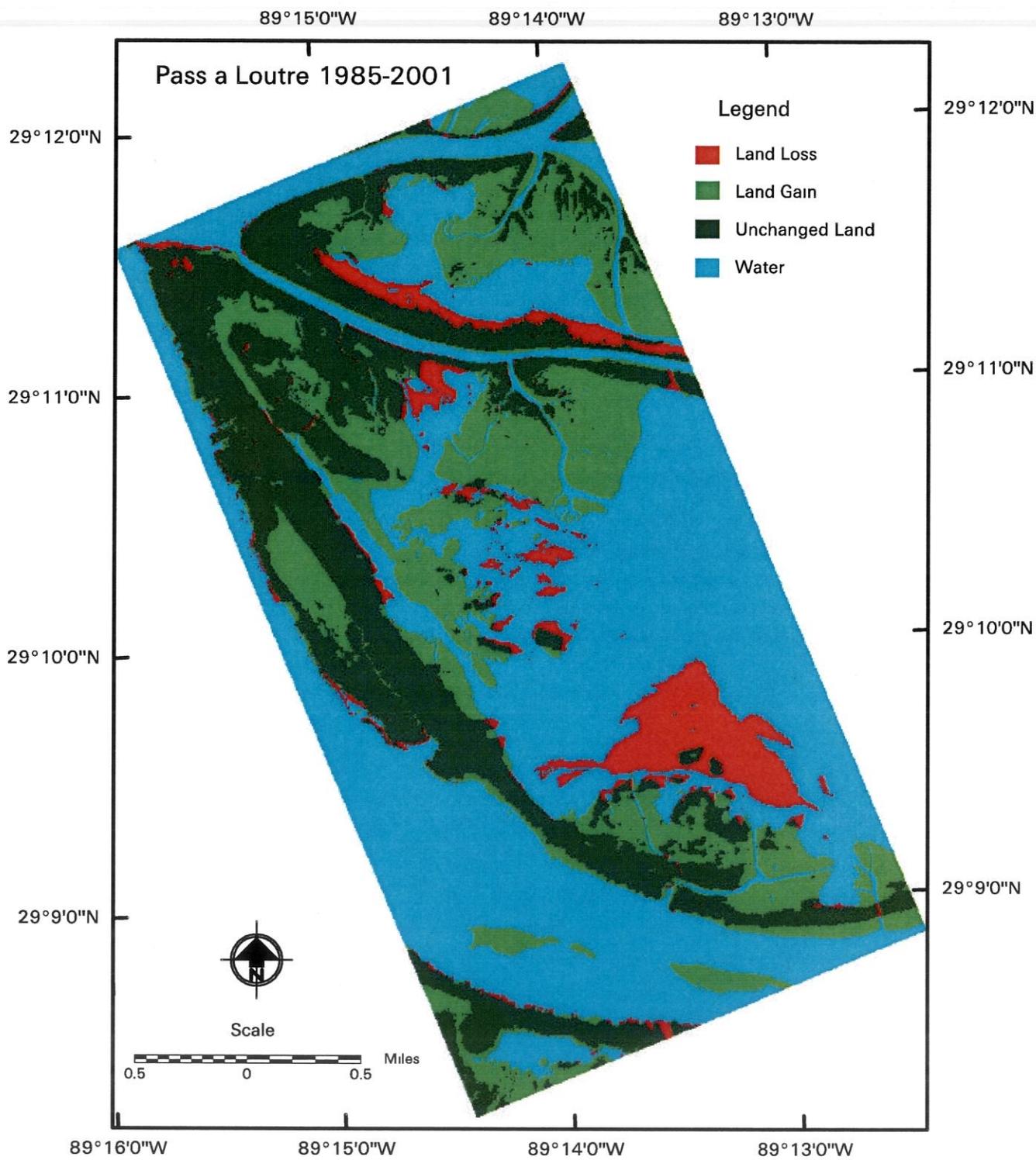


Figure 54 Shoreline Changes of the Pass a Loutre Bump study area between December 1985 and January 2001

Habitat Inventory

The aerial photographic interpretation combined with field surveys identified six major habitat types in the Pass a Loutre (PAL) BUMP study area. These habitats are further classified as natural and man-made. The natural class identifies natural deltaic processes as responsible for habitat creation. The BUMP man-made (BUMP-made) class identifies the habitats created by the beneficial-placement of dredged material. The non-BUMP man-made class (other-made) 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.

Table 6 lists the areas of the six habitat types found in the PAL BUMP study area in December 1985. The location and arrangement of these habitats is presented in figure 55. The total area of the PAL BUMP study site was 1735.9 acres. Of this total, 1661.7 acres were natural and 74.2 acres were man-made with 0 acres of BUMP-made; or 95.7 percent were natural, 0 percent were BUMP-made and 4.3 percent were other-made.

In order of decreasing size and importance, the largest habitats found were natural marsh (1208.7 acres), natural forested wetland (453.0 acres), other-made upland (67.8 acres), and other-made shrub/scrub (6.4 acres).

In terms of habitat totals, marsh (1208.7 acres or 69.6%) dominated the Pass a Loutre 1985 landscape.

TABLE 6
December 1985 Habitat Inventory of the
Pass a Loutre BUMP Study Area

HABITAT	TOTAL	NATURAL	OTHER-MADE	BUMP-MADE
Marsh	1208.7	1208.7	0	0
Upland	67.8	0	67.8	0
Shrub/Scrub	6.4	0	6.4	0
Forested Wetland	453.0	453.0	0	0
Bare Land	0	0	0	0
Beach	0	0	0	0
Habitat Total	1735.9	1661.7	74.2	0

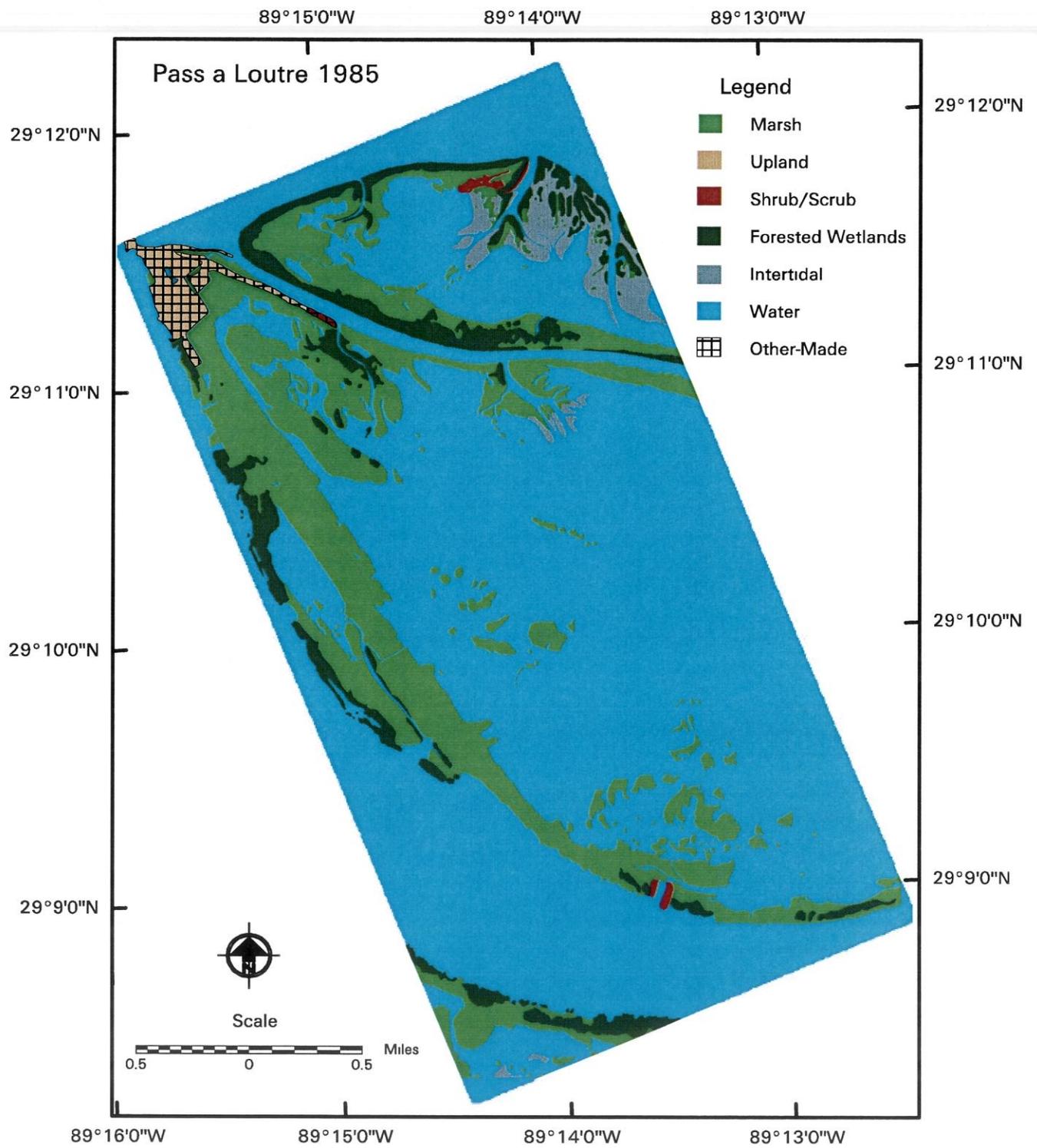


Figure 55 Habitat of the Pass a Loutre Bump study area in December 1985

Table 7 lists the areas of the six habitats found in the PAL BUMP study area in January 2001. The location and arrangement of these habitats is presented in figure 56. In 2001, the total area of the PAL BUMP study area was calculated as 1,801.8 acres. Of this total, 1,589.4 acres were natural and 212.4 acres were man-made including 135.2 acres BUMP-made and 77.2 acres other-made, or 88.2 percent was natural, 7.5 percent was BUMP-made and 4.3 percent was other-made.

In order of decreasing size and importance, the largest habitats found were natural marsh (1,032.1 acres), natural forested wetland (317.5 acres), natural upland (131.1 acres), natural bare land (108.7 acres), BUMP-made marsh (82.1 acres), and BUMP-made bare land (44.9 acres).

In terms of total area, marsh (1139.2 acres or 63.2%) dominated the landscape of the PAL BUMP study area.

TABLE 7
January 2001 Habitat Inventory of the
Pass a Loutre BUMP Study Area

HABITAT	TOTAL	NATURAL	OTHER-MADE	BUMP-MADE
Marsh	1,139.2	1,032.1	25.0	82.1
Upland	180.6	131.1	43.6	5.9
Shrub/Scrub	2.6	0.0	2.6	0.0
Forested Wetland	325.2	317.5	5.4	2.3
Bare Land	154.2	108.7	0.6	44.9
Beach	0.0	0.0	0	0.0
Habitat Total	1,801.8	1,589.4	77.2	135.2

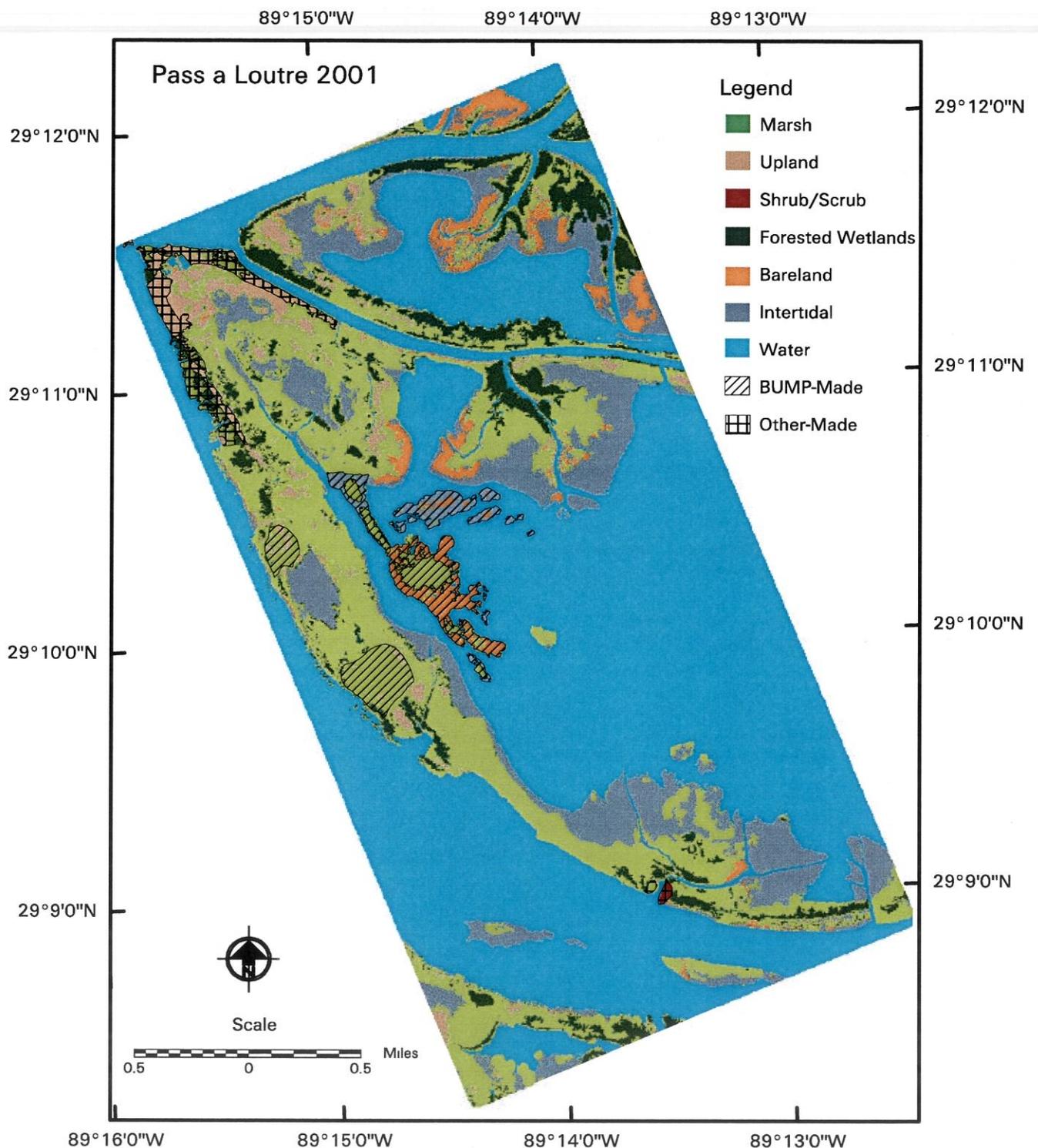


Figure 56 Habitat of the Pass a Loutre Bump study area in January 2001

Habitat Change

Figure 51 shows changes over time at the PAL BUMP study area of the major habitat categories: natural, other-made and BUMP-made. It clearly shows the dominance of the natural habitats. Figure 52 shows the creation of new habitat, both natural and man-made, along the PAL BUMP study area by comparing December 1985 and January 2001. Land gain due to beneficial use of dredged materials dominates the land-change processes of this area. The total area increased by +65.9 acres which represents a 4.4 percent increase in area between 1985 and 2001. There was an overall decrease of -72.3 acres of the natural habitats, an increase of +3.0 acres in other-made habitats, and an increase of +135.2 acres of BUMP-made habitats. Table 8 lists the major habitat changes during the period between December 1985 and January 2001.

The greatest cumulative habitat change between 1985 and 2001 was the increase of natural upland (+131.1 acres) and natural made bare land (+108.7 acres). Habitat change due to BUMP was the increase of +82.1 acres marsh and +44.9 acres of bare land. There was a loss of -176.6 acres of natural marsh, -135.5 acres natural forested wetlands. The overall change in natural and man-made habitats was an increase of +65.9 acres.

Figure 59 shows a time series of habitat changes along the PAL BUMP study area. Figure 53A graphs the natural habitat changes over time. Natural land building and erosion dominates the processes affecting the natural habitat class. Figure 53B graphs the other-made habitat changes over time. Figure 53C graphs the BUMP-made changes over time. Marsh and shrub/scrub creation by beneficial use of dredged material dominates the man-made class.

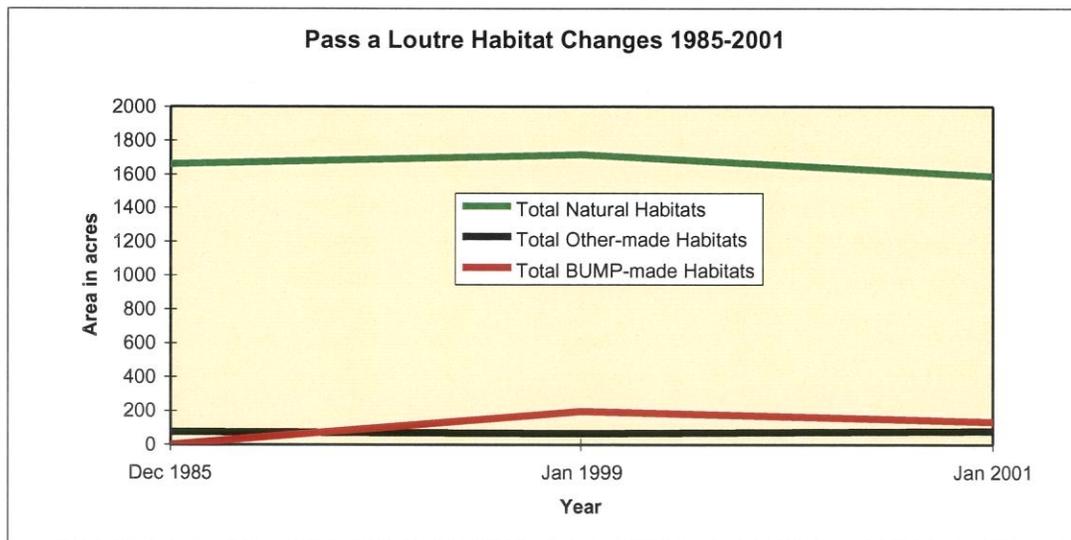


Figure 57. Graph showing the relative change in total area of the major habitat categories: natural, other-made, and BUMP-made, between 1985 and 2001.

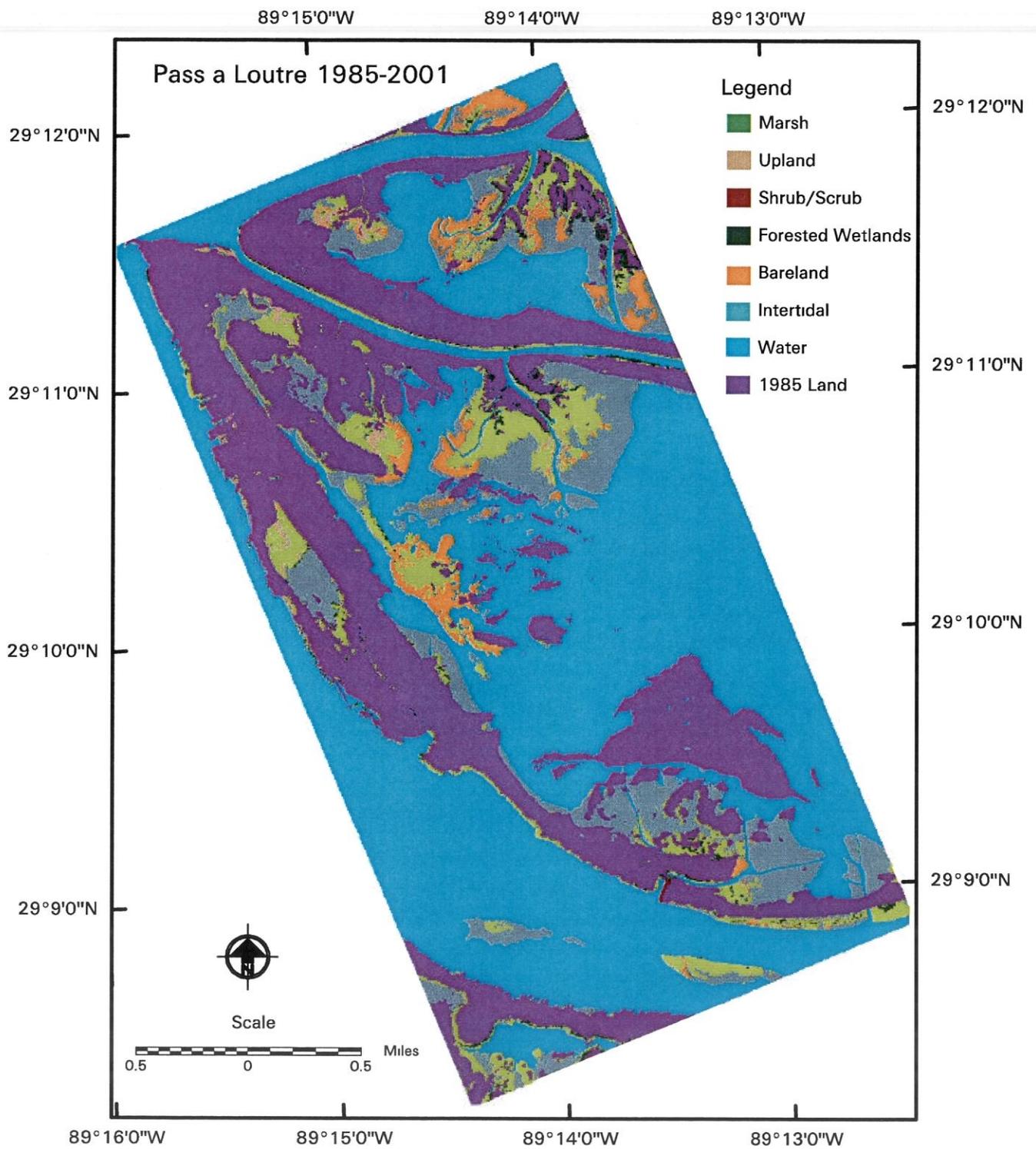


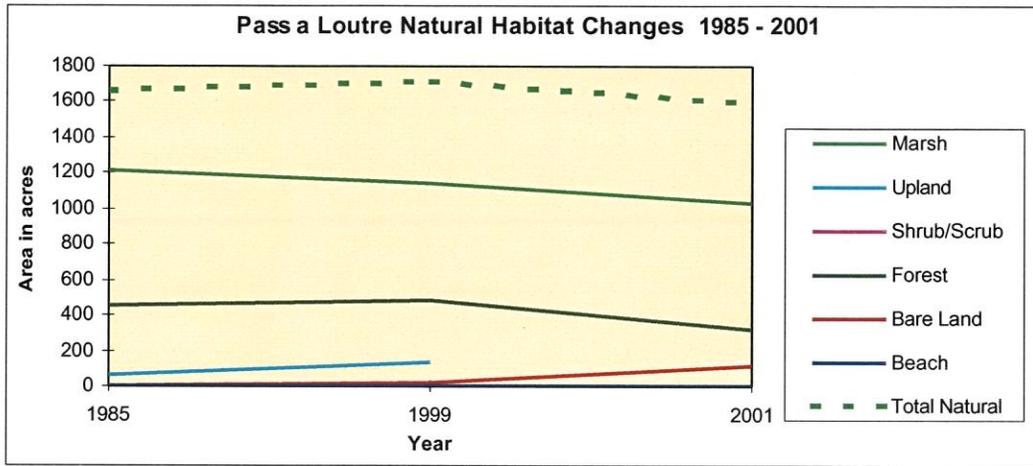
Figure 58 New habitats of the Pass a Loutre Bump study area between December 1985 and January 2001

TABLE 8
Cumulative Change in Total Area of each Habitat
in the Pass a Loutre Study Area between 1985 and 2001¹

HABITAT	Dec 1985	Jan 2001	AREA CHANGE	RATE OF CHANGE (acres/yr)
Natural Marsh	1,208.7	1,032.1	-176.6	-11.7
Natural Upland	0	131.1	+131.1	+8.7
Natural Shrub/Scrub	0	0	-	-
Natural Forested Wetland	453.0	317.5	-135.5	-8.9
Natural Bare Land	0	108.7	+108.7	+7.2
Natural Beach	0	0	-	-
Total Natural Habitats	1,661.7	1,589.4	-72.3	-4.8
Other-made Marsh	0	25.0	+25.0	+1.6
Other-made Upland	67.8	43.6	-24.2	-1.6
Other-made Shrub/Scrub	6.4	2.6	-3.8	-0.2
Other-made Forested Wetland	0	5.4	+5.4	+0.3
Other-made Bare Land	0	0.6	+0.6	-
Other-made Beach	0	0	-	-
Total Other-made Habitats	74.2	77.2	+3.0	+0.2
BUMP-made Marsh	0	82.1	+82.1	+5.4
BUMP-made Upland	0	5.9	+5.9	+0.4
BUMP-made Shrub/scrub	0	0	-	-
BUMP-made Forested Wetland	0	2.3	+2.3	+0.1
BUMP-made Bare Land	0	44.9	+44.9	+2.9
BUMP-made Beach	0	0	-	-
Total BUMP-made Habitats	0	135.2	+135.2	+8.9
HABITAT TOTAL	1,735.9	1,801.8	+65.9	+4.4

¹ in acres

A



B

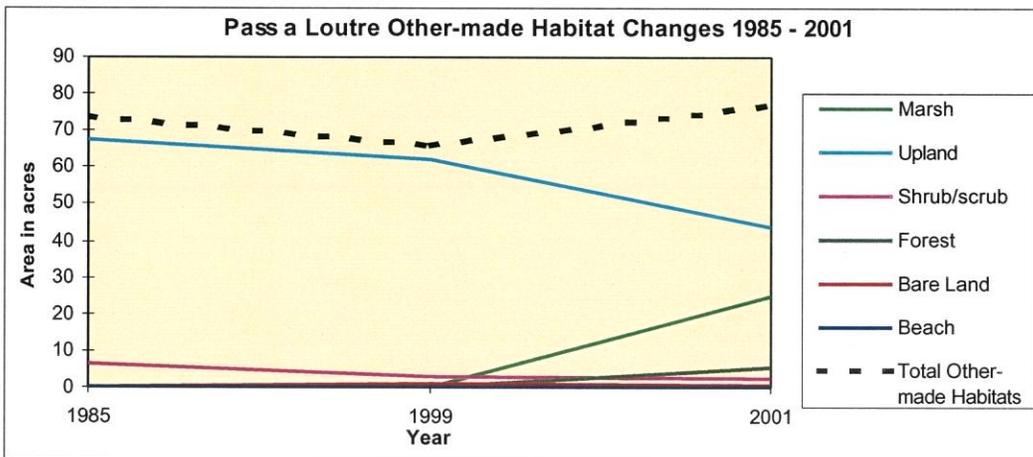


Figure 59. Time series showing the changes in total area of each habitat in the Pass a Loutre BUMP study area between December 1985 and January 2001. A) natural habitat changes. B) Other-made habitat changes. (continued on next page)

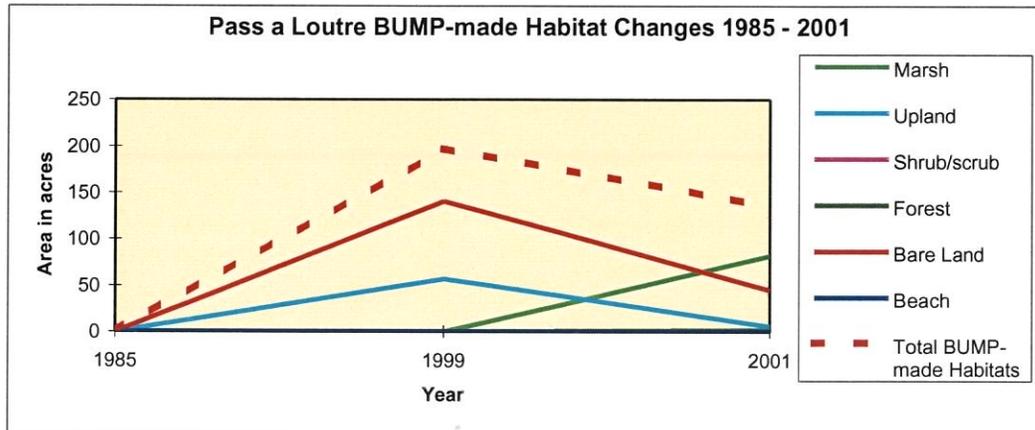


Figure 59 continued.

Time series showing the changes in total area of each habitat in the Pass a Loutre BUMP study area between December 1985 and January 2001. C) BUMP-made habitat changes.

CONCLUSIONS

1. The habitat inventory documented that the study area is primarily dominated by man-made habitats along Southwest Pass and natural habitats at Pass a Loutre.
2. Area change:
 - A) At Southwest Pass in 1985, the study area contained 9,389.5 acres of which 35% were natural and 65% were man-made. In 2001, the study area contained 1,9967.5 acres of which 53% remained natural and 47% were man-made.
 - B) At Pass a Loutre in 1985, the study area contained 1,735.9 acres of which 96% was natural and 4% was man-made. In 2001, the study area contained 1,801.8 acres of which 88% remained natural and 12% remained man-made.
3. Habitat change analysis:
 - A) At Southwest Pass, +7,771.7 acres of habitat was created by 2001 through the beneficial use of dredged material, with +2,711.0 of those acres created since 1985. Significant habitat increases between 1985 and 2001 include +4,293.9 acres of natural marsh, +1,641.4 acres of BUMP-made marsh, +1,156.7 acres of BUMP-made upland, 1,111.1 acres of natural upland, and +644.1 acres of BUMP-made shrub/scrub.
 - B) At Pass a Loutre, +135.2 acres of habitat was created by 2001 through the beneficial use of dredged material. Significant habitat increases between 1985 and 2001 include +131.1 acres of natural upland, +108.7 acres of natural bare land, +82.1 acres of BUMP-made marsh, and +44.9 acres of BUMP-made bare land.
4. The beneficial use of dredged material at the Pass a Loutre and Southwest Pass disposal areas has been successful in creating new habitats.
5. The rapid increase in area of Southwest Pass is a result of natural processes accelerated by wetland and other habitat creation as a result of the beneficial use of dredged material.
6. The increase in area of Pass a Loutre is a direct result of the beneficial placement of dredged material offsetting the natural land loss processes of the area.

REFERENCES

- Morgan, Joel David, 1977. The Mississippi River Delta - Legal-Geomorphic evaluation of historic shoreline changes in *Geoscience and Man*, Vol. 15, School of Geoscience, Louisiana State University, Baton Rouge, Louisiana.

**APPENDIX 2A
LIST OF VEGETATIVE SPECIES
OF THE MISSISSIPPI RIVER - SOUTHWEST PASS
AND PASS A LOU TRE
BUMP STUDY AREAS**

**LIST OF VEGETATIVE SPECIES
IN THE SOUTHWEST PASS AND PASS A LOUTRE 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 types of habitat the observed vegetation prefers. The list includes the 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.

Species names are listed in bold type with new taxonomic name changes indicated in red. Species added during the 2001 vegetation profiles are indicated by a "⁰¹." Probable but not verified species are listed preceded by a "?"

- ⁰¹**Acacia farnesiana** (L.) Willd.sweet acacia
large shrub or small tree; sandy ridges, edge of marshes, meadows behind dunes
- Alternanthera philoxeroides** (Mart.) Griseb. alligator weed
perennial; fresh or intermediate aquatic or very wet habitats
- Amaranthus sp.** amaranth, pigweed
annual herb; fields, waste places
- ⁰¹?**Amaranthus australis** (Gray) Sauer southern amaranth
erect annual; salt to fresh tidal marshes and shores
- ⁰¹**Ampelopsis arborea** (L.) Koehne pepper-vine
vine; low woods and marshes
- Ambrosia psilostachya** DCnaked-spike ragweed
rhizomatous perennial; sandy woods, meadows and along railroads
- Andropogon glomeratus** (Walter) BSP bushy bluestem, broomsedge
tufted perennials ; fields, roadsides, open woods, savannahs and bogs
- Aster sp.**purple aster
perennial; marshes, sand-mud flats
- 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
- Bacopa monnieri** (L.) Pennell. coastal water-hyssop
Succulent, creeping, perennial herb; sandy margins of fresh or brackish marshes,
streams and ponds
- ⁰¹**Borrichia frutescens** (L.) DC sea ox-eye
low shrub or woody herb; brackish marshes
- ⁰¹?**Bromus catharticus** Vahl. brome grass
annual grass; waste places and roadsides
- ⁰¹**Cerastium glomeratum** Thuill. mouse-ear chickweed
matted winter annual; fields, roadsides and waste places
- Chamaesyce serpens** matted broom-spurge
prostrate annual, poisonous ; sandy barrens, fields, pastures, roadsides

- Chenopodium ambrosoides** L Mexican-tea, American wormseed
erect annual herb; common weed of cultivated fields, pastures and waste ground
- ⁰¹**Ciclospermum (Apium) leptophyllum** (Pers.) Sprague ex Britt. & Wilson.....marsh parsley
annual; sandy waste places and roadsides
- Cirsium sp.** thistle
spiny biennial; roadsides, pastures, old fields, waste places, meadows
- Colocasia antiquorum** (L.) Schot elephantsear
large leaf perennial; along shorelines of bayous and lakes in fresh marshes
- ⁰¹**Commelina communis** L. dayflower
semi-erect annual; low, moist woods and waste places
- ⁰¹**Coronopus didymus** (L.) Sm. lesser swinecress
winter annual; fields, roadsides and other disturbed habitats
- 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
- ⁰¹**Cyperus elegans** L..... sticky flatsedge
- Cyperus oxylepis** sharp-scale flatsedge
annual; marshes and ditches
- Digitaria ciliaris** (Retz.) Koel. crab grass
annual; sandy fields, roadsides, waste places
- Distichlis spicata** (L.) Greene seashore salt grass
rhizomatous perennial; brackish marshes and flats
- Echinochloa crusgalli** (L.) Beauv. barnyard grass
coarse annual; low fields, marshes and waste places
- Echinochloa walteri** (Pursh) Heller..... Walter's millet
coarse annual; marshes and low waste places
- ⁰¹?**Eleocharis fallax** Weatherby creeping spikerush
rhizomatous perennial; brackish marshes
- Eleocharis montevidensis** Kunth. sand spike-rush
rhizomatous perennial; wet sands
- ⁰¹**Eleocharis parvula** (R.&S.) Link small spikerush
small, mat-forming, rhizomatous perennial; fresh to brackish marshes and bogs
- ⁰¹**Erigeron procumbens** (Houst. ex P.Mill.) Nelson..... Corpus Christi fleabane
perennial herb;
- ⁰¹**Eustoma exaltatum** (L.) Salisb. ex G.Don.....catch-fly prairie gentian
annual or perennial herb; upper reaches of brackish marshes
- Fimbristylis castanea** (Michaux) marsh fimbry, sandrush
rhizomatous perennial; brackish marshes, savannahs, meadows
- ⁰¹**Gamochaeta (Gnaphalium) purpurea** (L.) Cabrera
..... purple cudweed, spoonleaf purple everlasting
annual or biennial herb;
- Geranium carolinianum** L wild geranium

- winter annual; disturbed habitats, gardens, fields, pastures, roadsides
- ⁰¹**Geranium dissectum** L. cranesbill
Erect winter annual; in fields and pastures
- ⁰¹**Heliotropium curassavicum** L. seaside heliotrope
annual or short-lived perennial; seashores and borders of fresh or saline marshes
- Hydrocotyle ranunculoides** L.f. water penny
fleshy aquatic or semi-aquatic perennial; seepage areas, pools, stream margins and swamps
- Hydrocotyle umbellata** L. marsh pennywort
low perennial with rounded terminal leaves; low or moist areas - pond shores, swales, slough edges, ditches, freshwater marshes
- 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,
- Hymenocallis crassifolia** Herbert. spider lily
perennial bulb; brackish marshes, low woods and swamp forest borders
- Iris giganteaerulea** giant blue flag
rhizomatous perennial; fresh marshes, swamps, and stream margins
- Iva frutescens** L. marsh elder
shrub; brackish marshes, upper zones of salt marsh
- ⁰¹**Juncus bufonius** L. toad rush
low, branched annual; wet roadsides, low fields and ditches
- Juncus effusus** L. soft rush
perennial; moist soil, edges of swamps and ponds, low pastures
- Juncus roemerianus** Scheele. black rush, needlerush
perennial; upper portions of salt and brackish marshes, often in solid stands
- ⁰¹**Lantana camara** L. shrub-verbena, lantana
weak shrub; roadsides and waste places
- ⁰¹**Lepidium virginicum** L. poorman's pepper
winter annual: common weed of fields, gardens and other disturbed habitats
- ⁰¹**Lilaeopsis chinensis** (L.) Kuntze. eastern grasswort
aquatic perennial; intertidal zone and open mud flats in brackish marshes
- Limnoscium pinnatum** tansy dog-shade
annual herb;
- Lippia nodiflora** (L.) Michaux. [**Phyla nodiflora**] frogfruit
decumbent perennial herb; sandy, open habitats, usually moist
- Medicago lupulina** L. black medic
annual legume; fields, roadsides and waste places
- ⁰¹**Modiola caroliniana** (L.) G. Don Carolina bristlemallow
perennial herb; lawns, gardens, pastures, roadsides, and seepage slopes in woods
- ⁰¹**Myriophyllum aquaticum** (Vell.) Verdc parrot-feather
submersed and emersed perennial; pools and ditches
- Myrica cerifera** L. wax myrtle
shrub or small tree; sand flats, pinelands and marshes
- ⁰¹**Oenothera biennis** L. evening primrose
erect biennial; fields and waste places
- ⁰¹**Oxalis corniculata** L. creeping wood sorrel

- stoloniferous perennial; lawns, gardens, fields and waste places
- Oxalis stricta** L..... yellow wood-sorrel
rhizomatous perennial; stable dunes and interdunes, thin woods, fields, waste places
- ⁰¹?**Paspalum floridanum** Michx. Florida paspalum
Coarse, rhizomatous perennial; low woods, roadsides and fields
- Panicum repens** L. dogtooth grass, torpedo grass
creeping, rhizomatous perennial grass; fresh and intermediate marshes on slightly
elevated sites; provides forage for rabbits, nutria and cattle
- Parthenium hysterophorus** a wild quinine
perennial with tuberous thickened roots; woodlands, thickets, and old fields
- Phragmites communis** Trinius..... roseau cane
tall, rhizomatous, perennial reed; fresh marshes, elevated areas in brackish or salt marshes
- Phyla nodiflora** (L.) Michaux. common frogfruit
prostrate, perennial herb; sandy, open habitats, usually moist
- Physalis pubescens** L..... Low hairy 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
- Polygonum punctatum** Ell. dotted smartweed
rhizomatous perennial with erect stems; alluvial woods, swamp forests or fresh marshes
- ⁰¹**Polyopogon monspeliensis** (L.) Desf..... rabbit-foot grass
annual grass; brackish marshes
- ⁰¹**Ranunculus scleratus** L. cursed buttercup
erect, succulent annual; moist to wet places –edge of marshes or brackish pools, tidal mud,
ditches, swamps, swales, wet meadows
- Rubus trivialis** Michaux southern dewberry
trailing or arching, thorny shrub; roadsides, old fields and along railroads
annual grass; brackish marshes
- ⁰¹**Rumex verticellatus** L..... swamp dock
erect, robust perennial; swamp forests
- Sagittaria latifolia** Willd. wapato, duck potato
emersed monoecious perennial; fresh marshes, low meadow and stream and pond margins
- Salicornia bigelovii** Torrey. glasswort
annual succulent; brackish marshes, salt flats, low sand flats
- Salix nigra** Marshall. black willow
tree; stream banks and low, moist areas
- Sambucus canadensis** L. elderberry
stoloniferous shrub; swamp forests, alluvial woods and pastures
- Schoenoplectus (Scirpus) americanus** Persoon. bulrush, swordgrass
coarse rhizomatous perennial; fresh or brackish marshes, swales, shallow brackish water
- Schoenoplectus (Scirpus) olneyi** Gray..... Olney's bulrush
coarse rhizomatous perennial; fresh or brackish marshes and ditches
- ⁰¹**Schoenoplectus (Scirpus) robustus** Pursh..... alkali bulrush
creeping perennial; marshes and rocky stream beds
- ⁰¹**Schoenoplectus tabernaemontani (Scirpus validus)** (K.C. Gmel.) Palla..... softstem bulrush
creeping perennial; marshes and rocky stream beds

- Senecio glabellus** Poir.....butterweed
annual; alluvial woods, swamp forests and wet pastures
- Sesbania drummondii** (Rydb.) Cory.....Rattlebox
shrub; elevated areas in fresh to brackish marshes, backdunes, waste places
- Sisyrinchium atlanticum** Bickn.blue-eyed grass
small perennial; moist to wet areas in the open, ditches, freshwater marshes, meadows,
pond shores
- Sisyrinchium exile** Bickn.....yellow-eyed grass
annual; moist to wet places - roadsides, lawns, meadows, old fields,
- Solidago sempervirens** L.....seaside goldenrod
perennial; brackish marsh or saline sand
- ⁰¹**Sonchus asper** (L.) Hill.....spiney-leaved sow thistle
winter annual; roadsides, fields, pastures and waste places
- ⁰¹**Stenotaphrum secundatum** (Walter) KuntzeSt. Augustine grass
stoloniferous or mat-forming perennial; brackish marshes, and southern lawns
- 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
- Spergularia marina** (L.) Grisebach.saltmarsh sand spurrey
tufted annual; salt and fresh marshes and tidal flats
- Spiranthes vernalis** Engelm. & Gray.....spring ladies' tresses
stout or delicate, erect spiral orchid; moist roadsides, thin pinelands, fresh and brackish
marshes, swales, low energy beaches, prairies and low meadows
- Sporobolus indicus** (L.) R.Br.smut grass
tufted perennial grass; meadow between dunes, swales, thin maritime or live oak
woods, thin pinelands, lawns, pathways, roadsides
- Sporobolus virginicus** (L.) Kunth.coastal dropseed
Extensively creeping rhizomatous perennial grass; brackish marshes, low sandy areas,
low dunes
- Sporobolus pyramidatus**whorled dropseed
perennial grass;
- Stellaria media** (L.) Cyrillo.common chickweed
prostrate or decumbent annual; waste places and fields
- Stenotaphrum secundatum** (Walter) Kuntze.St. Augustine grass
stoloniferous, mat-forming perennial; brackish marshes, lawns
- ⁰¹?**Teucrium canadense** L.....Canada germander
perennial herb; low moist woodlands, meadows and marshes
- Taxodium distichum** (L.) Richard.bald cypress, swamp cypress
large, deciduous tree; swamps
- ⁰¹**Trifolium repens** L.white clover
creeping perennial; lawns, fields and roadsides
- ⁰¹**Triodanis perfoliata** (L.) Nieuwl.....clasping venus' looking-glass
annual;
- Typha domingensis** Persoon.southern cat-tail
2-3 m tall, rhizomatous perennial; brackish and freshwater habitats

- **Vigna luteola** (Jacquin) Benth. deer pea, beach pea
perennial herbaceous vine; waste places, borders of marshes and low fields
- Xanthium strumarium** L. var. **strumarium** Cocklebur
annual coarse herb; sandy beaches and waste places
- Zeuxine strateumatica**lawn orchid
perennial herb, orchid; lawns and waste places, wet fields, hummock edges, roadside ditches
- ⁰¹**Zizaniopsis miliacea** (Michx.)Doell & Aschers. southern wild rice, water millet
rhizomatous perennial; brackish and freshwater marshes