APPENDIX M

DREDGED MATERIAL MANAGEMENT PLAN (DMMP)

Brazos Island Harbor, Texas Channel Improvement Study

FINAL INTEGRATED FEASIBILITY REPORT AND ENVIRONMENTAL ASSESSMENT

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1.0 INTRODUCTION

1.1 PURPOSE OF REPORT

The Brazos Island Harbor (BIH) project, also known as the Brownsville Ship Channel (BSC), is an existing deep-draft navigation project located on the lower Texas coast. The channel uses the natural Brazos-Santiago Pass to connect the Gulf with the inland portion of the BSC terminating at the Port of Brownsville (POB). A feasibility-level planning study is being completed to determine whether channel improvements to the existing Brazos Island Harbor (BIH) project are feasible and in the Federal interest.

The goal of this Dredged Material Management Plan (DMMP) is to develop a placement plan that will accommodate the 50-year placement of dredged material associated with the BIH channel improvements, taking into consideration cost and environmental concerns.

The purpose of this document is to 1) describe the existing conditions of dredged material placement at BIH; and 2) describe and document the selection of a DMMP. This DMMP will be included as an appendix to the Final Integrated Feasibility Report and Environmental Assessment (FIFR-EA). The DMMP covers placement of dredged material over the 50-year period of analysis from 2021 to 2071 studied in the FIFR-EA.

1.2 PROJECT AREA DESCRIPTION

The project area, shown in Figure 1, includes the BSC channel and property directly adjacent to the channel, including the POB and upland placement areas (PAs), as well as offshore PAs and a nearshore Feeder Berm. Nearly all of the property adjacent to the land-locked portion of the channel is owned by the POB. The Port infrastructure includes railroad and highway systems allowing access to the Port facilities. The existing BSC navigation channel is 19.4 miles in length. The Entrance and Jetty Channels extend east to west for approximately 2.4 miles, from the open Gulf of Mexico, through the jetties to the Laguna Madre. The flared North and South Jetties flank Brazos Santiago Pass, which connects the Gulf with the Lower Laguna Madre. The Main Channel extends 17 miles westward from the Laguna Madre to the Turning Basin, which is located on the eastern outskirts of the city of Brownsville.

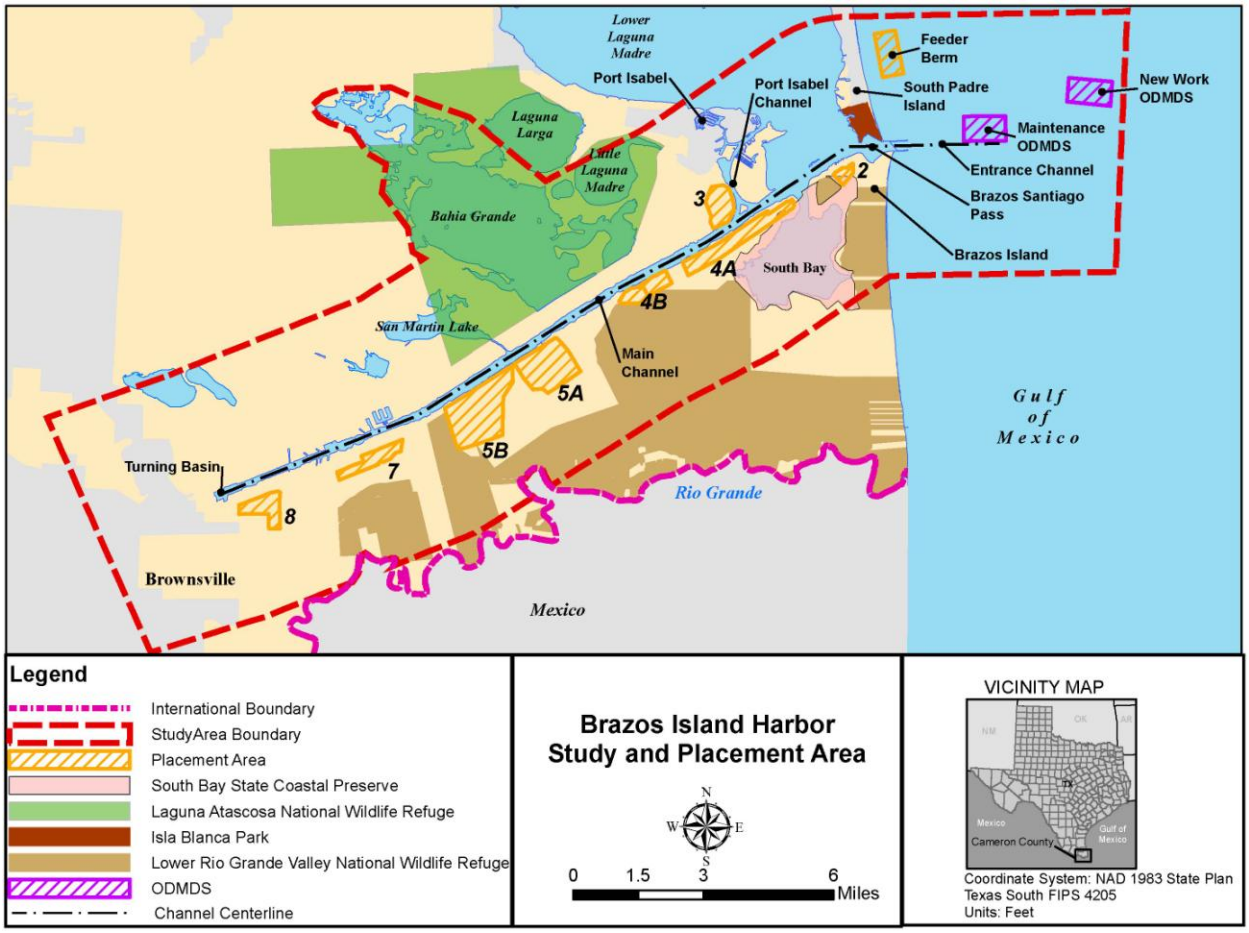

Figure 1 – Study Area Map

There are ten PAs available for the placement of dredged material from the proposed BIH Project— two existing Ocean Dredged Material Disposal Sites (ODMDSs; separate sites for new work and maintenance), which can be used for the Entrance and Jetty Channels, seven upland PAs for containment of material from the Main Channel, and one nearshore Feeder Berm that can be used for beach-quality sediments from the Entrance and Jetty Channels, and a portion of the Main Channel. The ODMDSs and Feeder Berm are all dispersive and by their nature have unlimited capacity.

1.3 SCOPE OF STUDY

Navigation is a priority mission of the U.S. Army Corps of Engineers (USACE) and effective accomplishment of this mission requires dredging to achieve navigable channel dimensions sufficient to meet the needs of waterborne transportation. In this effort, USACE is committed to environmentally sound dredging and placement or management of dredged materials as defined by applicable laws and policies. This can best be achieved through the development of a long-

term management strategy for dredged material as delineated in a DMMP. It is the policy of USACE that all DMMPs include an assessment of potential beneficial use (BU) of dredged material for environmental purposes including fish and wildlife habitat creation and restoration and/or hurricane and storm damage reduction.

Dredged material management planning for all Federal harbor projects is conducted by USACE to ensure that maintenance dredging activities are performed in an environmentally acceptable manner, use sound engineering techniques, are economically justified, and ensure that long-term placement facilities are available. Ultimately, the DMMP identifies specific measures necessary to manage the volume of material likely to be dredged within the BIH project over the 50-year period of analysis included in the feasibility study.

1.4 AUTHORIZATION AND DEVELOPMENT HISTORY

1.4.1 Authorization Documents

This DMMP study is being conducted for inclusion in the FIFR-EA pursuant of the latest study authority.

The Congress authorized USACE to conduct a study of BIH, Texas, to determine whether the project should be modified in any way, particularly with a view to widening and deepening the existing channels, pursuant to a resolution of the Committee on Public Works, U.S. House of Representatives dated May 5, 1966.

1.4.2 Development History

Since 1880 with the first Federal involvement in navigation improvements, the BIH has evolved from a shallow-draft navigation channel with a depth of only 10 feet to a deep-draft navigation channel with its current 42-foot depth (Figure 2). The Rivers and Harbors Acts (RHAs) of 1880 and 1881 provided for deepening of the natural channel through the Brazos Santiago Pass to 10 feet, widening the channel through the pass to 70 feet, and the construction of two parallel jetties at the pass. Construction of the South Jetty was started in 1882 and continued until 1884, when operations were suspended due to a lack of funds.

The RHA of 1919 provided authorization to deepen the channel to 18 feet with a 400-foot width through the pass. Under this authorization, two short stone jetties were constructed and some channel dredging was performed. As authorized in the RHA of 1930, jetties at the Brazos Santiago Pass were constructed in 1935 in conjunction with the construction of a navigation channel to Port Isabel. More channel improvements were completed in 1936 when the Main

Channel to the Brownsville Turning Basin was dug through the Rio Grande deltaic plain to provide a navigation channel and turning basin for the City of Brownsville. After these channel improvements, the small fishing community of Port Isabel, located on the mainland overlooking the Laguna Madre and Brazos Santiago Pass, began to grow and industrial facilities were constructed along the western end of the Main Channel, near the Turning Basin and the City of Brownsville.

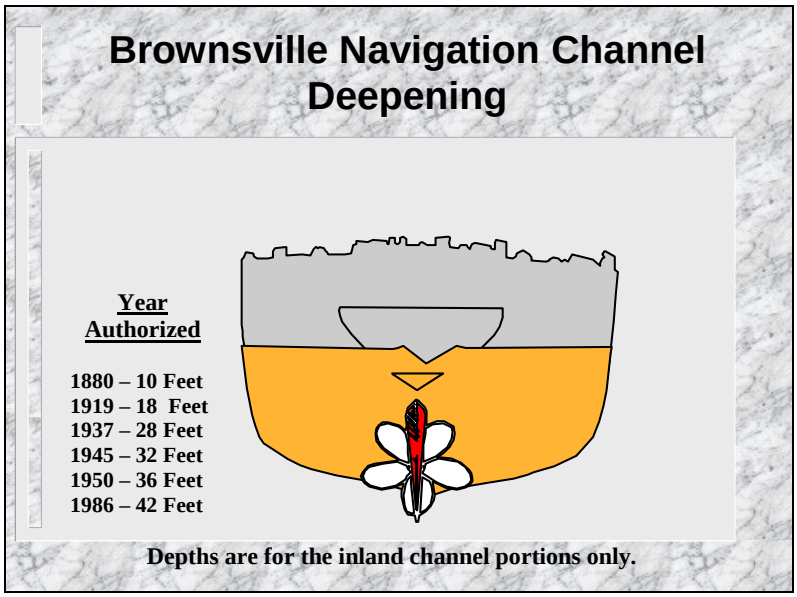

Figure 2: History of Channel Deepening

Several improvements to the waterway were authorized by the RHA of 1960. Most of the project improvements were constructed:

- Widening 1.3 miles of the Brownsville Turning Basin Extension from 300 feet to 500 feet in 1964;
- Construction of a third basin to the Brownsville Fishing Harbor in 1968;
- Widening the upper 3-mile reach of the BIH from 200 to 300 feet in 1980; and
- Deepening a locally dredged extension of the Brownsville Turning Basin from its 32-foot depth to 36 feet in 1980.

The construction of a 1,000-foot extension to the North Jetty, which was authorized by the RHA of 1960, was deauthorized under Section 1001 of the Water Resource Development Act (WRDA) of 1986; however, the current project dimensions were authorized under Section 201, Public Law 99-662. Some of the authorized improvements (e.g. recreational facilities, jetty walkways and comfort stations, and dust control measures) were not implemented. The authorized increase of the turning basin by 1,000 feet, also included in the RHA of 1960, was

modified to a 1,200-foot width based on subsequent engineering analyses. Construction of the WRDA 1986 channel improvements was completed in 1996.

1.5 CHANNEL ALIGNMENT

The BIH provides for –42-foot deep mean lower low water (MLLW) navigation on the inland portion of the channel and a 44-foot depth in the offshore Entrance and Jetty Channels. The BIH is essentially a straight waterway with no bridges or other obstructions for the entire 19.4-mile length of the waterway and is operated for single-lane, one-way traffic only. The existing waterway consists of the Entrance Channel, Jetty Channel, Main Channel, Turning Basin Extension, and Turning Basin.

1.6 DATUM

1.6.1 Vertical Datum

Army regulations and USACE Headquarters guidance on tidal datum, provided in Engineering Technical Letter 1110-2-349 Requirements and Procedures for Referencing Coastal Navigation Projects to Mean Lower Low Water Datum, dated April 1, 1993, and Engineering Manual (EM) 1110-2-1003, dated April 1, 2002, stress the necessity of converting local datum, such as Mean Low Tide (MLT) to MLLW. EM 1110-2-1003 further states that MLLW should be tied to the North American Vertical Datum (NAVD) 88. The predominant reason for conversion to MLLW is the need for consistency within the shipping and dredging industries with regard to channel depths.

Historically, USACE–Galveston used the MLT datum for its navigation channels. As noted in the regulations and guidance above, this datum was recently converted to MLLW for consistency with other USACE Districts. MLLW datum was used for all quantity calculations during plan formulation. For the BIH conversion, on average, the MLT/MLLW difference is +0.31 foot. Because this difference was so small and it would have little to no effect on dredging quantities, the study addresses MLT as equal to MLLW for conversion from historic dredging records and drawings. Therefore, –42 feet MLT is considered equal to –42 feet MLLW. The elevations of the PAs are referenced to NAVD 88.

1.6.2 Horizontal Datum

Horizontal coordinates will be based on North American Datum of 1983 (NAD 83), Texas State Plane Coordinates, South Central Zone.

2.0 EXISTING AND FUTURE WITHOUT PROJECT CONDITIONS

2.1 DESCRIPTION OF EXISTING CONDITIONS

USACE is responsible for maintaining BIH channel to its authorized dimensions to ensure navigability of the waterway (Table 1). There are nine PAs available for the placement of dredged material from the existing BIH Project—one site that can be used for the offshore section of the channel, seven upland confined sites for containment of material from the landlocked reach of the channel (PAs 2, 4A, 4B, 5A, 5B, 7, and 8), and a nearshore Feeder Berm. A separate ODMDS site was designated for the placement of offshore new work material when the existing 42-foot channel was constructed during the mid-1990s. This New Work ODMDS has been inactive since that time, but it would be reactivated for construction of the Recommended Plan. The ODMDS and Feeder Berm are dispersive in nature and therefore have unlimited capacity. The Maintenance ODMDS is utilized for maintenance material deemed not suitable for beach or nearshore placement and is located approximately 2.5 nautical miles from shore. The nearshore Feeder Berm site is used for the close placement of beach quality sediment to augment the South Padre Island nearshore profile.

2.1.1 Authorized PAs for the Existing BIH Channel

The nine PAs utilized for current maintenance needs are described below. Figure 1 above presents the location of the seven upland confined PA sites and two ODMDS sites, as well as the Feeder Berm.

Offshore PAs

Maintenance ODMDS

This offshore PA occupies 352 acres of open water with no containment dikes. It is reserved for maintenance materials dredged from the existing Jetty Channel and Entrance Channel (Station 0+000 to Station -13+000) by hopper dredge. The Maintenance ODMDS has not been used in recent years because it was preferable to use the material beneficially, if possible. Material from the offshore channels is generally placed in the Feeder Berm or provided for beach nourishment on South Padre Island under cost-sharing agreements with the General Land Office and the City of South Padre Island. Coordinates of the control points for the Maintenance ODMDS (also known as PA 1), as outlined in the "Brazos Island Harbor Ocean Dredged Materials Disposal Site Designation" report, dated July 1990, are presented in Table 2. As noted in Section 1.6.2 above, the horizontal datum for the ODMDS is referenced to Texas State Plane, NAD(83), Texas South Zone.

Table 1. Dimensions of Existing Brownsville Ship Channel

Channel Reach	Constructed Depth (feet)	Constructed Bottom Width (feet)	Channel Length (miles)
Entrance Channel (Gulf of Mexico to offshore end of jetties)	44	300	1.3
Jetty Channel (Gulf of Mexico to Laguna Madre)	44	300_A	1.1
Main Channel (Laguna Madre to Turning Basin Extension)	42	250_B	15.1
Turning Basin Extension	Transitions from 42 to 36	Transitions from 400 to 325	1.3
Turning Basin	36	Transitions from 325 to 1,200	0.6

Notes:

A. Includes 0.2 mile by 400 feet transition to Main Channel. Remainder of Jetty Channel (0.9 mile) is 300 feet wide.

B. Includes 0.4 mile by 400 feet transition from Jetty Channel and 3.2 mile by 400 feet transition to Turning Basin. Remainder of Main Channel (11.5 miles) is 250 feet wide.

Table 2 Maintenance ODMDS Control Points

Control Point No.	Latitude	Longitude	Northing (Y)	Easting (X)
1	26° 04’ 32”	97° 07’ 26”	16,555,390.361	1,435,890.262
2	26° 04’ 32”	97° 06’ 30”	16,555,446.327	1,440,996.513
3	26° 04’ 02”	97° 06’ 30”	16,552,417.497	1,441,029.918
4	26°0 04’ 02”	97° 07’ 26”	16,552,361.528	1,435,923.292

Feeder Berm BU Site 1A

Feeder Berm BU Site 1A occupies 313 acres in a near shore open water area with no containment dikes, and is reserved for maintenance dredge materials from the Entrance Channel and Jetty Channel (0+000 to Station -13+000). Material that is not provided for beach placement on South Padre Island is placed at this site by hopper dredge. . The purpose of this PA is to restore material into the littoral current along South Padre island. Coordinates of the control points for Feeder Berm Site 1A, according to the “Underwater Feeder Berm Construction” report, dated 1988, are presented in Table 3.

Table 3 Maintenance Feeder Berm BU Site 1A Control Points

Control Point No.	Latitude	Longitude	Northing (Y)	Easting (X)
1	26° 06' 11"	97° 09' 23"	16,565,270.617	1,425,115.409
2	26° 06' 15"	97° 08' 55"	16,565,701.700	1,427,663.599
3	26° 05' 19"	97° 09' 13"	16,560,461.499	1,428,631.538
4	26° 05' 23"	97° 08' 45"	16,560,030.355	1,426,083.032

Upland Confined PAs

The seven upland confined PAs are described individually in more detail below. Each of these seven existing PAs is provided through a 50-year easement from the non-Federal Sponsor to the U.S. Government. The material is dredged by cutterhead and pumped into the PAs through floating and submerged hydraulic pipelines. This easement was issued on January 26, 1994.

PA 2

PA 2 is located on the south side of the junction of the Jetty Channel and Main Channel and occupies an area approximately 71 acres in size (Figure 1). The site is completely confined with 7,642 linear feet of existing containment dike with an average height of 27 feet along its perimeter. It has been used to confine dredged material from the first section of the Main Channel. The site has not been used recently and the drop-outlet structure is currently non-functioning.

PA 4A

PA 4A occupies an area approximately 469 acres in size along the south side of the Main Channel near the junction with Port Isabel Channel (Figure 1). The site is completely confined with 33,910 linear feet of existing containment dike with an average height varying from 17 to 23 feet along its perimeter. The site was last used for placement of dredged material from the adjacent reach of the Main Channel reach in 2009. The drop-outlet structure is currently silted in and in need of extensive excavation prior to future use.

PA 4B

PA 4B occupies an area approximately 243 acres in size along the south side of the Main Channel. The site is completely confined with 16,338 linear feet of existing containment dike with an average height of 7 feet along the perimeter of the site. The site has not been used for maintenance dredging for several years. The drop-outlet structure is currently non-functioning.

PA 5A

PA 5A occupies an area approximately 704 acres in size along the south side of the Main Channel (Figure 1). The site is completely confined with 21,628 linear feet of existing containment dike with an average height of 6 feet along its perimeter. It is used for placement of maintenance dredged material from the adjacent section of the Main Channel. The drop-outlet structure is currently silted in and in need of extensive excavation prior to future use.

PA 5B

PA 5B occupies an area approximately 1,020 acres in size along the south side of the Main Channel (Figure 1). The site is completely confined with 29,343 linear feet of existing containment dike with an average height of 12 feet along its perimeter. The current drop-outlet structure is functional with maintenance having been performed in 2012 by the non-Federal Sponsor. The site has been used recently for placement of maintenance material from dredging of the adjacent section of the Main Channel.

PA 7

PA 7 occupies an area approximately 257 acres in size along the south side of the Main Channel (Figure 1). The site is completely confined with 20,471 linear feet of existing containment dike with an average height of 20 feet along its perimeter. The site has been used recently for placement of maintenance material from dredging of the adjacent section of the Main Channel. The current drop-outlet structure is functional having been maintained in recent years by the non-Federal Sponsor.

PA 8

PA 8 is located on the south side of the Main Channel near the Turning Basin and occupies an area approximately 288 acres in size (Figure 1). The site is completely confined with 18,024 linear feet of existing containment dike with an average height of 22 feet along its perimeter. The site has been used recently for placement of maintenance material from dredging of the adjacent section of the Turning Basin Extension and Turning Basin. The current drop-outlet structure is functional having been maintained in recent years by the non-Federal Sponsor.

2.1.2 Dredging Quantities

As shown in Table 4, approximately 1.1 million cubic yards (MCY) of shoaled material accumulates annually in the BIH channel. The dredging frequency varies by channel reach with the Entrance and Jetty Channels having the most frequent dredging cycle of 1.5 years.

Table 4 Existing Shoaling Quantities

CHANNEL REACH (Station)	O&M Cycle Frequency (year)	Shoaling (CY/year)
17+000 to 0+000	1.5	351,000
0+000 to 11+000	4.5	154,000
11+000 to 28+000	4	176,000
28+000 to 34+000	4	41,000
34+000 to 50+000	4	118,000
50+000 to 65+000	5	137,000
65+000 to 79+415	6	93,000
79+415 to 89+500	7	33,000
TOTAL SHOALING		1,103,000

Available dredging history data was collected from June 1952 through March 2011 from the USACE dredging histories database. This data provided a basis for estimating existing shoaling rates, and evaluating how previous channel modifications have altered shoaling in the channel. The data gathered was used in calculating average annual shoaling rates by reach. All material that was shoaled was assumed to be removed in these estimates.

2.1.3 Advance Maintenance and Allowable Overdepth

The channel has historically been maintained to various depths of advance maintenance and allowable overdepth below the authorized 42-foot channel template. An additional depth outside the required template is permitted to allow for inaccuracies in the dredging process. District commanders may dredge a maximum of two feet of Allowable Overdepth in coastal regions, and in inland navigation channels (ER 1130-2-520 Navigation and Dredging Operations and Maintenance Policies). This additional dredging allowance is referred to as allowable overdepth. Past dredging of the existing channel has varied between 1’ to 2’ allowable overdepth.

2.2 FUTURE MAINTENANCE WITHOUT-PROJECT CONDITION

Maintenance dredging activities would continue to be performed as they have been in the past in the future without-project condition (FWOP). Dredging of the Entrance and Jetty Channels would be performed by hopper dredge, with higher shoaling sections dredged as frequently as

every 18 months, and other reaches dredged on the average of 4.5 years. The additional allowable overdepth and advance maintenance described in Section 2.1.3 would continue to be used in channel maintenance dredging. From the existing shoaling quantities in Table 4, the total 50-year shoaling is calculated to be 55.0 MCY of material.

Following the practice of recent years, it is assumed that all material from the Entrance and Jetty channels would be placed in the least-cost nearshore Feeder Berm or directly onto South Padre Island beaches under cost-sharing agreements with the Texas General Land Office (GLO) and the City of South Padre Island. The Main Channel reaches would continue to be dredged every 4 to 7 years with a hydraulic pipeline cutterhead, with material being pumped to the existing PAs that line the channel's south bank. No new PAs would be needed to accommodate quantities expected over the 50-year period of analysis. PA dikes would continue to be raised incrementally as additional capacity is needed. On occasion in the past, the BIH channel maintenance has been postponed because of budget considerations, resulting in restricting vessel drafts to those shallower than the authorized depth. However, quantities are calculated for the FWOP with the expectation that the channel would be maintained at authorized depths throughout the period of analysis.

3.0 LEAST COST DISPOSAL ALTERNATIVE

Placement options were evaluated to determine the best disposal alternative for all material, both new work and Operations and Maintenance (O&M). These alternatives considered possible beneficial use of dredged material, as well as traditional PAs.

3.1 BENEFICIAL USE OPPORTUNITIES

Section 2037 of WRDA 2007 amended Section 204 of WRDA 92 dealing with regional sediment management. Section 204 states that a regional sediment management plan shall be developed by the Secretary of the Army for sediment obtained through the construction, operation, or maintenance of an authorized Federal water resources project. The purposes of using sediment for the construction, repair, modification, or rehabilitation of Federal water resource projects are to reduce storm damage to property; to protect, restore, and create aquatic and ecologically related habitats, including wetlands; and to transport and place suitable sediment.

During this feasibility study, a conceptual sediment budget was developed (HDR, 2008) and the beneficial use of the dredged material was investigated. New work construction would yield primarily clay sediments, which are suitable for dike construction or marsh restoration. New work material from the Main Channel would be stockpiled within the existing PAs and used for future incremental dike raisings. No marshes in need of clay material for restoration were

identified near the project area. New work material from the Entrance and Jetty Channels would be placed at the New Work ODMDS; sediments to be dredged would be overwhelmingly clay and would not be suitable for placement at the nearshore Feeder Berm, which was designed to receive sandy sediments.

The potential for beneficial use of maintenance material from the new project was also investigated. Shoaled sediments from the majority of the Main Channel (Stations 11+000 to 89+500) are expected to be primarily clay and silt. No marsh areas that would benefit from these sediment types have been identified near the project area. This material would continue to be placed in the existing upland, confined PAs.

Maintenance dredging of the eastern end of the Main Channel (Stations 0+000 to 11+000) and the entire Jetty and Entrance Channels are expected to be primarily sand with some silt, suitable for use in the nearshore Feeder Berm. Sandy material deposited in this nearshore berm is moved by cross-shore and longshore currents toward the shoreline of South Padre Island, decreasing shoreline erosion. Sandy materials could also be used to directly renourish eroding beaches fronting the City of South Padre Island; however, beach placement is not a least-cost plan. The incremental difference between the cost of normal placement into the Feeder Berm and the cost to pump material directly onto the beach must be provided by a non-Federal sponsor. In the past, the City of South Padre Island and the General Land Office have participated in paying the incremental cost to place the material directly onto the beach at South Padre Island. This incremental cost has been about $2 to $3 million per dredging cycle.

3.2 SCREENING FOR LEAST COST PLAN

Based on the possible beneficial use options identified above, several alternative placement plans were considered for maintenance material from Station –17+000 to 11+000. This reach includes the Entrance Channel Extension for the Recommended Plan (-17+000 to -13+000), the Entrance Channel, Jetty Channel, and a portion of the Main Channel. This reach contains primarily sandy material that would be suitable for placement in the Feeder Berm, the current least-cost disposal plan for maintenance material. Another option for this material would be placement into the Maintenance ODMDS, which is located directly adjacent to the channel extension. However, the Maintenance ODMDS has been designated for material only from the Entrance and Jetty Channels. This designation prevents material from Station 0+000 to 11+000 (part of the Main Channel) to be placed in the Maintenance ODMDS. Placement of the material from Station 0+000 to 11+000 is limited to the Feeder Berm because of the lack of capacity in the nearby upland PAs.

Additional advance maintenance (AM) was considered to allow channel dredging cycles to be combined in order to save mobilization and demobilization costs that occur with each dredging contract.

Table 5 presents the quantifiable costs and dredging cycles for the two remaining placement options: Placement Plan 1 (Maintenance ODMDS and Feeder Berm) and Placement Plan 2 (Feeder Berm).

Use of Placement Plan 2 rather than Placement Plan 1 provides an economically and environmentally balanced, sustainable solution for life cycle sediment management for the BIH Recommended Plan. While life-cycle maintenance dredging costs for Placement Plan 1 are essentially equivalent to Placement Plan 2, environmental benefits of Placement Plan 2 make it the optimal sediment management solution.

Environmental benefits are achieved by regularly placing material trapped by the channel extension back into the littoral system through the use of the Feeder Berm. The material is then available for cross-shore and longshore sediment transport to South Padre Island. This improves environmental stewardship, while improving relationships with area stakeholders on South Padre Island, where shoreline erosion has averaged 18 feet per year. Placing material into the Maintenance ODMDS removes the material from the littoral system and keeps it from nourishing the littoral system.

Table 5 Alternative Placement Plans

Stationing	**Placement Location**	**Dredging Cycle (years)**	**Average Annual Costs**
Placement Plan 1			
Sta. –17+000 to 0+000	Maintenance ODMDS	1.5	$6,246,000
Sta. 0+000 to 11+000	Feeder Berm	4.5	
Placement Plan 2			
Sta. –17+000 to 0+000	Feeder Berm	1.5	$6,387,000
Sta. 0+000 to 11+000	Feeder Berm	4.5	

In addition, the Feeder Berm option (Placement Plan 2) has the potential to reduce life cycle costs because sediments from the Entrance and Jetty Channels are placed farther upcurrent from the channel than the Maintenance ODMDS option (Placement Plan 1). The current Entrance Channel terminates at the southwest corner of the Maintenance ODMDS, with the majority of

this ODMDS offshore of the current channel limits. For the Recommended Plan, the Entrance Channel Extension would extend the channel along the Maintenance ODMDS's southern limit. The Maintenance ODMDS site is dispersive in nature; material is generally moved away from the site by the Gulf current within a few weeks to months. While the current flows from south to north most of the time, storms and seasonal reversals sometimes result in the current moving from north to south. If maintenance materials are present at the ODMDS site when the current reverses, they could move back into the channel. The historic dredging records used to establish this study's channel shoaling rates include the current practice of Feeder Berm use for placement of all of the material from the Jetty and Entrance Channels. The Maintenance ODMDS has not been used in more than a decade. Therefore, any increase in shoaling due to the periodic reverse in current flows from north to south has not been accounted for using the recent historic records. Use of the Maintenance ODMDS with the future channel alignment could potentially increase channel shoaling and maintenance costs.

Because of uncertainties described above and the fact that these average annual costs for the two placement plans are nearly identical, these plans' costs are considered equivalent. Therefore, Placement Plan 2, the Feeder Berm option, is the preferred solution because it is the least-cost, environmentally preferable plan from Station –17+000 to 11+000.

Maintenance material from the remainder of the Main Channel (11+000 through 89+500) would be hydraulically pumped to the nearest upland, confined PAs, which line the south side of the channel. As discussed above, no opportunities for beneficial use have been identified for this portion of the channel. Use of the adjacent PAs represents the least-cost placement plan for the remainder of the project area.

4.0 DESCRIPTION OF THE DREDGED MATERIAL MANAGEMENT PLAN FOR THE RECOMMENDED PLAN

4.1 NEW WORK PLACEMENT

For the Recommended Plan, the new work material from channel deepening would be distributed among the existing New Work ODMDS (Figure 3) and upland confined PAs as shown in Table 6. Dredging of the Entrance Channel Extension (-18+000 to -13+000), the Entrance Channel and the Jetty Channel would be accomplished by hopper dredge. Dredging of the Main Channel through the Turning Basin (11+000 to 89+500) would be performed by cutterhead dredges. District policy recommends 2-foot allowable overdepth in reaches where large dredges operate. Table 7 presents the allowable overdepth by channel reach for the Recommended Plan.

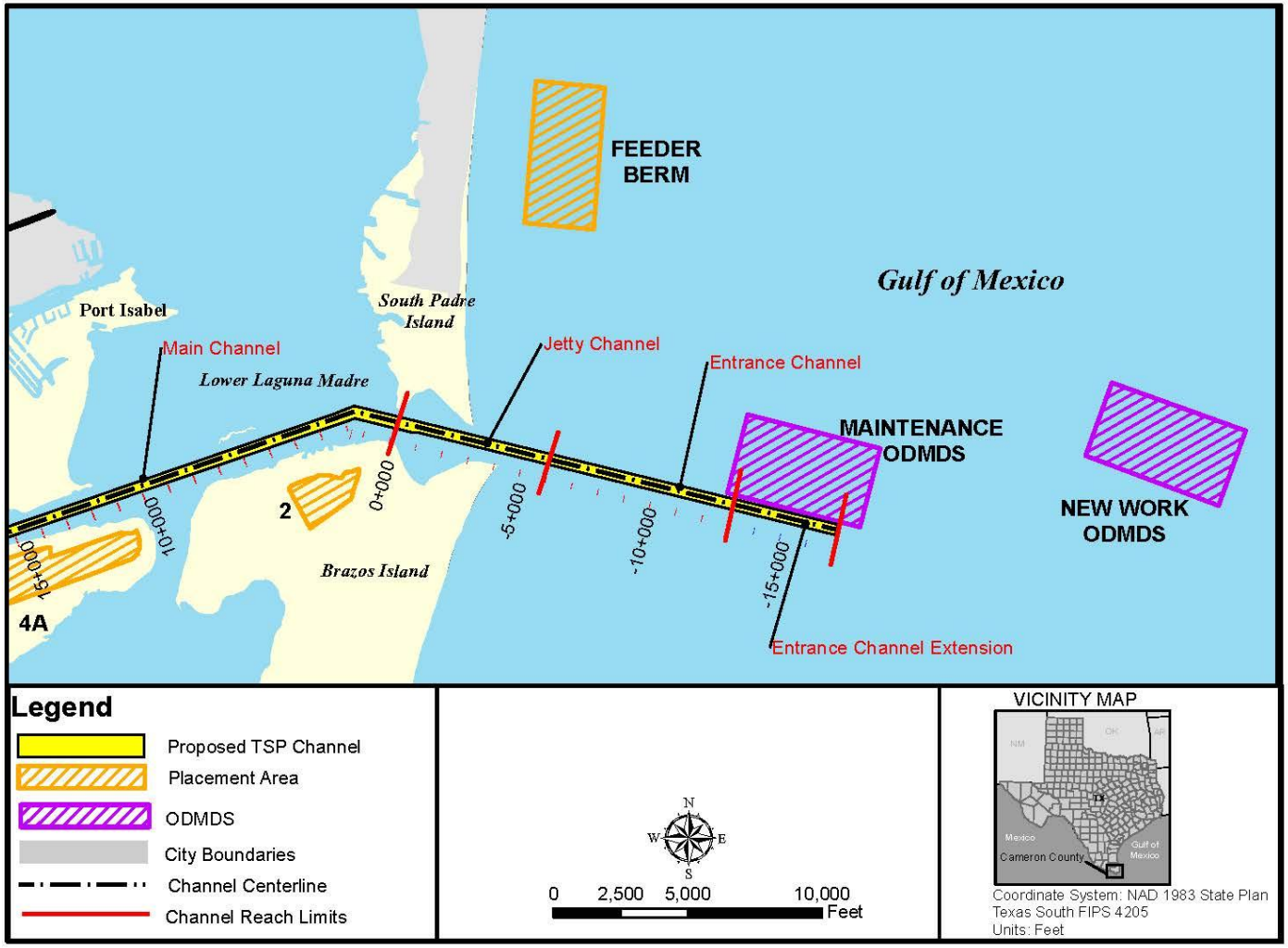

Figure 3 Recommended Plan - Entrance Channel Extension to Main Channel

Table 6 Brazos Island Harbor Recommended Plan –
New Work Quantities & Placement Area Dike Elevations After Construction

Channel Stations		Type of Dredge	PA Location	Current PA Size (acres)	Deepening Dredge Quantity (MCY)	Existing PA Dike Elevation in Feet (NAVD88*)	New Work Dike Elevation in Feet (NAVD88)
–17+000	0+000	Hopper	New Work ODMDS	350	2.1		
0+00 0	7+000	Pipeline	2	71	0.9	27	36
7+000	25+000	Pipeline	4B	243	2.7	7	19
25+000	50+000	Pipeline	5A	704	3.6	6	12
50+000	70+000	Pipeline	5B	1020	2.6	12	15
70+000	82+000	Pipeline	7	257	1.8	20	26
82+000	89+500	Pipeline	8	288	0.4	22	25
				Total CY	14.1		

*NAVD = North American Vertical Datum

Table 7 Allowable Overdepth

Reach	Allowable Overdepth (ft)
Brownsville Entrance Channel (Sta. -17+000 to Sta. 6+000)	2
Brownsville Jetty Channel (Sta. -6+000 to Sta. 0+000)	2
Brownsville Main Channel (Sta. 0+00-Sta.79+415)	1
Brownsville Turning Basin Extension Channel (Sta. 79+415-Sta. 86+215)	1
Brownsville Turning Basin (Sta. 86+215-Sta. 89+500)	1

The Port of Brownsville is responsible for dredging their docks for the channel improvements. This dredging of port facilities is expected to be completed during the deepening of the channel at the same time as the adjacent channel improvement and is relatively small compared to the dredging of the Main Channel.

4.2.1 New Work ODMDS

All of the material from Station -17+000 to 0+000 would be placed at the existing New Work ODMDS (U.S. Environmental Protection Agency [EPA], 1991). This site is located in a dispersive offshore environment and has unlimited capacity. It is located approximately 4 miles from shore in 60 to 70 feet of water. The 350-acre site is large enough to contain all new work material that would be placed there during construction. A Site Management and Monitoring Plan (SMMP) will need to be developed in consultation with, and approved by, EPA before dredged materials can be placed at the site. A new format for SMMP's is currently under development with EPA Region 6. An SMMP for the Recommended Plan will be developed during the Pre-Construction, Engineering Design phase of this project.

Coordinates of the control points for the New Work ODMDS, as outlined in the "Brazos Island Harbor 42-Foot Project, Texas Ocean Dredged Material Disposal Site Designation" report, dated November 1991, are presented in Table 8.

Table 8 New Work ODMDS Control Points

Control Point No.	Latitude	Longitude	Northing (Y)	Easting (X)
1	26° 05' 16"	97° 05' 04"	16,559,975.766	1,448,788.403
2	26° 05' 10"	97° 04' 06"	16,559,429.626	1,454,083.306
3	26° 04' 42"	97° 04' 09"	16,556,599.632	1,453,841.842
4	26° 04' 47"	97° 05' 07"	16,557,044.843	1,448,547.713

Upland PAs

New work material from the Main Channel (Stations 0+000 through 84+200) would be pumped from cutterhead dredges through a combination of fully submerged and floating hydraulic pipelines into existing upland confined PAs owned and managed by the BND (PAs 2, 4B, 5A, 5B, 7, and 8). PA 4A would not be used for new work placement. In addition, new work material may be placed in PA 3, a PA managed by the San Benito Navigation District and generally used for Port Isabel Channel material. The clay new work material would be stockpiled and used to raise the PA 3 dikes for later, unrelated maintenance dredging of the Port Isabel Channel. Specific quantities going to PA 3 are unknown at this time; should PA 3 be utilized, quantities going to PA 2 and/or 4B would be reduced. PA 3 is completely confined by earthen dikes, and is nearing capacity at its current levee height. The area contains no wetland or environmentally sensitive habitat. The non-Federal sponsor's dredging of the dock facilities is expected to be placed in PA 5A and/or PA 8.

None of the existing PAs would need to be expanded, and no new PAs would be needed. Construction to raise the containment dikes to heights needed to accommodate new work quantities would be done within the footprints of the existing PAs. The resulting elevations of the PA dikes for the new work placement activities are also shown in Table 6. They would range from a total elevation of 12 feet NAVD88 around PA 5A to a total elevation of 36 feet around PA 2. Armoring of the exterior toe of the PA 4A and 4B dikes on the side facing the channel would be necessary from Station 22+000 to 33+800. PA 4A is an existing PA that would not be used for new work material during this project; however, this site would be utilized for maintenance material during the 50-year period of analysis. A new dike would be constructed to protect a large loma on the south side of PA 4B from impacts associated with dredged material placement; all other lomas in the project area are already protected by similar dikes. As recommended by 2013 USFWS Coordination Act Report, the new dike would be constructed a minimum of 30 feet from the toe of the existing loma.

4.2 MAINTENANCE MATERIAL PLACEMENT

Maintenance dredging would generally be conducted by hopper and cutterhead dredges, with material being distributed among a nearshore Feeder Berm or the existing Maintenance ODMDS (Figure 3), and upland confined PAs as shown in Table 9. Advance maintenance would be a constant 2 feet for the entire length of the channel. Maintenance quantities are expected to increase approximately 14.3 percent over the FWOP condition. The project's maintenance dredging quantities increase by approximately 6.7 MCY over the 50-year period of analysis. Maintenance dredging would utilize the same PAs as those identified for the FWOP condition, with the exception of PA 2, and the duration and frequency of dredging events would be within the range occurring under current conditions.

The Port is also responsible for the cost of maintaining their facilities. It is expected that these facilities will be dredged at the same time as the adjacent reach of channel, if needed. The Port would pay the incremental costs of the facilities dredging, and for construction of placement area capacity (dike raising) for placement area of maintenance materials. The landlocked reaches of the channel where the Port facilities are located do not have high rates of shoaling. Additionally, the banks of these facilities are basically hardened (sheet piling, etc.) and there is very little erosion and most likely, even less shoaling is expected within the dock area. Overall, the quantity of material to be removed at the Port facilities is negligible when compared to the maintenance dredging of the main channel and can easily be included within the PAs without any additional dike raises being needed to accommodate the dock material. This maintenance dredging of port facilities is expected to be completed at the same time as maintenance of the adjacent channel reaches. Non-Federal quantities that could be deposited in the Federal project PA(s) were estimated to be 13.3 MCY of maintenance material over the 50-year period of analysis (Table 9).

Table 9 Brazos Island Harbor Recommended Plan – Operations & Maintenance Quantities and Placement Area Dike Elevations

Channel Stations		Shoaling Rate (cy/yr)	PA	Size (acres)	Dredge Cycle (years)	Number of Cycles in 50 years	Quantity per Cycle (cy/Cycle)	Total O&M Quantity in 50 years (MCY) (rounded)		Total Dike Elevation in 50 years (feet NAVD88)
–17+000	0+000	470,630	Nearshore Feeder Berm Site 1A	320	1.5	33	706,000	23.3		N/A
0+000	11+000	161,595			4.5	11	727,000	8.0		N/A
11+000	28+000	183,995	4A	469	4	12	736,000	8.8		35
28+000	34+000	43,047	4B	243	4	12	172,000	2.1		24
34+000	50+000	123,527	5A	704	4	12	494,000	5.9		17
50+000	65+000	143,577	5B	1,020	5	10	718,000	7.2		19
Non-Federal Permit Dredging					5	10	831,000		6.7	
65+000	79+000	98,637	7	257	6	8	586,000	4.7		38
Non-Federal Permit Dredging					6	8	415,000		3.3	
79+000	89+500	30,377	8	288	7	7	241,000	1.7		28
Non-Federal Permit Dredging					6	8	831,000		3.3	
				Total Federal Channel O&M Dredging Volume				61.7		
				Non-Federal Permit Dredging Volume					13.3	
				Total Dredging Volume				75.0		

Dredging of the Entrance and Jetty Channels and the first 11,000 feet of the Main Channel (–17+000 to 11+000) would generally be performed by a hopper dredge, and material would be placed in the nearshore Feeder Berm Site 1A). Sediment removed by maintenance dredging would therefore be regularly placed back into the littoral system, available for cross-shore and longshore sediment transport to South Padre Island. Monitoring of material placed at the Feeder Berm has demonstrated that it moves toward the beach and disperses, with the major movement being in the alongshore direction. If for some reason the Feeder Berm cannot be used, maintenance material from the Entrance and Jetty Channels (Station –17+000 to 0+000) could be placed in the Maintenance ODMDS. The ODMDS and Feeder Berm are located in dispersive environments and have unlimited capacities.

Maintenance material from the remainder of the Main Channel (Stations 11+000 through 89+500) would be placed in existing PAs 4A, 4B, 5A, 5B, 7, and 8 (Figures 4 and 5). PA 2 would not be used for maintenance work placement. Upland PAs and containment dikes are sized to accommodate total quantities over the 50-year period of analysis. None of the existing PAs would need to be expanded, and no new PAs would be needed.

Construction to raise the containment dikes to heights needed to accommodate the 50-year maintenance quantities would be done within the footprints of the existing PAs using material stockpiled during new work construction. Dikes would be raised incrementally as needed to contain material from each maintenance cycle. An additional 13.3 MCY of material is expected to be placed in the PAs over the 50-year period of analysis from non-Federal dredging to maintain the port facilities. The resulting elevations of the PA dikes for the 50-year Dredged Material Management Plan (DMMP), including the non-Federal dredging quantities, are also shown in Table 9. They range from a total elevation of 17 feet NAVD88 around PA 5A to a total elevation of 38 feet around PA 7.

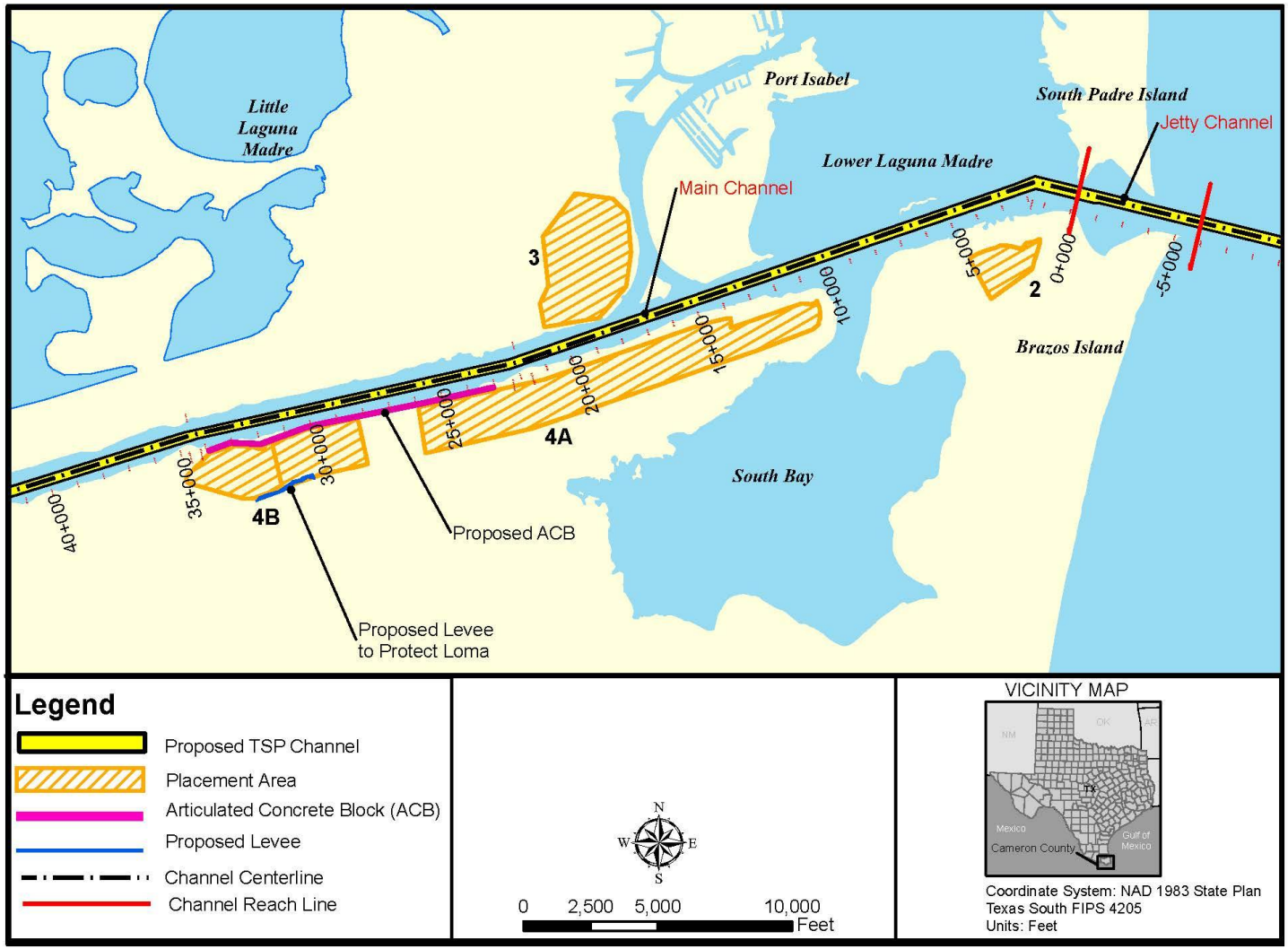

Figure 4 Recommended Plan - Jetty Channel to Main Channel

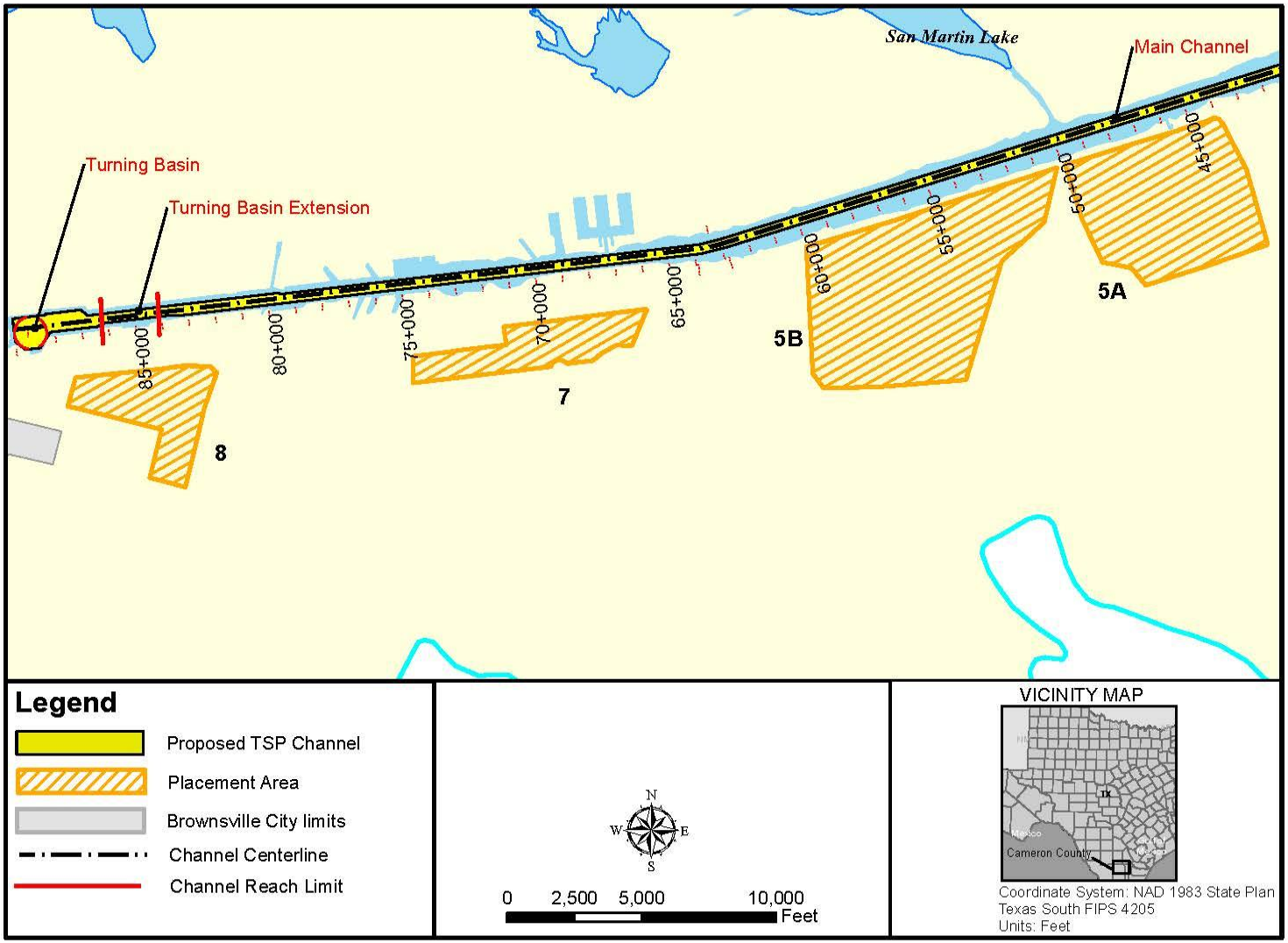

Figure 5 Recommended Plan – Main Channel to Turning Basin