



REPLY TO  
ATTENTION OF:

DEPARTMENT OF THE ARMY  
GALVESTON DISTRICT, CORPS OF ENGINEERS  
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**PLANNING ASSISTANCE TO STATES PROGRAM**

**SECTION 22 REPORT**

**ACTIVITIES TO REDUCE  
EROSION LOSSES  
ALONG THE TEXAS GULF COAST**

U.S. Army Engineer District, Galveston  
Southwestern Division  
June 1993



# ACTIVITIES TO REDUCE EROSION LOSSES ALONG THE TEXAS COAST

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# **ACTIVITIES TO REDUCE EROSION LOSSES ALONG THE TEXAS COAST**

## **INTRODUCTION**

This report has been prepared as part of a cooperative agreement between the State of Texas and the United States Army Corps of Engineers, Galveston District, under the Planning Assistance to States Program. The lead agencies for the State of Texas have been the Texas Water Development Board under the direction of the Executive Administrator, Mr. Craig Pedersen, and the Texas General Land Office led by Land Commissioner, Mr. Garry Mauro.

## **AUTHORITY**

The authority for the Corps of Engineers to cooperate with States in preparing water resources related plans comes from Section 22 of Public Law 93-251. This authority was amended by Section 921 of the Water Resources Development Act of 1986, Public Law 99-662, which limits Federal expenditures to \$300,000 in any one year for studies for any one State. Further policy decisions implemented cost sharing between the Federal Government and States beginning in Fiscal Year 1991 at a 90-10 ratio, changing to 70-30 in Fiscal Year 1992, then to 50-50 in Fiscal Year 1993 and beyond.

## **PURPOSE AND BACKGROUND**

The State of Texas continues to actively pursue the development of a comprehensive coastal management plan for the State's public lands. Some of the major issues which are being addressed in this plan are coastal erosion, beach access, and wetland loss.

The purpose of this report has been to describe types of Federal assistance available for erosion control projects and to document the various studies and activities that the Corps of Engineers has recently been involved in for addressing erosion problems along the Texas coast. This report is intended to provide decision-makers background information necessary to prioritize erosion threats on the coast and develop a conceptual management plan for short- and

long-term coastal erosion control projects for the Texas Coastal Management Program.

Two other reports have been prepared by the Galveston District under the Section 22, Planning Assistance to States Program to aid the State in their endeavors in formulating a comprehensive coastal management plan. The reports were completed in August 1992 and are titled, "Galveston Beach Groinfield Maintenance Material Placement," and "Inlets Along the Texas Gulf Coast."

## **SCOPE OF STUDIES**

The inventory of Corps of Engineers' investigations and efforts to address erosion problems along the Texas coast focuses on the Gulf of Mexico shoreline extending from the mouth of the Sabine River to the mouth of the Rio Grande. Although investigations of erosion problems date back many years, this report describes only the activities that have recently been completed, are currently underway, or are planned to be initiated in the near future. The report also describes the authorities for Corps of Engineers involvement in erosion control activities including details on study requirements, the advantages, constraints, and Federal/non-Federal funding requirements associated with each authority.

## **CHARACTERISTICS OF THE TEXAS COAST**

A narrow barrier chain composed of islands and peninsulas extends along the entire Texas coastline except for two relatively short reaches. These exceptions are where the mainland fronts the Gulf for about 35 miles in the area southwest of Sabine Pass and for about 30 miles in the vicinity of Freeport. Behind the barrier chain lies a vast complex of shallow bays and lagoons, broken in several locations by natural and man-made inlets or passes.

Composed of a complex system of endlessly shifting sand dunes, beaches, and submerged bars, the islands and peninsulas serve as the first line of defense for the mainland against hurricanes and other tropical storms. Sand dunes bordering the Gulf side of these islands act as a natural seawall, absorbing and dissipating the

forces of wind-driven waves and thus preventing or reducing inland flooding. The dunes also store sand that replenishes the beaches after storms.

As areas of natural beauty, these islands and peninsulas offer a variety of recreational opportunities to man, are convenient port sites for commercial fishing and shipping operation facilities, and have become increasingly popular as sites for second homes, permanent residences, hotels, and other types of tourist development.

Of the 367 miles of shoreline, 60 percent is classified as erosional, 33 percent is in equilibrium, and 7 percent is accretionary. A generic statement as to the cause of the erosion problems along the Texas coast is that there is a deficit of sediment moving to and through a particular reach of shoreline. Erosion of updrift coasts does supply materials to downdrift coasts; however, the eroded volume of material from one area may not be sufficient to offset the erosion losses at all specific segments of downdrift shorelines. Erosion along the Texas coast is recognized as a serious problem.

## **AUTHORITIES FOR CORPS OF ENGINEERS INVOLVEMENT IN EROSION CONTROL ACTIVITIES**

The conduct of studies and management of construction in beach erosion control projects has been delegated by Congress to the Corps of Engineers. Federal involvement in beach erosion control could consist of a Congressionally authorized study, a small beach erosion project under special continuing authority, beneficial use of material dredged from navigation channels, or technical assistance.

### **CONGRESSIONALLY AUTHORIZED STUDIES**

These types of studies originate when a public entity approaches a Congressman or Senator with a problem that is beyond the entity's ability to alleviate or solve alone. The Congressman or Senator in turn introduces a resolution before the appropriate House or Senate

public works committee and when passed, the problem is authorized to be studied by the Corps of Engineers. Once a Congressional study authority is available, the study is assigned to the local Corps District. The District then, through the normal Federal budget process, asks for money to conduct the study. When Federal funds to conduct the study are included in an annual Energy and Water Development Appropriations Act, the District can begin the study.

The investigations are conducted in two phases. The first phase is a 1-year long reconnaissance study which is conducted at Federal expense and consists of all work and analyses required to determine whether there is a Federal interest in further planning. If Federal interest is demonstrated, a scope of work and study cost estimate for the second study phase is developed and negotiated with the study sponsor. The second phase is a 3- to 4-year long, cost-shared feasibility study. If this feasibility study shows there is a Federal interest in participating in the project, a local sponsor must also be identified to share the construction cost of the project.

The degree of local participation is established by Federal statutes and policy and depends on shoreline ownership and use. Federal cost participation for shore and beach restoration and protection projects may be up to one-half the cost of protecting shores owned by non-Federal public agencies. Project costs assigned to benefit privately owned shores or to prevent losses of private lands shall be borne by the project sponsor. Projects for protection of shores not publicly owned may be eligible for Federal cost sharing up to one-half provided that significant public benefit can be demonstrated. The Federal participation is adjusted in accordance with the degree of public benefit. As a minimum, local interests are required to provide all lands, easements, and rights-of-way; share in the costs of construction; and maintain the project after completion.

#### **CONTINUING AUTHORITIES PROGRAM**

The Continuing Authorities Program provides the Corps with the authority to respond quickly to water resources problems. Congress



has authorized the Corps to construct small projects within certain funding limits. The study and design criteria and cost sharing requirements are the same as for congressionally authorized studies. The main advantage of this study procedure is that time savings are realized through the preparation of combined feasibility and detailed design studies and the elimination of several authorization and budget steps through the study. The disadvantage of this procedure is that the Federal share of the cost of a project cannot exceed a specified dollar amount which is established by law.

Under the Continuing Authorities Program, Section 103 of the River and Harbor Act of 1962, as amended, provides authority for the Corps of Engineers to develop and construct small shore and beach restoration and protection projects not specifically authorized by Congress. Beach erosion control projects cover construction of revetments, groins, jetties, and placement of sand on public beaches. The Federal share in such projects may not exceed \$2 million, and the project must not be dependent on additional improvements for successful operation. This Federal cost limitation includes all project-related costs for studies, planning, engineering, construction, supervision, and administration.

Section 111 of the River and Harbor Act of 1968 authorized the investigation and construction of projects to prevent or mitigate shore damages resulting from Federal navigation works, at full Federal cost but limited to \$2 million per project. This authority was modified by the Water Resources Development Act of 1986, Public Law 99-662. As modified, this authority now allows implementation of nonstructural measures to mitigate shore damages from Federal navigation works, requires local interests to operate and maintain Section 111 measures, and requires cost sharing in the same proportion as for the works causing the shore damage.

#### **OTHER ASSISTANCE**

Technical and engineering assistance can also be provided to State, County, or local governments or agencies when Federal participation in a project is not feasible. However, this assistance is limited

to site inspection of problem areas, advice on possible methods of protection, providing copies of available data, review of designs or reports, and inspection and advice on adequacy of construction. Such assistance cannot involve surveys; foundation investigations; preparation of preliminary designs, plans, or specifications; nor supervision of construction.

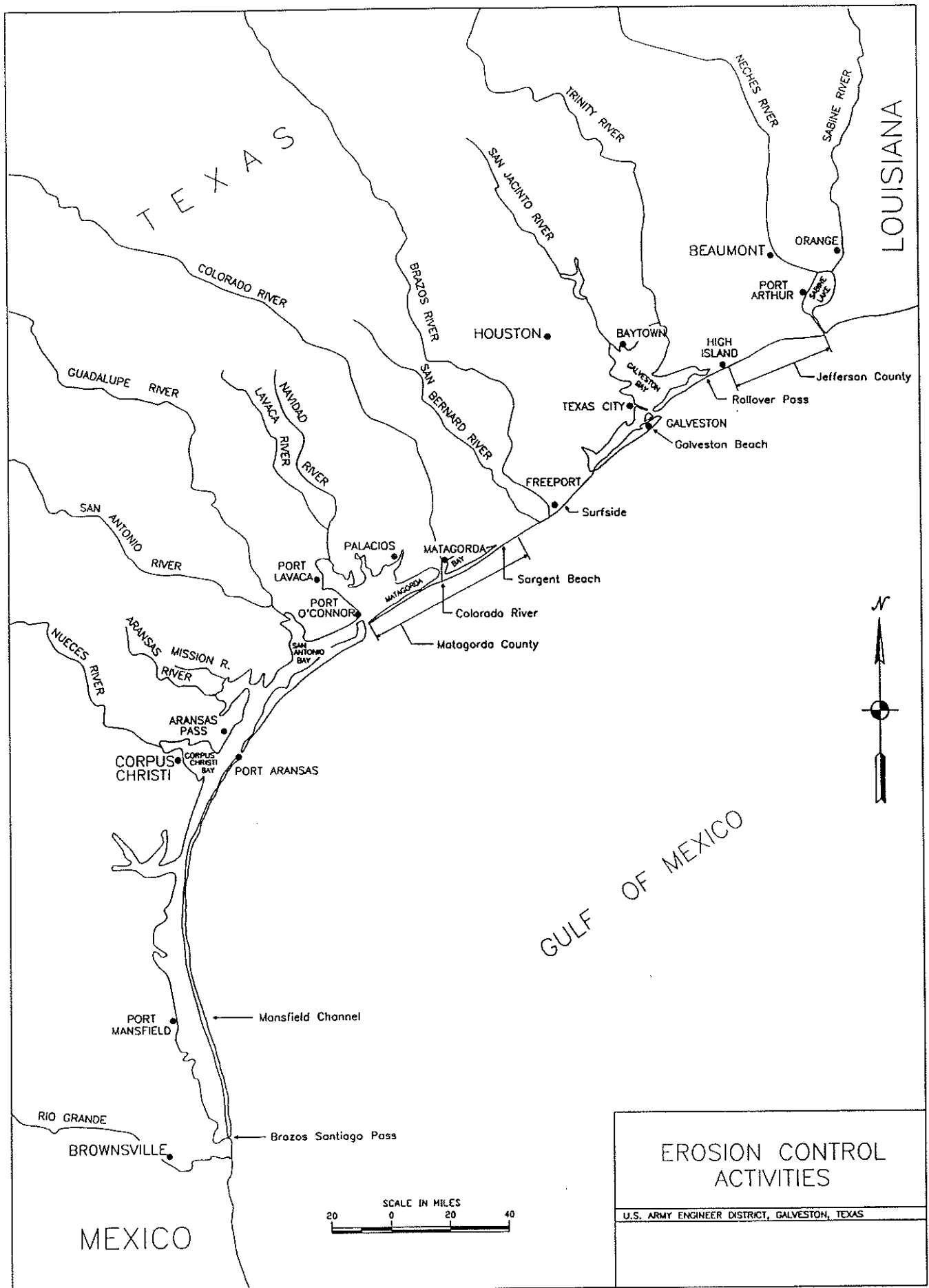
Section 933 of the Water Resources Development Act of 1986 modified Section 145 of the Water Resources Development Act of 1976. These Acts allow the Corps to place beach quality sand dredged from constructing and maintaining navigation projects on beaches. The State must request this action and act as the local sponsor for the project. Current policy allows for the Corps to share 50 percent of the additional costs if the added cost of such placement is justified by benefits associated with protection of the beach. Recreational benefits produced as a consequence of the basic project may exceed 50 percent of the total project benefits, but economic justification must be demonstrated on the basis of recreation benefits limited to 50 percent of the total benefits.

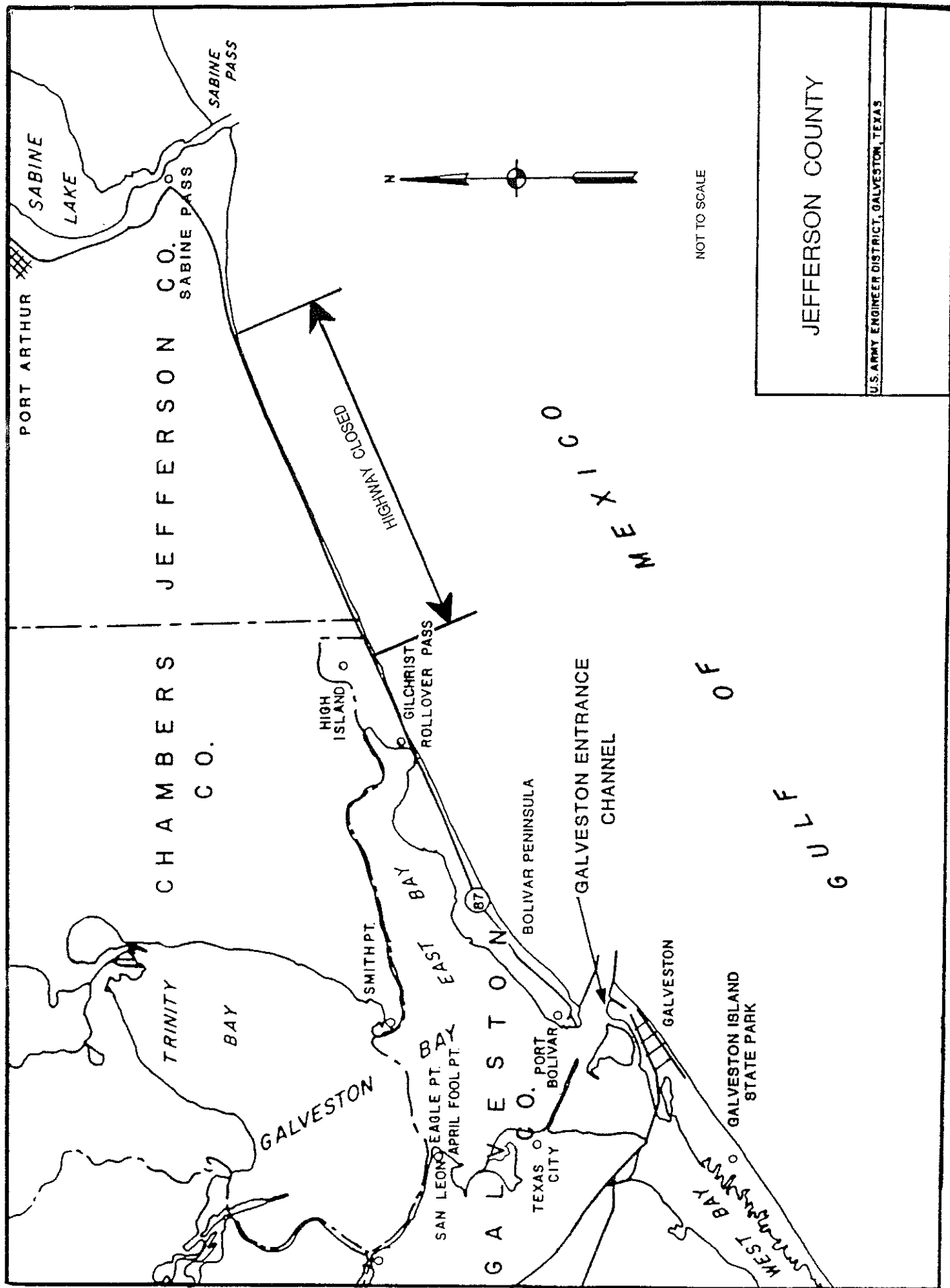
#### **RECENTLY COMPLETED, ONGOING, OR PLANNED ACTIVITIES ALONG THE TEXAS GULF SHORELINE**

The following paragraphs describe recently completed, ongoing, or planned efforts by the Corps of Engineers to address erosion problems along the Texas coast. Figure 1 is a map showing the location of each activity.

##### **JEFFERSON COUNTY**

Approximately 20 miles of the 30-mile Gulf of Mexico shoreline of Jefferson County is experiencing erosion that has caused the closure of about 16.8 miles of State Highway 87, which parallels the upper Texas coast as shown in Figure 2. Westward, the highway is primarily used for access to Bolivar Peninsula and Galveston Island, and eastward, the highway links the Texas coastal route to the Louisiana coastal route and the cities of Holly Beach and Cameron. East of Bolivar Peninsula, the area immediately inland from the coastline is rural with the only human habitation being at





JEFFERSON COUNTY

U.S. ARMY ENGINEER DISTRICT, GALVESTON, TEXAS

FIGURE 2

High Island and in the town of Sabine Pass. The area is virtually flat with coastal marshes and prairies used for cattle grazing. State Highway 87 traverses 12 miles of the 81,700-acre McFaddin Marsh National Wildlife Refuge and approximately 2-1/2 miles of the 15,100-acre Sea Rim State Park. Sea Rim State Park is located in the easterly portion of the study area, approximately 10 miles west of Sabine Pass with McFaddin Marsh Refuge immediately westward from the State Park. The shoreline has eroded at a rate of from 5 to 10 feet per year from Sea Rim State Park westward to the Jefferson-Chambers County line based on data from the Bureau of Economic Geology. The remainder of the area is stable or accretional. The major problem generated from the erosion in addition to the loss of land, is damage that has been caused to the State Highway. The highway has been moved inland several times to escape the effects of erosion only to be affected later as the erosion continued or a hurricane struck the area. The major cause of the erosion is a deficit in sediment supply in that there are no major rivers located within this littoral cell which would add material to the littoral zone. The net littoral drift direction is from east to west in the study area.

Two studies have been conducted by the Galveston District addressing erosion problems in this area. In June 1984, the Corps completed a study which investigated the feasibility of providing shore erosion control along the Gulf shores of Jefferson and Chambers Counties. The study was conducted at the request of the Texas Department of Transportation, formerly the Texas State Department of Highways and Public Transportation, under authority of Section 103 of the River and Harbor Act of 1962, as amended. Various shore stabilization measures were considered for the study reach; however, none were found to be economically feasible. The other study, the Galveston County Shore Erosion Study, was completed in May 1985. This study was conducted in response to U.S. House of Representatives' Committee on Public Works and Transportation resolutions dated October 10, 1974 and September 22, 1976. Although the feasibility study focused on solutions to erosion problems in Galveston County and Surfside Beach in Brazoria County, the technical studies extended eastward to Sabine Pass. The results of the Galveston County Shore Erosion Study are discussed later in this report in the section on Galveston Beach.

Authorization for a new study to investigate the feasibility of providing shore protection improvements along the Gulf of Mexico in Jefferson County was provided by a resolution adopted by the U.S. House of Representatives' Committee on Public Works and Transportation on June 10, 1992. This study will focus on alternatives to address the erosional impacts to the highway in Jefferson County, but will necessarily include the reach of shoreline from the Sabine Pass Jetties to the North Jetty of the Galveston Harbor Entrance Channel to encompass an essentially independent littoral cell. Funds have not yet been received to initiate this study.

#### **ROLLOVER PASS**

Rollover Pass is located 22 miles northeast of Galveston and was constructed by the Texas Game and Fish Commission, now the Texas Parks and Wildlife Department. As shown on Figure 2, Rollover Pass connects the Gulf of Mexico with East Galveston Bay. The Pass was designed to improve water quality in Galveston Bay and was initially opened between October 1954 and February 1955. The erosion rate in the immediate vicinity of the Pass, particularly on the west side, is higher than the general trend for the area on either side of the Pass. As part of the Galveston County Shore Erosion Study, a beach nourishment plan and a combination groins with beach nourishment plan were investigated for reducing erosion in this popular fishing spot. However, both alternatives were found to lack economic justification, mainly because the remoteness of available borrow sites for beach material caused the project costs to far exceed the benefits derived from the protection.

There has been recent interest in the use of maintenance materials that are periodically removed from the Gulf Intracoastal Waterway (GIWW) in the Rollover Pass area for placement on nearby beaches. The Galveston District has had discussions with representatives from the Texas General Land Office, Galveston County officials, and local interests from the Gilchrist and Crystal Beach areas on this matter and they all view this possibility favorably.

To make a preliminary investigation of the amount and quality of sand available from the Rollover Bay reach of the GIWW, a sampling

effort was conducted by the Galveston District in February 1992. Based on only a few samples, the material removed from the channel contains as much as 85 percent sand with the remainder being silts and clays. The average sand percentage of the total volume of material from this channel reach would be expected to be much less, probably on the order of 50 to 60 percent. It is a matter of opinion if this material would qualify as "beach quality sand". For most beach-front property owners behind an eroding shoreline, the sand content percentage is not of primary importance. Conversely, for recreational beach users, a sandy beach is of utmost concern. Therefore, like most situations, some disagreement as to the use of this material on the beach can be expected.

Without question, material from the channel placed on the beach would contain significant silts and clays, and would cause a turbidity plume, possibly for several months, as waves and currents remove the finer materials. Also of concern is the possible recycling and short-circuiting of the material through Rollover Pass when material is placed on the updrift or east side of the pass. This would have the effect of increasing the dredging frequency of this reach and would have to be further evaluated.

The Corps of Engineers is mandated to use the least costly means of dredged material disposal that is in compliance with environmental laws and regulations. However, we continue to look for ways to use maintenance materials, such as that removed from the Rollover Bay area of the GIWW, in the most beneficial way possible. The approximate 1-mile portion of the GIWW channel across Rollover Bay requires maintenance dredging on about a 2-year cycle. This is more frequent than adjacent areas because of the tidal action of Rollover Pass pulling in materials moving along the Gulf shoreline. If the cost of placing the material on the beach exceeds the cost of the current method of leveed upland disposal, the additional cost could be shared equally with a non-Federal sponsor, in accordance with Section 933 of the Water Resources Development Act of 1986, Public Law 99-662.

There are a number of activities which must be accomplished prior to use of the beach in the vicinity of Rollover Pass as a disposal area. This would involve the securing of additional sediment data in the Rollover Bay reach of the GIWW; developing a detailed

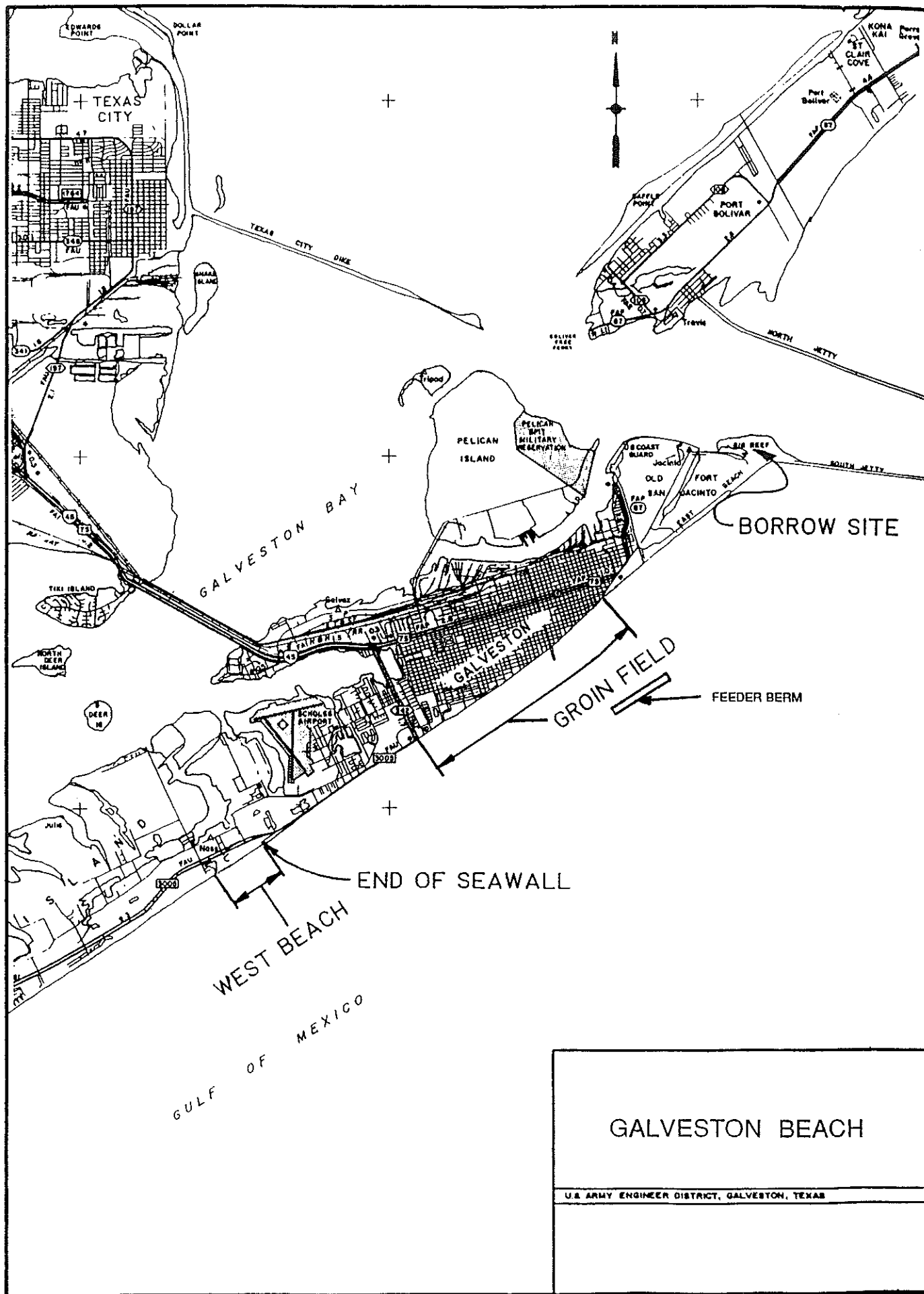
dredged material disposal plan including pipeline routes, discharge location(s), etc.; developing the costs of the plan for comparison with existing procedures; possible execution of a local cost-sharing agreement with a non-Federal sponsor; preparation of an environmental document, either an Environmental Assessment or Environmental Impact Statement; and coordination of the document with various State and Federal resource agencies and others.

## **GALVESTON BEACH**

Galveston Island is a 28-mile long barrier island, oriented in a northeast-southwest direction and varies in width from 1/2 to 3 miles. The City of Galveston virtually encompasses the entire Island. The densest developed portion of the city occupies the northeastern one-third of the Island and is protected from storm waves on the Gulf side by a concrete seawall approximately 10 miles long. About 4 miles of the seawall is fronted by a system of 15 groins, referred to as the groinfield. Galveston Island is a major tourist attraction, and the Island's Gulf shoreline is used heavily for recreational activities.

The Corps of Engineers has been working with the City of Galveston and Galveston County for several years to find a way to nourish the Galveston beachfront. As mentioned previously in the discussion on Jefferson County, the Galveston County Shore Erosion Study was completed in May 1985. The feasibility report recommended the construction and periodic renourishment of a 3.8-mile long segment of beach in the groinfield between 10th and 61st Streets and a 0.6-mile long reach at the western end of the seawall, as shown in Figure 3. Approximately 1.3 million cubic yards of sand would be placed in the groinfield, and 0.2 million cubic yards would be placed at the west end of the seawall. The benefits to be derived from the groinfield portion of the project were entirely recreational, and recreation has been viewed as low priority for Federal funding for the last few years. The benefits derived from the West Beach portion of the project were from damages prevented to development, and it was determined that the non-Federal portion of the total project costs was 85 percent. The local non-Federal sponsor, Galveston County, decided that the cost sharing was unacceptable, and the study was terminated.





In August 1992, the Galveston District completed a study under the Planning Assistance to States Program which investigated the possible use of material dredged from the Galveston Harbor Channel for beach nourishment for the Galveston groinfield area. Unfortunately, subsequent scientific field investigations by the Corps' Waterways Experiment Station in Vicksburg, Mississippi, revealed that the maintenance material averaged approximately 60 percent sand which was judged to not be suitable for beach nourishment purposes. On behalf of the Texas General Land Office, the District is assessing the possibility of using Big Reef, a naturally accreting fillet located between the Galveston jetties, as a source of material to nourish Galveston beaches. This study is also being conducted under the Section 22 program, and is scheduled for completion in June 1993.

In April 1993, the Galveston District awarded a maintenance dredging contract for the Galveston Harbor and Channel project that provides for construction of an offshore feeder berm in the Gulf of Mexico with the material removed from the channel. An estimated 2.7 million cubic yards of dredged material will be removed from the channel. The berm site will receive 560,000 cubic yards, and the rest of the material will be placed in an existing offshore disposal area. The berm will be located approximately 1 to 2 miles offshore in 18 to 25 feet of water, parallel to the shoreline, and generally within the limits of the groinfield. It is anticipated that the berm will be as wide as a football field, more than a mile long, and 4 to 8 feet high. The dredging project is scheduled for completion in September 1993. This practice is still experimental in nature, but the concept is that the wave-generated currents will carry sand from the berm toward the shore where it will slowly replenish the beach. Bathymetric surveys will be made and compared to before dredging transects to monitor the berm itself immediately following construction, and at 2 months, 6 months, and 12 months after construction. A similar project, described later in this report, was constructed off South Padre Island and has yielded positive benefits.

## **SURFSIDE**

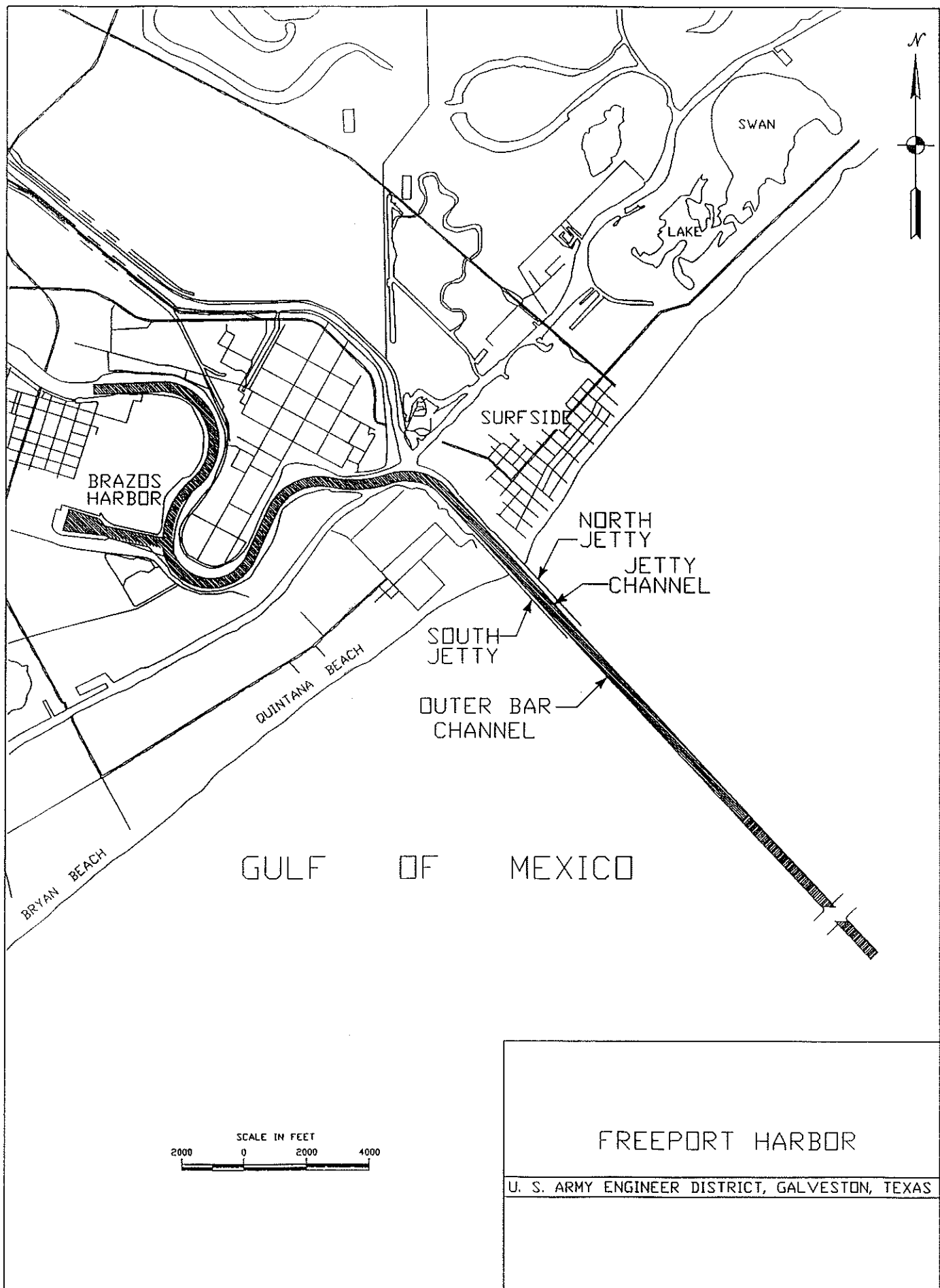
The Gulf beach at Surfside is a 2-mile segment of narrow, sandy beach located near Freeport in Brazoria County and is approximately 11 miles from the western limits of Galveston County. The community of Surfside borders on the Gulf of Mexico and is immediately northeast of the jettied entrance to Freeport Harbor as shown in Figure 4. Development within the community is primarily residential with a large concentration of seasonal beach cottages.

During the late 1970's, several homes were destroyed and others sustained erosion damage from storms. Initial evaluations of Surfside as part of the Galveston County Shore Erosion Study found that a beach nourishment project was economically feasible; however, no local sponsor capable of providing the required non-Federal cost could be identified.

Prior to the deepening of Freeport Harbor to 45 feet, the beach at Surfside was experiencing severe erosion. In September 1991, approximately 283,000 cubic yards of sand, clay, and silt dredged during the deepening project were placed onto the beach for the purpose of beneficial use of dredged material. This site was coordinated with the various Federal, State, and local agencies as a disposal site for dredged material at no additional cost to the local sponsor. Initially, the beach looked more like mud than beach. However, the clay and silt were eventually washed away by rain and waves, leaving behind an attractive recreation spot.

## **MATAGORDA COUNTY**

Matagorda County, located along the mid-Texas coast, has experienced erosion problems along the Gulf of Mexico shoreline as far back as the 1850's. A reconnaissance study was completed in May 1991 in response to a Congressional study resolution adopted August 8, 1984 by the House Committee on Public Works and Transportation. The area studied is shown in Figure 5. The Matagorda County Shore reconnaissance study analyzed erosion problems along the entire 70-mile Gulf of Mexico shoreline of the County, excluding the Sargent Beach area. The Sargent Beach area was omitted because studies were already underway to address the



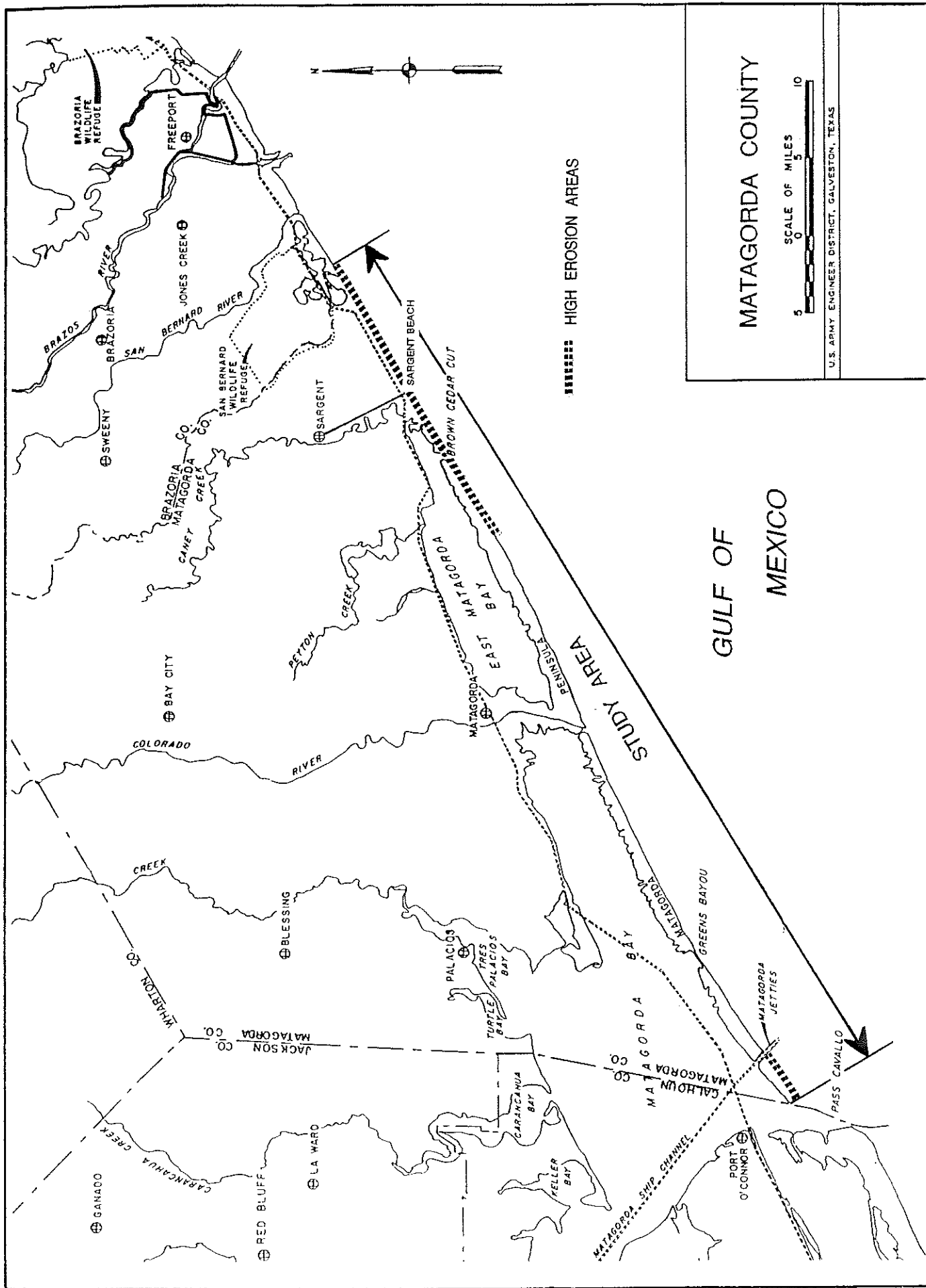


FIGURE 5

serious threat to the GIWW in that area under separate study authority. The Sargent Beach studies are discussed in more detail below.

Investigations conducted as a part of the Matagorda County Shore reconnaissance study showed that erosion problems do exist along two specific reaches of the County's Gulf shoreline. These are from Cedar Lakes to the eastern portion of East Matagorda Bay, which includes the Sargent Beach area; and the area between the jettied Matagorda Ship Channel and Pass Cavallo. The reach west of the Matagorda jetties is essentially undeveloped private property, and it is not in the Federal interest to protect private property from erosion damages. Insufficient benefits would be generated from storm damage prevention to offset the costs of providing a beach erosion control or storm damage prevention project. The reconnaissance study therefore recommended that no further studies be undertaken since there was no way to justify Federal participation in stabilizing the Gulf shores of the County at this time.

#### **SARGENT BEACH**

Sargent Beach is located in Matagorda County between East Matagorda Bay and Cedar Lakes, approximately 170 miles northeast of Corpus Christi and 20 miles southwest of Freeport. There is a serious erosion problem in the Sargent area which will, if not addressed in the near future, adversely effect the economically important GIWW.

In the Sargent area, shown in Figure 6, the shoreline separating the Gulf of Mexico and the GIWW continues to experience the highest erosion rate along the Texas coast. This erosion rate has accelerated in recent years and has exceeded 50 feet per year at some stations and for short periods of time. The average rate is in the 30-foot per year range. More than 40 residences have been lost to erosion at Sargent in the past 15 years.

The 7-mile reach of the GIWW near Sargent is now separated from the Gulf by a barrier width of from 600 to 900 feet. A buffer zone of at least 300 feet between the two bodies of water should be maintained to avoid operational problems to the waterway. This

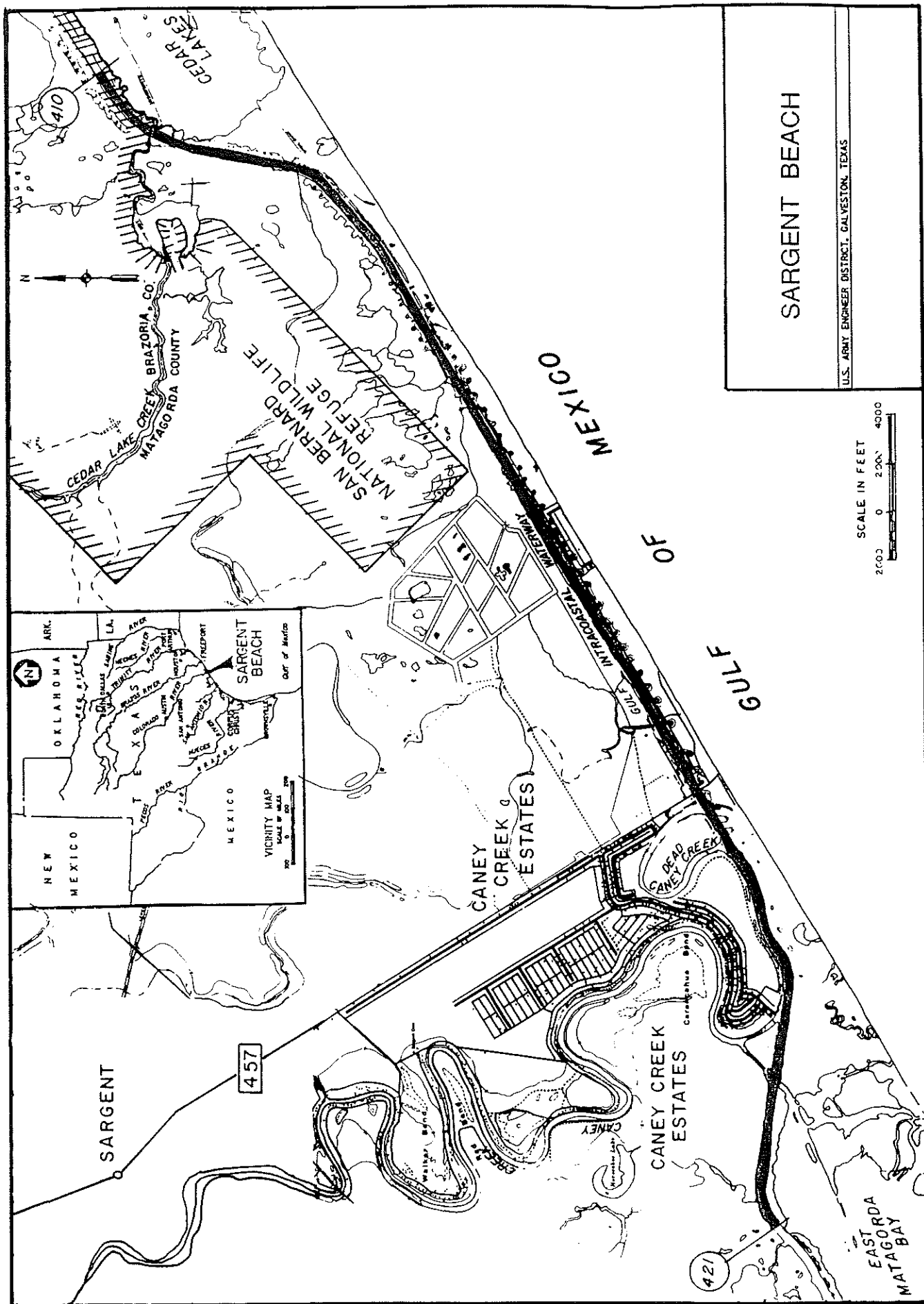


FIGURE 6

buffer zone will begin to be affected near the turn of the century if erosion remains unchecked. An extended breach of the waterway would essentially halt the annual traffic in excess of 16 million tons of commerce south of Freeport on the GIWW, resulting in major economic impacts from shipping delays, changing to alternative modes of transportation, or experiencing high costs for channel maintenance of the waterway.

A Reconnaissance Report was completed in November 1989. This report concluded that remedial measures in the Sargent Beach area were warranted and in the Federal interest to pursue in the more detailed feasibility phase. The feasibility analyses consisted of evaluating and screening various alternatives for assuring continued navigability of the GIWW. These alternatives consisted of typical coastal erosion control measures such as shore armoring, beach nourishment, groins, breakwaters, etc., and realignment of the GIWW further inland. The Final Feasibility Report and Environmental Impact Statement were completed in February 1992 and the project was authorized by the Congress for construction in November 1992.

The recommended plan consists of an 8-mile long concrete-block revetment with two sections of concrete sheetpile wall where there are poor foundation conditions. Additional engineering and design studies are underway, and construction is currently scheduled to begin in Fiscal Year 1995 with project completion expected by August 1998.

If a major storm surge or an extremely high tide were to breach the land barrier prior to completing the project, the Corps would activate emergency plans. If the barrier is breached in a small area and directly exposes the GIWW traffic to Gulf waves, the breach will be filled with dredged material. An extensive breach will be filled with rubble before placing the dredged material. Under all circumstances, dredging capability is available through private dredging companies mobilized through the Corps' emergency contracting procedures until a permanent solution can be put in place.

Dredged material has been placed in the surf zone at Sargent Beach on four occasions during maintenance dredging of the GIWW in an



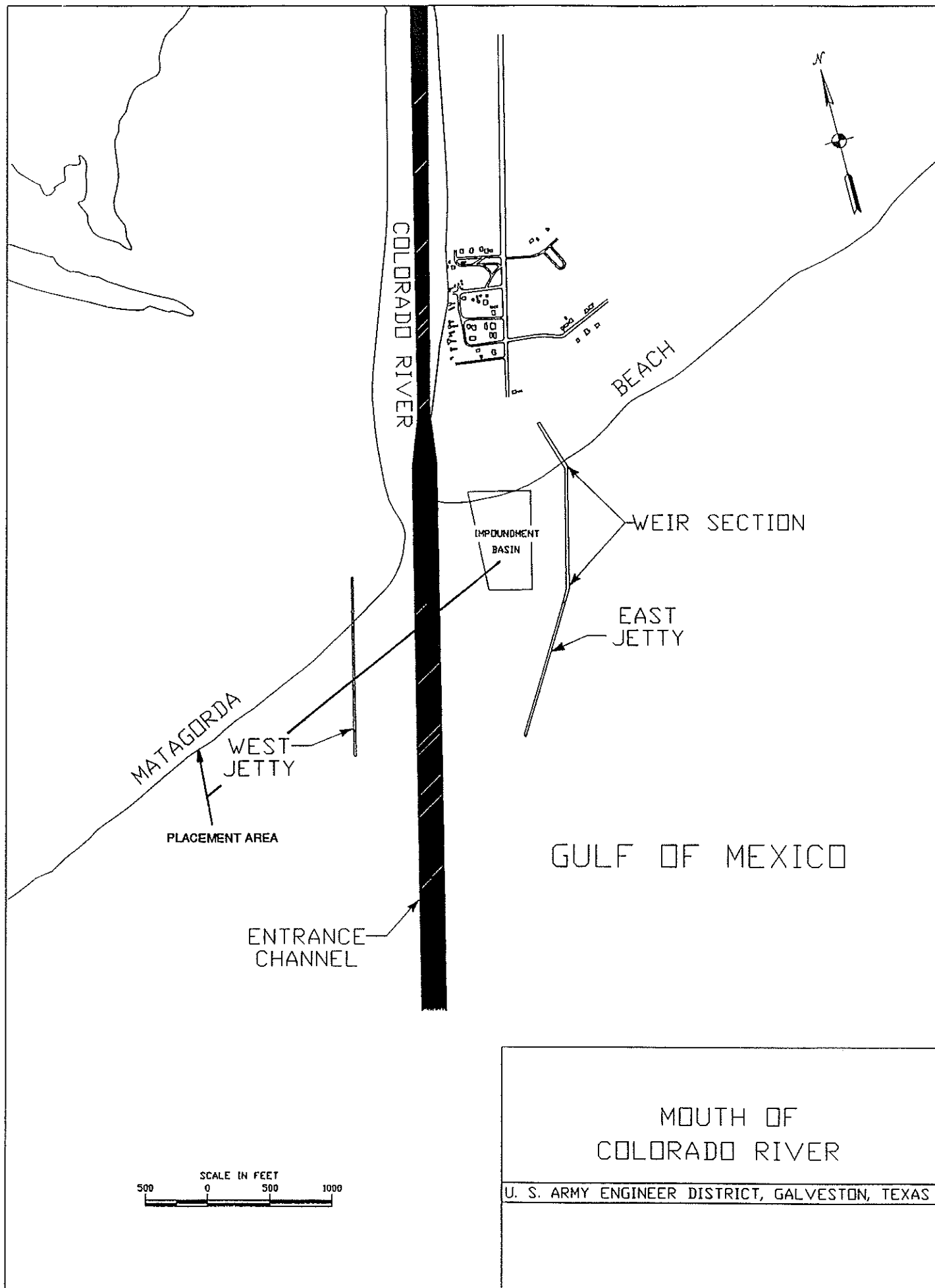
effort to retard the retreating shoreline. In the summer of 1988, 289,400 cubic yards of dredged material were placed on the Gulf shoreline. The material excavated from the area opposite McCabe Cut contained a high percentage of sand; however, most of the remaining material was silt and clays and only remained on the beach a short time. Maintenance material from the waterway was also discharged directly onto the beach in October 1988 (22,360 cubic yards) and between September 1989 and January 1990 (135,000 cubic yards). On both of these occasions, the material reacted similarly to the earlier placement, disappearing from the beach in a matter of days. Approximately 29,000 cubic yards of dredged material were again placed on the beach in the early part of 1993 as part of the most recent maintenance dredging cycle.

#### **MOUTH OF COLORADO RIVER**

The Mouth of Colorado River project is located in the delta portion of the Colorado River in Matagorda County. The project extends from the river's mouth at the Gulf of Mexico to the town of Matagorda.

The navigation features of the project include dual jetties into the Gulf with the East Jetty containing a weir segment to allow sediments to accumulate in a constructed impoundment basin between the jetties; an Entrance Channel 15 feet deep and 200 feet wide; a 12-foot deep by 100-foot wide navigation channel from the Entrance Channel to the GIWW which generally follows the old Colorado River Channel; and a harbor and turning basin. The project also includes recreational facilities adjacent to the East Jetty and features to restore the Colorado River outfall to Matagorda Bay.

Of special interest for this report on efforts to reduce erosion losses is the impoundment basin feature of the project. The impoundment basin is a trapezoidal area situated between the weir section of the East Jetty and the Entrance Channel as shown in Figure 7. The basin is located so that littoral material will readily move across the weir and be deposited into the basin. Periodic dredging of the entrance channel and impoundment basin and disposing of the material on the beach west of the entrance, where it can reenter the littoral system, provides a means for



nourishment of downdrift beaches. On two occasions, an average of 1,492,500 cubic yards of material has been removed from the impoundment basin and placed on the beach.

#### **MANSFIELD CHANNEL**

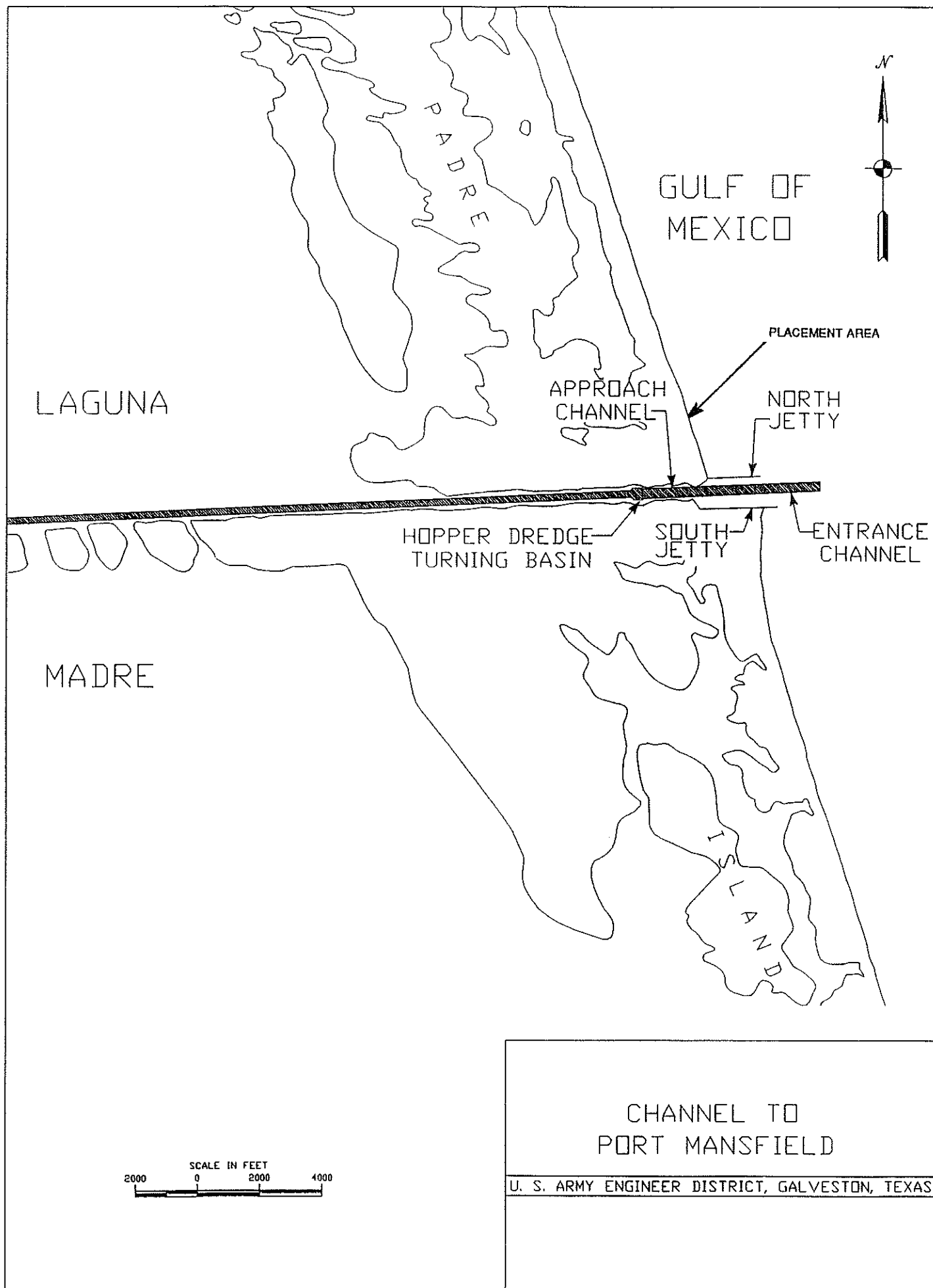
The Channel to Port Mansfield is a Federally-maintained shallow-draft navigation project located along the south Texas coast about 93 miles south of Corpus Christi. The channel crosses Padre Island and connects the Laguna Madre with the Gulf. The Channel to Port Mansfield project, shown in Figure 8, is 14 feet deep and 100 feet wide and has a jettied entrance 16 feet deep by 250 feet wide.

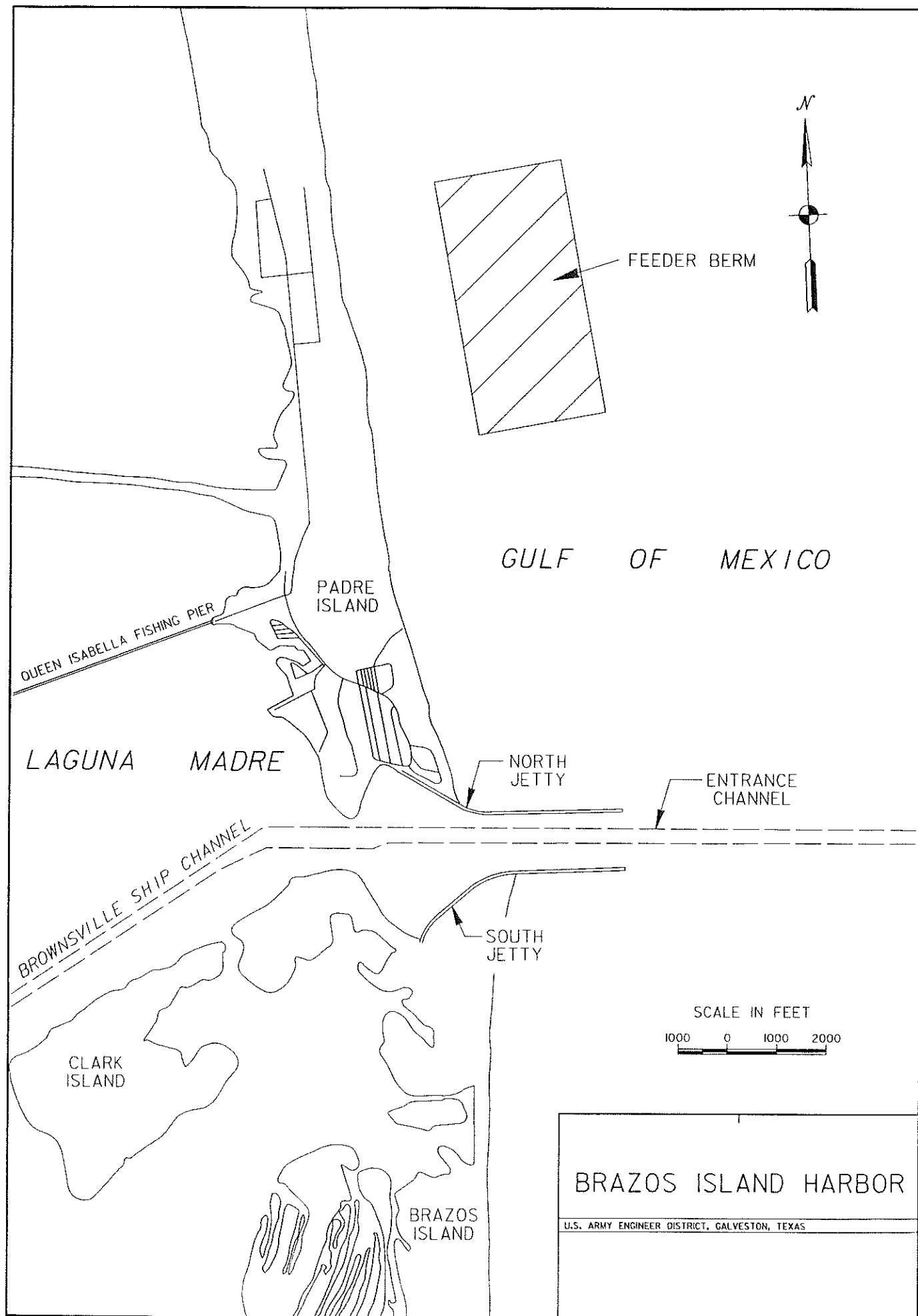
On six occasions since the late 1970's, material removed during maintenance dredging of the Channel to Port Mansfield Approach Channel has been placed directly on North Beach as a beneficial use of dredged material and to prevent flanking of the jetty. The average quantity of material placed on the beach was 204,400 cubic yards. However, no monitoring of the activity has been performed.

#### **BRAZOS SANTIAGO PASS**

Brazos Santiago Pass is a natural inlet located just north of the Texas-Mexico border at the southern tip of Padre Island. The Pass is Federally-maintained as part of the jettied entrance channel of the Brazos Island Harbor project, which provides access to the ports of Port Isabel and Brownsville. The jettied entrance channel of the Brazos Island Harbor project is shown in Figure 9.

The area of South Padre has undergone varying rates of erosion since the 1850's except for the extreme southern tip of the Island adjacent to the jetties. The Galveston District and the Waterways Experiment Station's Coastal Engineering Research Center cooperated in an experimental project to investigate using dredged material to construct nearshore berms to protect the shoreline and augment the beach profile. Between December 1988 and January 1989, a feeder berm was constructed off South Padre Island using material dredged from the Pass. The berm construction site was approximately 1.5 miles north of the jetties and 0.4 mile offshore in 24 to 28 feet





of water. The site is about 1-mile long and 0.5-mile wide, and the berm height is 4 feet. Approximately 220,000 cubic yards of sandy dredged material were placed in the nearshore berm when constructed. An extensive monitoring plan is in place to evaluate the berm's effectiveness, and so far the project has yielded positive results. The material is migrating from the berm and returning to the littoral system.

In addition to pre-construction surveys made in December 1988 and post-construction surveys in January 1989, surveys were conducted in March and June 1989. Figure 10 shows comparisons of these surveys. These initial monitoring efforts showed that subsequent to construction, the berm moved approximately 300 feet shoreward during the winter months from January to March 1989. Historically, winter is when the highest wave energy is experienced in the area, and the maximum movement of the berm is expected. As shown in the figure, from March to June, with lesser energy in the environment, the berm had little to no movement.

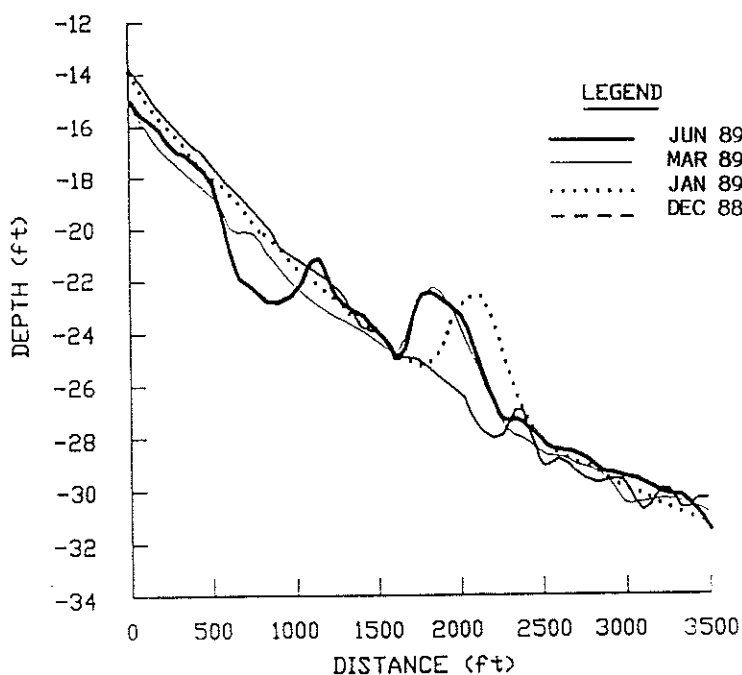


FIGURE 10. Cross Section Brazos Santiago Pass Nearshore Berm.

A survey in May 1990 indicated only 35,000 cubic yards of material remaining within the berm footprint, and an additional 580,000 cubic yards of material were placed in the berm in April 1991.

## **SUMMARY**

It is evident that there is a diversity of shoreline conditions which exist along the Texas coast. These conditions vary from erosional, to accretional, to stable. The erosional and accretional shorelines vary considerably in degree, from gradual to extreme. The usual approach when addressing coastal shorelines is to focus on a problem area, which usually means that erosion is affecting manmade improvements, important natural resources, or some other economic loss is involved. However, the entire system must be evaluated including the stable areas, but particularly the areas that are accreting. One cannot just accept the gain (accretion) and concentrate on the loss (erosion). There is a finite volume of littoral material in the nearshore coastal zone; therefore, addressing the erosion may entail a trade-off in sacrificing portions of the accreting areas. Gains and losses will occur at any interruption of the shoreline whether it is natural or manmade.

The erosion occurring along the shorelines of Texas, as well as other shorelines of the United States, is a complex issue both in terms of causes and potential solutions. The contributory factors are both natural and human induced. The degree of the contribution from each causative factor varies from area to area and in most cases has not been assessed. The lack of assessment can be attributed to competition for funding to embark on a long-term analysis. Such an analysis would undoubtedly contribute significantly to the base of knowledge in the coastal arena. However, the implementability of solutions that would address the problem of shoreline erosion on a national basis would be overwhelming from fiscal and engineering standpoints. For those and other reasons, erosion problems are generally treated on a localized basis.

Involvement by the Corps of Engineers in the assessment and possible resolution of shoreline erosion problems is on a case-by-

case basis when authority and funds are provided by the Congress to begin a study of the problem. Federal participation in a project can be provided only if a solution to the problem is found to be in the Federal interest, is environmentally acceptable, and a non-Federal sponsor can be identified that is willing and able to share in the cost of the studies, the construction, and future maintenance activities. This is a long and oftentimes frustrating process, particularly for local residents that see the coastal processes continuing to claim coastal lands daily.

In the absence of authority and funds to directly address erosion problems, the Corps attempts to use the resources that are available to minimize the impacts of shoreline erosion. One of these resources is material that is removed from navigation channels through maintenance dredging operations. Although the material may not be beach quality sand, often there are merits to use of the material for erosion control even though it is not of optimum quality and may not totally produce the desired results. We are continuing to look for additional opportunities for beneficial uses of dredged material, particularly in the area of shoreline erosion control.



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