LITTLE VERMILION BAY
SEDIMENT TRAPPING PROJECT

PROJECT REPORT

GENERAL:

The project is located in Vermilion Parish approximately 4 miles southwest of Intracoastal City, Louisiana in the northwest corner of Little Vermilion Bay. The purpose of the project is to provide a mechanism to encourage sediment deposition in a confined area to promote accretion of the existing bank line and to provide a buffer to the wave action which has caused loss of a substantial portion of the marsh in this particular area. The Cooperative Agreement between the NOAA National Marine Fisheries Service and the State of Louisiana Department of Natural Resources dated January 2, 1997 defined the project features as 14,000 linear feet of earthen terraces constructed to an elevation of 2 feet above mean sea level with plantings of smooth cordgrass on the terraces. The project as constructed, included 23 terraces totaling 23,300 linear feet constructed to 4.6 feet (NAVD 88) above mean sea level. A pattern was selected to utilize sediment-laden flows from two entrances to Little Vermilion Bay from the Freshwater Bayou. The two entrances are the northwest to southeast channel which is the main channel through Little Vermilion Bay and a secondary entrance on the west side of Little Vermilion Bay which is Schooner Bayou.

FIELD SURVEYS AND PRELIMINARY DESIGN:

Field surveys began on September 3, 1997 and were completed on February 5, 1998. Job access problems were encountered throughout the fall and early winter months. Frequent strong northerly winds coupled with low tides rendering the job site inaccessible on many days.

The first order of work was to bring horizontal and vertical control to the project site using the closest available published permanent N.G.S. benchmarks. A review of the N.G.S. data sheets provided Horizontal Control Monument "Datum" as the nearest available monument that would provide satisfactory GPS geometry to the project site. N.G.S. Monument "Datum" did not have a vertical component; therefore vertical datum had to be established for it. Vertical datum was transferred from N.G.S. Vertical Monument 57V96 to Horizontal Monument "Datum" using GPS measurements. Vertical Monument 57V96 was also used to establish the vertical component of the control monuments at the project site.

Four locations were selected in the project area to establish project control monuments for the collection of survey data. Horizontal and vertical control datum was transferred to Project Monuments "PEN1", "PEN2", "PEN3" and "PEN4" using Trimble 4400 GPS equipment. Using Real Time Kinematics, a total of eight sessions with a minimum duration of 20 minutes each was used to establish horizontal and vertical positions for "PEN1", "PEN2", "PEN3" and "PEN4". Two independent sets of data were collected in Real Time Kinematics to establish horizontal and

vertical control datum on Monuments "PEN1", "PEN2", "PEN3" and "PEN4". Monuments "57V96" and "Datum" were each used as base stations to transfer horizontal and vertical datum to "PEN1", "PEN2", "PEN3" and "PEN4". Results from sessions using both base stations yielded the same values for "PEN1", "PEN2", "PEN3" and "PEN4". As an additional check, "PEN2" was used as a base station and datum was transferred to "57V96" and "Datum", the results of which validated the values established in the earlier sessions. Project Monument "PEN1" is located on the northeast side of the Little Vermilion Bay on a small island; Monument "PEN2" is located on the main channel south of and just off the Rainey Refuge Canal; Monument "PEN3" is located on the south bank of an oilfield location canal south of and opposite the well platform; "PEN 4" is located on the north end of an island on the northwesterly side of Little Vermilion Bay. See attached map (Exhibit No. 1) for the locations of "PEN1", "PEN2", "PEN3" and "PEN4".

Field survey data for mapping was collected using a Trimble 4400 base station at "PEN2" and a roving Trimble 4400 Receiver. Collection of field data was divided into five parts. This consisted of the Bay bottoms east and west of the Navigation Canal, the Navigation Canal, Shoreline and oilfield structures. The weather and tidal conditions dictated which part we worked on. Approximately 3800 survey data points were collected, input into HP-Land Innovations Engineering Design System, processed, assembled into three data formats [Lambert Coordinate System (LA So.) (NAD 83) in feet and North American Vertical Datum (NAVD 88) in feet, Universal Transverse Mercator (UTM) (NAD 27) in meters and North American Vertical Datum (NAVD 88) in meters and Universal Transverse Mercator (UTM) (NAD 83) in meters and North American Vertical Datum (NAVD 88) in meters], and contoured. A permanent staff gauge was set on a 4" x 4" post in a well location canal next to the third piling from the main channel.

A 24" x 36" topography and layout map was drawn on AutoCad 14.

GEOTECHNICAL

Soils and Foundations Engineers, Inc. was selected to perform soil borings analysis and provide recommendations for the construction of the terraces. Ten soil borings were taken in the project area as shown on Exhibit No. 1. The soil borings taken found layers of very soft dirt, clay and organic clay soils from the mudline to depths of 5 to 15 feet. Soils Laboratory Testing & Analysis resulted in recommendations of a berm width of 90 feet between the toe of the embankment and the edge of the Borrow Canal cut slope for 6 foot high terraces. This would have required a very large bucket dredge to cast the materials the 90 to 175 feet to construct the terrace cross-section. Interviews with dredging contractors revealed that the longest boom available was 150 feet. Accordingly, the dredge could not place the fill beyond 150 feet and would have to sling (throwout) material for that portion beyond 150 feet. This would leave serious impacts upon the contractor's ability to construct the cross-section of terrace designed. The recommended alternative was to construct 5 foot high terraces utilizing staged construction with a lapse of 4½ to 5 years between stages. This alternative produced terrace cross-section with a berm of 50 feet which would require placement of fill material between 50 feet to 145 feet which is within the capability of existing bucket dredging equipment. It was decided by NOAA National Marine Fisheries Service that one stage construction with 50 feet berms should be

pursued (see letter from the Department of Natural Resources and NOAA National Marine & Fisheries Service).

PERMITS

The primary permitting agency for this project was the U.S. Corps of Engineers. A permit application was submitted on July 14, 1998. After several reviews and comments by the U.S. Corps of Engineers, the permit was approved on April 29, 1999.

FINAL DESIGN (Plans & Specifications)

Final designs (Plans and Specifications) were completed in September 1998. Planting of vegetation was removed from this project to be handled as a separate contract by the Department of Natural Resources.

CONSTRUCTION

A pre-bid conference attended by 10 potential bidders was held March 26, 1999. Bids for the project were opened on April 8, 1999. A total of 5 bids were received; the low bidder was Berry Brothers Construction from Berwick, Louisiana. A pre-construction meeting was held on May 17, 1999. The Contractor mobilized at the job site at about 10 p.m. on May 17, 1999 and started work on May 18, 1999. The project was completed on July 23, 1999.

For logistic reasons, the Contractor chose to construct the project in two parts: the first to be constructed was the terraces along the main navigation channel running northwesterly to southeasterly through Little Vermilion Bay; the second part was the terraces along the west bank of Little Vermilion Bay. This segregation of construction provided the Contractor with the most efficient means of mobilization and movement of his equipment to accommodate a staged construction of the terraces as described below. The Contractor selected to construct the terraces in two lifts with the express intention of allowing time for the first lift of each terrace to consolidate as much as possible before applying the second lift. The first terrace constructed was Terrace "I" followed in order by Terraces "E", "D", "H", "G", "F", "B", "C" and "A" completing the first lift on June 12, 1999. On June 13, 1999, the Contractor returned to Terrace "E" to begin the second lift, leaving Terrace "I" for last to allow additional consolidation time for Terrace "I" because of poor quality of soils encountered at that location. He completed the second lift to the above terraces on June 19, 1999. Terraces "E", "D", "H" and "G" had a few low reaches after the second lift. A third lift was applied to the low reaches on July 7, 1999. After completing the second lift on the terraces along the main navigation channel through Little Vermilion Bay, the Contractor moved to the second work location via Freshwater Bayou and Schooner Bayou. The Contractor started the first lift on Terrace "J" on June 20, 1999 proceeding thence to Terraces "O", "P", "K", "L", "P", "R", "N" and "S". The first lift to Terrace "S" was completed on July 4, 1999. The second lift phase was started on July 12, 1999 and complete July 15, 1999. Terraces "R" and "N" each had a 200 foot low spot after the second lift. A third lift was applied to the low areas on "N" and "R" on July 15, 1999.

Surplus project funds were used to add an additional 1500 feet to Terrace "I". The first lift was applied on July 20 & 21, 1999; the second lift on July 22, 1999 and the third lift on July 23, 1999.

Adjustments to several terraces were made during construction. The length of Terrace "C" was reduced by 150 feet to provide a buffer distance from a pipeline. Terrace "M" (700') was eliminated because a pipeline located across the contractor's access did not have sufficient depth to allow the dredge to cross over it. Four hundred fifty feet (450') was added to Terrace "K" and 400' was added to Terrace "L" to replace the reduction on Terrace "C" and the elimination of Terrace "M". An additional 1500' was added to Terrace "I" along Rainey Refuge Canal to provide more terrace length to break and reduce the wave action and act as a buffer to protect other terraces. See Exhibit No. 2 for the final terrace lengths.

During the construction phase, a difference was observed in the tide gauge readings at Maxie Pierce's Landing and the job site tide gauge. Readings taken over several weeks indicated the job site tide gauge was reading about 0.6 feet higher than the Maxie Pierce Landing tide gauge. Later static GPS sessions and differential leveling confirmed that the monuments at the project site ("PEN1", "PEN2", "PEN3" and "PEN4") were 0.65 feet lower than originally calculated. Therefore, the Bay contours were adjusted 0.65 feet lower. The bottom of the Bay is at an average minus 0.5 feet elevation and the design elevation of the terraces is at elevation 4.6 feet. This did not affect the maximum terrace height of 5.0 feet that could be constructed at this project location. The Cooperative Agreement and Scope of Services call for the construction of terraces to an elevation of 2.0 feet above Mean Sea Level. The terrace as constructed to 4.6 feet (NAVD 88) above Mean Sea Level, provide a freeboard of 1.7 feet at Mean High Tide (2.9' MSL) and 4.2 feet at Mean Low Tide (0.4' MSL).

CONCLUSIONS:

Several conditions were observed during various phases of this project which may be of value when considering a similar type project. One of the shortcomings of this project was the limited amount of horizontal and vertical datum located in the vicinity of the work site. There was one horizontal monument and one vertical monument available for use on this project. Additional monumentation could have been used, but this would have required an extensive survey network to implement. A current coastal network of horizontal and vertical monuments would have been very beneficial in the establishment of project datum.

Water depths were very shallow in the project area. This topographic feature lends itself to the collection of survey data during the summer months when a normal high tide can be expected. Our field survey efforts were concentrated during the late Fall and Winter months which experienced predominantly northerly winds coupled with normally low tides rendered the work site accessible only by airboat on many occasions.

Geotechnical soils analysis recommended a staged construction method with a spacing of 4½ to 5 years between stages. This was based on the poor soils found in the project area. These poor soil conditions were verified during the construction of the terraces. The Contractor

encountered very poor soils along the Rainey Refuge Canal (Terrace "I") and at various locations along some of the other terraces. A strata of good clay material was found on the northeasterly side of the project. A noticeable deposition of clay material was observed on the easterly portions of Terraces "A", "B", "C" and "D". These terraces in the clay area appeared to stand-up better after the first lift as compared to other terraces after the first lift. It also appeared that these terraces experienced less consolidation between the first and second lifts. Monitoring of the terrace cross sections should show less future settlement on the easterly portions of "A", "B", "C" and "D". The Contractor's election to build the terraces in multiple lifts proved to be the appropriate construction technique to offset the poor soil conditions. This allowed the first lift to consolidate and form a base for the second lift and in some areas, the third lift. This method worked very well toward raising a terrace 5 feet above the Bay floor. The time between lifts allowed the material to consolidate and this appeared to be beneficial to the construction of the terraces.

The Contractor did an excellent job with the available materials and should be considered for future projects.

A monitoring program should be implemented to ascertain the rate and extent of terrace settlement (if any) and to formulate any required terrace refurbishment to maintain the integrity of the terrace cross-section.